

We sincerely thank the editor and the reviewers for their thorough evaluation of our manuscript and for their constructive and insightful comments. We have carefully revised the manuscript in accordance with all suggestions, which have helped us to significantly improve the clarity, scientific rigor, and overall quality of the work. Below, we provide a detailed, point-by-point response to each comment.

Referee 1

Novelty and Contribution

*Summary : The Introduction was revised to more clearly define the study's focus and situate it within the existing literature. We now better highlight the limited knowledge on rhizobacterial communities associated with wild coastal legumes, particularly *Lotus creticus*, and emphasize their relevance as models for studying plant-microbe interactions under salinity and nutrient stress. The literature review was streamlined and expanded to better contextualize PGPR mechanisms and the contribution of this work. In addition, the soil context was clarified to reflect the main constraints of Mediterranean coastal systems and their broader relevance, and the study objectives were refined to improve overall coherence.*

- 1. The Introduction does not clearly define the knowledge gap that this study is intended to address. Therefore, the discussion of the study's novelty and contribution remains insufficient.**

Page 2, lines 54-59: Added 'Although most investigations have centered on cultivated species like wheat, rice, and maize, the rhizobacterial communities of wild coastal legumes, particularly *Lotus creticus*, remain insufficiently explored. Under coastal environmental conditions, rhizosphere processes, particularly microbial-mediated nutrient mobilization, play a key role in plant survival and growth (Adeleke et al., 2024; Chu et al., 2025). Those environments also represent environmentally challenging ecosystems that provide a relevant natural model for studying plant-microbe interactions under combined salinity and nutrient limitations (Marien et al., 2023).

Page 2, lines 60-63: Added 'In this context, assessing the functional diversity of rhizobacteria associated with wild coastal legumes is key to understanding how soil limitations shape microbially mediated plant adaptation in saline coastal soils. Therefore, this study aims to isolate and characterize rhizobacteria associated with *L. creticus*, evaluate their plant growth-promoting traits, and assess their potential as bioinoculants to improve plant performance in Mediterranean coastal environments'

- 2. The manuscript does not sufficiently place this study within the broader context of existing research on plant growth-promoting rhizobacteria (PGPR), and thus does not adequately explain why rhizobacteria associated with *L. creticus* represent a clearly novel and scientifically meaningful research target.**

Page 2, lines 47-49: Added ‘These bacteria have been extensively studied and demonstrated significant potential to enhance plant growth and stress tolerance under saline and nutrient-limited conditions (Vejan et al., 2016; de Andrade et al., 2023; Nisa et al., 2026).’

Page 2, lines 49-54: Added ‘They promote plant performance through multiple mechanisms, including nutrient acquisition, phytohormone production, and stress alleviation (Sharma et al., 2025). For instance, phosphate solubilization improves phosphorus availability in calcareous soils, siderophore production enhances iron uptake under alkaline conditions, and ACC deaminase activity reduces ethylene-induced stress under salinity (Pattnaik et al., 2021; Khan et al., 2022; Yang et al., 2026). Additionally, these microorganisms can induce systemic tolerance and improve plant resilience to abiotic stresses such as drought and salinity (Bashan et al., 2014; Mekureyaw et al., 2022; Salwan et al., 2023).’

Page 2, lines 56-57: Added ‘Under coastal environmental conditions, rhizosphere processes, particularly microbial-mediated nutrient mobilization, play a key role in plant survival and growth (Adeleke et al., 2024; Chu et al., 2025).

3. **The review of previous PGPR-related studies remains rather limited, making it difficult for readers to accurately identify the added contribution of this work relative to the existing literature.**

Page 2, lines 47-49: Added ‘These bacteria have been extensively studied and demonstrated significant potential to enhance plant growth and stress tolerance under saline and nutrient-limited conditions (Vejan et al., 2016; de Andrade et al., 2023; Nisa et al., 2026).’

Page 2, lines 49-50: Added ‘They promote plant performance through multiple mechanisms, including nutrient acquisition, phytohormone production, and stress alleviation (Sharma et al., 2025).’

Page 2, lines 50-52: Added ‘For instance, phosphate solubilization improves phosphorus availability in calcareous soils, siderophore production enhances iron uptake under alkaline conditions, and ACC deaminase activity reduces ethylene-induced stress under salinity (Pattnaik et al., 2021; Khan et al., 2022; Yang et al., 2026).’

4. **The manuscript does not yet sufficiently explain why the saline soils in the study area are representative, or whether their scientific significance extends beyond a single regional case. This somewhat weakens the broader relevance and applicability of the results. Meanwhile, the soil-science focus in the Introduction remains insufficiently developed.**

Page 2, lines 36-41: Added ‘As in many regions in the world, Mediterranean coastal soils are generally sandy or weakly developed, exhibiting elevated salinity, low organic matter

and nutrient availability, and poor water-holding capacity, which together impose strong constraints on plant establishment and growth (Ferreira et al., 2022; Sun et al., 2026). Therefore, sustainable management and ecological restoration strategies are required to preserve ecosystem functionality and support agricultural productivity. Legumes (Fabaceae) are widely recognized as effective biological tools for sustainable revegetation and soil restoration (Ainane et al., 2021).'

5. **The manuscript does not yet clearly articulate the key rhizosphere soil processes involved in this study, nor does it fully explain the potential importance of these bacteria under saline soil conditions. Strengthening the systematic review of relevant studies, particularly those concerning the role of PGPR in promoting plant growth, to more clearly define the knowledge gap addressed by this study.**

Page 2, lines 49-54: Added 'They promote plant performance through multiple mechanisms, including nutrient acquisition, phytohormone production, and stress alleviation (Sharma et al., 2025). For instance, phosphate solubilization improves phosphorus availability in calcareous soils, siderophore production enhances iron uptake under alkaline conditions, and ACC deaminase activity reduces ethylene-induced stress under salinity (Pattnaik et al., 2021; Khan et al., 2022; Yang et al., 2026). Additionally, these microorganisms can induce systemic tolerance and improve plant resilience to abiotic stresses such as drought and salinity (Bashan et al., 2014; Mekureyaw et al., 2022; Salwan et al., 2023).'

6. **Clarifying the representativeness of the saline soils in the study area and their broader scientific significance, while reinforcing the logical chain among the saline soil environment, rhizosphere microbial functions, and plant growth-promoting effects, so that the soil-science-related research questions can be more clearly framed;**

Page 2, lines 36-48: Revised 'As in many regions in the world, Mediterranean coastal soils are generally sandy or weakly developed, exhibiting elevated salinity, low organic matter and nutrient availability, and poor water-holding capacity, which together impose strong constraints on plant establishment and growth.'

Page 2, lines 49-54: Added 'They promote plant performance through multiple mechanisms, including nutrient acquisition, phytohormone production, and stress alleviation (Sharma et al., 2025). For instance, phosphate solubilization improves phosphorus availability in calcareous soils, siderophore production enhances iron uptake under alkaline conditions, and ACC deaminase activity reduces ethylene-induced stress under salinity (Pattnaik et al., 2021; Khan et al., 2022; Yang et al., 2026). Additionally, these microorganisms can induce systemic tolerance and improve plant resilience to abiotic stresses such as drought and salinity (Bashan et al., 2014; Mekureyaw et al., 2022; Salwan et al., 2023).'

7. Proposing a clear scientific hypothesis to enhance the logical coherence and academic contribution of the study.

Page 2, lines 60-61: Revised ‘In this context, assessing the functional diversity of rhizobacteria associated with wild coastal legumes is key to understanding how soil limitations shape microbially mediated plant adaptation in saline coastal soils.’

Page 2-3, lines 60-65: Added ‘Therefore, this study aims to isolate and characterize rhizobacteria associated with *L. creticus*, evaluate their plant growth-promoting traits, and assess their potential as bioinoculants to improve plant performance in Mediterranean coastal environments.’

Methodological Justification

*Summary : The Methods section was revised to improve clarity and reproducibility. The sampling design is now more clearly described, including the sampling period, study location, plot distribution, and replicate structure, with composite rhizosphere samples collected from distinct *L. creticus* plants. The definition and sampling procedure of rhizosphere soil, as well as the depth (0-20 cm), were also clarified. Soil analyses were refined by adding key parameters such as electrical conductivity and by clearly distinguishing analytical methods, including the use of Walkley-Black for soil organic matter and loss on ignition for plant material, as well as specifying that phosphorus values correspond to available P. Additional details on sample preparation and analytical procedures were included, and statistical methods were clarified to better describe replication and data analysis across all experiments:*

8. Key information such as the sampling time, plot locations, number of sampling points, and whether replicate samples were included has not been clearly stated. We thank the reviewer for highlighting the lack of clarity regarding the sampling design. The manuscript has been revised accordingly to explicitly include the sampling time, plot distribution, number of sampling points, and replicate strategy.

Page 3, lines 68-75: Added ‘Plant samples of *L. creticus* were collected in March 2024 from a natural population of *L. creticus* growing wild in the coastal region of northwestern Morocco, near Tahadart Beach (35°34'56.0"N, 5°59'23.5"W). The region is characterized by a Mediterranean climate, with approximately 525 mm of annual precipitation and an average temperature of 19.1 °C. Sampling was conducted at the late flowering stage on mobile dunes. Three independent biological replicate plots of 1 m² were randomly established from the area near the seashore to capture spatial variability. Each replicate corresponds to a composite sample collected from each plot. Samples (stems and leaves) were oven-dried at 60 °C to constant weight prior to analysis. The dried samples were analyzed for crude protein content using the Kjeldahl method (AOAC, 1997) and for organic matter by incineration at 550 °C for 12 h (AOAC, 1997).’

9. In addition, the soil type and texture, as well as the definition of rhizosphere soil and the procedure used to collect it, are not sufficiently clear.

Page 3, lines 77-78: Added ‘The soil tightly attached to the roots was then recovered by brushing the roots into the same bags.’

10. The exact depth range corresponding to the “surface layer” should also be specified.

Page 3, line 78: Added ‘Also, rhizosphere soil firmly adhering to the roots was sampled from the 0-20 cm surface layer.’

11. The authors are encouraged to provide a more detailed description of the sampling design, the location of the study area, and the procedures used to obtain soil samples in the Materials and Methods section.

Page 3, lines 68-75: Added ‘Plant samples of *L. creticus* were collected in March 2024 from a natural population of *L. creticus* growing wild in the coastal region of northwestern Morocco, near Tahadart Beach (35°34'56.0"N, 5°59'23.5"W). The region is characterized by a Mediterranean climate, with approximately 525 mm of annual precipitation and an average temperature of 19.1 °C. Sampling was conducted at the late flowering stage on mobile dunes. Three independent biological replicate plots of 1 m² were randomly established from the area near the seashore to capture spatial variability. Each replicate corresponds to a composite sample collected from one of the three plots. Samples (stems and leaves) were oven-dried at 60 °C to constant weight prior to analysis. The dried samples were analyzed for crude protein content using the Kjeldahl method (AOAC, 1997) and for organic matter by incineration at 550 °C for 12 h (AOAC, 1997).’

12. Additional details are still needed for the analytical methods. In particular, the absence of basic parameters such as electrical conductivity (EC) means that the manuscript does not yet adequately characterize the basic environmental features of the saline soils, even though such information is important for defining the saline soil context and interpreting the subsequent results.

Page 3, line 78-84: Added ‘Electrical conductivity (EC) is measured by the saturated paste method using an ORION brand conductivity meter, model 162 (USSLS, 1954). The exchangeable sodium percentage (ESP) was calculated as $ESP = (Na^+ / CEC) \times 100$, where CEC represents the cation exchange capacity (FAO, 1970). Total soil nitrogen was measured using the Kjeldahl method (ISO, 1995). Total Available phosphorus was assessed using the Olsen method (Olsen et al., 1954), and exchangeable potassium was

measured by flame photometry following the method of Bower et al. (1952). Soil organic matter was evaluated using the Walkley and Black method (Walkley and Black, 1934).'

- 13. The authors should further clarify the material analyzed for each parameter, the source of the samples, the sample pre-treatment procedures, and the purpose of each analysis.**

Page 3, lines 73-75: Added 'Samples (stems and leaves) were oven-dried at 60 °C to constant weight prior to analysis. The dried samples were analyzed for crude protein content using the Kjeldahl method (AOAC, 1997) and for organic matter by incineration at 550 °C for 12 h (AOAC, 1997).'

- 14. Key information on the statistical analyses should also be Added in order to improve methodological transparency, the reliability of result interpretation, and the overall reproducibility of the study.**

Page 7, line 227-230: Added 'All experiments were performed in three independent replicates and presented as means $\pm$ standard deviation (SD). Differences among means were evaluated using analysis of variance (ANOVA) once normality and homogeneity of variances had been verified. Significant differences were assessed using Fisher's Protected Least Significant Difference (LSD) test ($P < 0.05$). Statistical analyses were conducted using STATISTICA 13.3 software.'

- 15. In addition, some details regarding the replicate settings, evaluation criteria, and data presentation in the molecular identification, functional assays, and stress-tolerance assays also require further clarification.**

Page 3, line 96-107: Added 'Bacterial genomic DNA was extracted using the phenol-chloroform method described by Chen and Kuo (1993)..... The robustness of the tree topology was evaluated by bootstrap analysis with 1000 replicates.

Page 7, line 203-205: Added 'Bacterial growth was assessed qualitatively based on colony formation and compared with control plates without NaCl. All assays were performed in triplicate (Novitsky and Kushner, 1975).'

Page 7, line 227-230: Added 'All experiments were performed in three independent replicates and presented as means $\pm$ standard deviation (SD). Differences among means were evaluated using analysis of variance (ANOVA) once normality and homogeneity of variances had been verified. Significant differences were assessed using Fisher's Protected Least Significant Difference (LSD) test ($P < 0.05$). Statistical analyses were conducted using STATISTICA 13.3 software.'

Page 4, line 121-122: Added 'Through nitrogen enrichment and biocontrol in the rhizosphere, ammonia production improves nutrient availability and contributes to plant growth under stress conditions (Yang et al., 2025).'

Page 4, line 127-128: Added ‘The isolates were evaluated for their ability to produce hydrogen cyanide (HCN), a key trait involved in the suppression of soil-borne pathogens and the maintenance of rhizosphere health (Sehrawat et al., 2022).’

Page 5, line 133-134: Added ‘Siderophore secretion facilitates iron acquisition under limiting conditions by chelating Fe³⁺ and improving its bioavailability to plants (Timofeeva et al., 2022).’

Page 5, line 139-140: Added ‘ACC (1-aminocyclopropane-1-carboxylate) deaminase activity enables rhizobacteria to mitigate plant stress by lowering ethylene levels through the degradation of its precursor (Orozco-Mosqueda et al., 2020).’

Page 5, line 146-147: Added ‘IAA (Indole-3-acetic acid) is a phytohormone involved in the regulation of root development and the stimulation of cell elongation and division (Etesami and Glick, 2024).’

Page 5, line 153-154: Added ‘Through the degradation of cellulose-rich compounds, cellulase production supports carbon transformation and nutrient recycling in soil environments (Datta et al., 2024).’

Page 5, line 159-160: Added ‘Amylase activity reflects the capacity of microorganisms to hydrolyze starch into assimilable sugars, supporting microbial metabolism and soil biochemical processes (Morbias et al., 2024).’

Page 6, line 164-165: Added ‘Chitinase production is linked to antifungal activity through the enzymatic degradation of chitin, a major structural component of fungal cell walls (Veliz et al., 2017).’

Page 6, line 169-170: Added ‘Protease activity contributes to nitrogen cycling by facilitating the degradation of proteinaceous substrates and may also play a role in suppressing pathogenic microorganisms (Adamczyk et al., 2021).’

Page 6, line 174-175: Added ‘Urease activity catalyzes the hydrolysis of urea into ammonia, contributing to nitrogen transformation in soils (Zhang et al., 2026).’

Page 6, line 178-179: Added ‘By converting hydrogen peroxide into water and oxygen, catalase plays a key role in protecting cells from oxidative damage caused by reactive oxygen species (Roy et al., 2022).’

Page 7, line 199-215: Added ‘Salt tolerance reflects the ability of microorganisms to survive and maintain metabolic activity under high osmotic pressure conditions typical of saline environments (Witzel et al., 2025).’

Discussion

Summary : The Discussion was revised to provide a clearer and more integrated interpretation of the results. We strengthened the links between soil constraints typical of Mediterranean coastal environments (alkaline pH, CaCO₃, nutrient leaching, and salinity) and the functional roles of the identified PGPR. In this context, phosphate solubilization, siderophore production, and ACC deaminase activity are now more explicitly connected to nutrient availability and stress mitigation.

*The interpretation was also refined at the strain level. The performance of *Pseudomonas protegens* P79 is discussed in relation to its metabolic versatility, while the antifungal activity of *Pseudomonas sesami* R8 is linked to secondary metabolite production. The effects of *Pseudomonas helleri* R125 and *Pseudomonas trivialis* R150 on shoot biomass are associated with improved*

nutrient mobilization. Differences between growth parameters were also clarified, including the elongation effect observed for R15 and the root responses associated with P79 and R8. Overall, these revisions improve the coherence and depth of the Discussion:

- 16. The Discussion does not yet sufficiently explain why these strains exhibit the reported functions under saline soil conditions, and the overall mechanistic interpretation remains rather weak.**

Page 15, lines 361-365: Added ‘Direct effects include plant-level physiological traits such as IAA production, known to stimulate root system development and improve the plant’s capacity to explore the soil and nutrient uptake (Etesami and Glick, 2024). Also, ACC deaminase activity plays a key role in alleviating stress-induced ethylene accumulation and mitigating growth inhibition under adverse environmental conditions (Gamalero et al., 2023).’

Page 15, lines 365-367: Added ‘In contrast, soil-mediated effects involve processes like phosphate solubilization and siderophore-based iron chelation. It could also include ammonia production, which affects rhizosphere pH and enhances nutrient solubility and availability (Yang et al., 2025).’

Page 15, lines 370-375: Added ‘Phosphorus is an essential element for plant growth; however, its uptake is often restricted due to its immobilization in soils, particularly sandy soils, where rapid leaching and low organic matter content reduce its uptake by plants (Gerke et al., 2024). In alkaline, calcareous coastal sandy soils, phosphate tends to precipitate by forming insoluble complexes with calcium ions, decreasing thereby its bioavailability (Johan et al., 2021). Increasing phosphate solubilization not only enhances plant growth but also increases microbial biomass P, as microorganisms rapidly assimilate the released phosphate.’

- 17. At the same time, the soil-science focus in this section should be further strengthened, particularly through a clearer analysis of the relationships among nutrient limitation in saline soils, rhizosphere microbial promotion of nutrient mobilization, and plant stress resistance.**

Page 14, lines 351-353: Added ‘Such conditions are known to impose multiple constraints on plant growth, including water leaching due to sandy texture, nutrient immobilization and precipitation, under alkaline pH conditions, and osmotic stress associated with salinity (Zhu et al., 2024; Sun et al., 2026).’

Page 15, lines 370-375: Added ‘Phosphorus is an essential element for plant growth; however, its uptake is often restricted due to its immobilization in soils, particularly sandy soils, where rapid leaching and low organic matter content reduce its uptake by plants (Gerke et al., 2024). In alkaline, calcareous coastal sandy soils, phosphate tends to precipitate by forming insoluble complexes with calcium ions, decreasing thereby its

bioavailability (Johan et al., 2021). Increasing phosphate solubilization not only enhances plant growth but also increases microbial biomass P, as microorganisms rapidly assimilate the released phosphate.'

- 18. The current Discussion still tends, to some extent, toward a restatement of results and literature listing.**

Page 14, lines 359-361: Revised 'At the strain level, distinct functional profiles indicate that the five *Pseudomonas* isolates may contribute to plant performance through different but complementary mechanisms that collectively support plant establishment and growth in constrained soil environments.'

- 19. The authors are advised to interpret the results more cautiously, clearly distinguishing between conclusions directly supported by the data and reasonable inferences based on the literature.**

Page 15, lines 376-379: Revised 'Additionally, the increase in dry weight observed with *Pseudomonas protegens* P79 may be attributed to its metabolic versatility and its ability to produce a wide array of extracellular enzymes, which facilitate organic matter decomposition and nutrient release under nutrient-limited conditions (Daunoras et al., 2024), but also to its ability to synthesize phytohormones such as IAA. '

- 20. The logical linkage among the soil background, the functional traits of the strains, and the observed plant growth responses should also be further strengthened.**

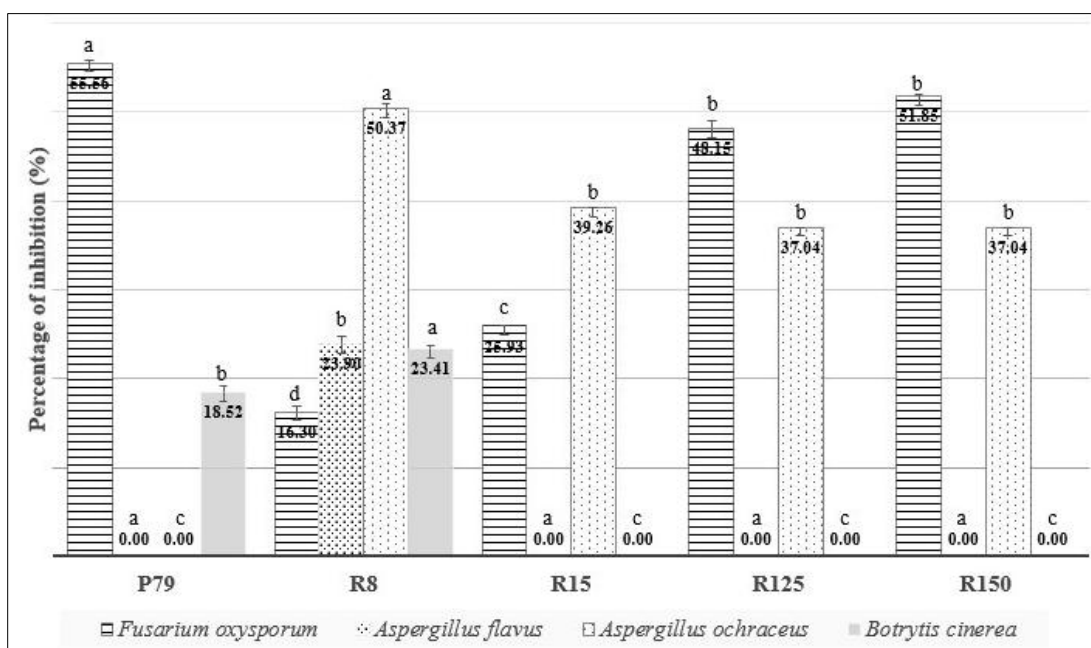
Page 14, lines 350-353: Revised 'In this study, the soil where *L. creticus* was identified was characterized as a sandy Arenosol with an alkaline pH, moderate salinity, and very low levels of organic matter. Such conditions are known to impose multiple constraints on plant growth, including water leaching due to sandy texture, nutrient immobilization and precipitation, under alkaline pH conditions, and osmotic stress associated with salinity (Zhu et al., 2024; Sun et al., 2026).'

Page 14, lines 357-358: Added 'These strains exhibited notable plant growth-promoting traits that support plant development in environments where nutrient availability is often limited by leaching and ionic imbalances (Sun et al., 2026).'

Technical Corrections

- 21. In Figure 3, some values are close to zero, and under the current scale it is difficult to clearly distinguish the differences among treatments, which affects the readability of the results. The authors are advised to optimize the presentation of this figure.**

Figure 3 has been revised to improve readability and better distinguish differences among treatments.



22. Line 256: Table 5 reports that the salinity tolerance of strain R8 is 9%, whereas line 256 states 11%. Please verify this and ensure consistency.

Page 12, line 315: Revised ‘11%’ replaced with ‘9% NaCl’

23. Line 264: Figure 4 shows that the root length under the R150 inoculation treatment is significantly lower than that in the control and most other treatments, whereas the main text states that there is no significant difference in root length between the inoculation treatment and the control. Please verify this and ensure consistency.

Page 13 line 223-224 : Revised ‘A significant reduction in root length was observed under R150 inoculation compared to the control and most other treatments.’

24. Line 300: In Table 4, the chitinase activity of P79 is reported as “moderate activity”; therefore, the corresponding wording in the main text should be more cautious.

Page 11 line 289: ‘Significant’ replaced with ‘moderate’

Referee 2

Pedological context needs deeper integration into the scientific narrative

Summary : The manuscript was revised to better integrate the soil context into the overall scientific narrative. The studied soil is now clearly described as a sandy Arenosol, with additional details

on its granulometry, electrical conductivity, exchangeable sodium percentage, and nutrient status to provide a more complete picture of the system. The Discussion was also improved to more clearly connect these soil constraints-such as nutrient leaching, phosphorus immobilization under alkaline conditions, and salinity stress-with the functional roles of the identified rhizobacteria. In this framework, key microbial traits, including phosphate solubilization, siderophore production, and ACC deaminase activity, are more explicitly linked to nutrient availability and stress mitigation. Overall, these revisions strengthen the coherence between soil properties, microbial functions, and plant responses:

25. The study aims at using rhizobacteria for the restoration of saline marginal soils, but currently lacks a sufficiently detailed pedological framework describing what makes these soils limiting, and how the identified traits mitigate these limitations.

Page 8, lines 233-235: Added ‘The results of the soil analysis (Table 1) indicated the occurrence of *L. creticus* in a sandy Arenosol, characterized by a high proportion of sand and low clay and silt fractions. The soil was alkaline (pH=8.4), showed moderate salinity (EC = 4.2 mS/cm) and low exchangeable sodium percentage (ESP = 6.3%). It was also nutrient-poor, containing very low organic matter (0.48%) and limited amounts of available phosphorus (3 ppm), potassium (45.2 ppm), and nitrogen (0.08%).’

Page 14, lines 342-357: Added ‘In Mediterranean coastal regions, *L. creticus* is among the plant species that are well adapted to saline and nutrient-poor environments. Such adaptation is mainly attributed to the capacity of the species to make osmotic and transpiration adjustments, and produce bioactive compounds such as hydroxybenzoic acid and gallic acid, necessary for maintaining photosynthetic activity under stress conditions (Araniti et al., 2014; Barreira et al., 2017). On the other hand, soil microbiota has been extensively reported to play a critical role in enhancing nutrient mobilization and uptake as well as stress tolerance (Howieson et al., 2011; Rima et al., 2018). In this study, the soil where *L. creticus* was identified was characterized as a sandy Arenosol with an alkaline pH, moderate salinity, and very low levels of organic matter. Such conditions are known to impose multiple constraints on plant growth, including water leaching due to sandy texture, nutrient immobilization and precipitation, under alkaline pH conditions, and osmotic stress associated with salinity (Zhu et al., 2024; Sun et al., 2026). In general, legumes are salt-sensitive, and symbiosis is often limited at high salinity (Bruning and Rozema 2013). However, the *L. creticus* was able to maintain vigorous growth and high capacity of nodulation, indicating the functional importance of rhizosphere microorganisms. In this context, five rhizobacterial strains of the genus *Pseudomonas* were isolated from the rhizosphere of *L. creticus* growing wild in the coastal region of Morocco.’

Page 14, lines 351-353: Added ‘Such conditions are known to impose multiple constraints on plant growth, including water leaching due to sandy texture, nutrient immobilization

and precipitation under alkaline pH conditions, and osmotic stress associated with salinity (Zhu et al., 2024; Sun et al., 2026).’

26. Although Table 1 provides essential soil chemical parameters, the study would greatly benefit from a more explicit and comprehensive description of the soil system in which *L. creticus* thrives.

Page 8, line 338 : Added granulometric assay, electrical conductivity and exchangeable sodium percentage and WRB class.

Table 1. Soil physicochemical properties of the sampling site.

WRB Class	C (%)	FSi (%)	CSi (%)	FS (%)	CS (%)	EC (mS/cm)	pH (H ₂ O)	pH (KCl 1N)	OM (%)	P ₂ O ₅ (ppm)	K ₂ O (ppm)	N (%)	ESP (%)
Arenosol	1.3	1.3	3.6	69.5	24.3	4.2	8.4	9.1	0.48	3	45.2	0.08	6.3

WRB: World Reference Base, C: Clay, FSi: Fine Silt, CSi: Coarse Silt, FS: Fine Sand, CS: Coarse Sand, EC: Electrical conductivity, OM: Organic matter, ESP: exchangeable Sodium Percentage.

Page 14, lines 350-353: Added ‘In this study, the soil where *L. creticus* was identified was characterized as a sandy Arenosol with an alkaline pH, moderate salinity, and very low levels of organic matter. Such conditions are known to impose multiple constraints on plant growth, including water leaching due to sandy texture, nutrient immobilization and precipitation, under alkaline pH conditions, and osmotic stress associated with salinity (Zhu et al., 2024; Sun et al., 2026).’

27. The manuscript does not mention the soil order, WRB classification, or granulometry. Given coastal Mediterranean systems, identifying whether the soils are Arenosols, Regosols, or Calcisols, for example, would strengthen ecological interpretation.

Page 8, lines 233-235: Added ‘The results of the soil analysis (Table 1) indicated the occurrence of *L. creticus* in a sandy Arenosol, characterized by a high proportion of sand and low clay and silt fractions.’

Page 8, line 338 : Added granulometric assay, electrical conductivity and exchangeable sodium percentage and WRB class.

28. Only pH and nutrient levels are described. Salinity characteristics (electrical conductivity, cation composition, sodicity indices) are missing, even though saline stress is mentioned as a key driver of plant-microbe interactions. Including at least EC and exchangeable sodium percentage (ESP) would contextualize why these PGPR traits matter physiologically.

As indicated above, the EC and ESP were added

- 29. Processes such as P mobilization in alkaline/sandy soils, nutrient leaching, or cation-anion imbalances in salt-affected soils should be linked more directly to the microbial traits measured (phosphate solubilization, ACC deaminase, siderophores). This would anchor the microbiological results more firmly within the soil science domain.**

Page 14, lines 351-353: Added ‘Such conditions are known to impose multiple constraints on plant growth, including water leaching due to sandy texture, nutrient immobilization and precipitation, under alkaline pH conditions, and osmotic stress associated with salinity (Zhu et al., 2024; Sun et al., 2026).’

Page 15, lines 370-375: Revised ‘Phosphorus is an essential element for plant growth; however, its uptake is often restricted due to its immobilization in soils, particularly sandy soils, where rapid leaching and low organic matter content reduce its uptake by plants (Gerke et al., 2024). In alkaline, calcareous coastal sandy soils, phosphate tends to precipitate by forming insoluble complexes with calcium ions, thereby decreasing its bioavailability (Johan et al., 2021). Increasing phosphate solubilization not only enhances plant growth but also increases microbial biomass P, as microorganisms rapidly assimilate the released phosphate.’

Sampling, Replicates, and Soil Background

Summary : The Methods section was revised to improve clarity and reproducibility, with a more precise description of the sampling design, replication structure, and soil analyses. The sampling approach now clearly states the use of three independent plots, each corresponding to a composite rhizosphere sample, and the replicate structure applied across experiments. It is also specified that all assays were conducted with three biological replicates and measurements performed in triplicate. Soil analytical methods were clarified to remove ambiguity, including the use of the Walkley-Black method for soil organic matter and the Olsen method for plant-available phosphorus. These revisions improve the overall consistency and robustness of the Materials and Methods section:

- 30. The high number of assays is impressive, but clearer descriptions would enhance transparency. While the methods are generally well written, several clarifications would strengthen reproducibility and scientific robustness.**

- 31. Sampling Design, the manuscript would benefit from clarification on:**

- ✓ The exact number of sampled plants.
- ✓ The number of rhizosphere soil samples.
- ✓ Whether isolates represent distinct plants or repeated subsampling of one plant's rhizosphere.
- ✓ Explicitly defining replicate structure is essential.

Page 3, lines 71-73: Revised 'Three independent biological replicate plots of 1 m² were randomly established from the area near the seashore to capture spatial variability. Each replicate corresponds to a composite sample collected from each plot.'

Page 7, line 227-230: Added 'All experiments were performed in three independent replicates and presented as means ± standard deviation (SD). Differences among means were evaluated using analysis of variance (ANOVA) once normality and homogeneity of variances had been verified. Significant differences were assessed using Fisher's Protected Least Significant Difference (LSD) test (P<0.05). Statistical analyses were conducted using STATISTICA 13.3 software.'

32. Soil Analyses, some parameters require clarification: Was organic matter expressed as Walkley-Black oxidizable C or loss on ignition? Both methods are mentioned (Walkley-Black and incineration at 550°C).

Page 3, lines 83-84: Revised 'Soil organic matter was determined using the Walkley and Black (1934) method.'

33. Specify whether P₂O₅ values are available P or total P.

Page 3, lines 82: Revised 'Total Available phosphorus was assessed using the Olsen method (Olsen et al., 1954)'

Interpretation of Results

Summary: The Discussion has been revised to improve the mechanistic interpretation of the results by linking key microbial traits to soil physicochemical constraints typical of coastal environments. In particular, phosphate solubilization was discussed in relation to phosphorus limitation under alkaline and calcareous conditions, siderophore production to iron limitation, and ACC deaminase activity to salinity-induced stress. A more strain-specific interpretation was provided to explain differences in plant responses, including enzymatic performance, antifungal activity, biomass production, and growth patterns. These revisions enhance the scientific depth and coherence of the Discussion.

34. Phosphate solubilization should be discussed in the context of high CaCO₃ and alkaline pH in coastal sandy soils.

Page 15, lines 370-375: Revised ‘Phosphorus is an essential element for plant growth; however, its uptake is often restricted due to its immobilization in soils, particularly sandy soils, where rapid leaching and low organic matter content reduce its uptake by plants (Gerke et al., 2024). In alkaline, calcareous coastal sandy soils, phosphate tends to precipitate by forming insoluble complexes with calcium ions, thereby decreasing its bioavailability (Johan et al., 2021). Increasing phosphate solubilization not only enhances plant growth but also increases microbial biomass P, as microorganisms rapidly assimilate the released phosphate.’

35. ACC deaminase should be connected with osmotic stress typical of coastal saline systems.

Page 15, lines 363-365: Added ‘Also, ACC deaminase activity plays a key role in alleviating stress-induced ethylene accumulation and mitigating growth inhibition under adverse environmental conditions (Gamalero et al., 2023).’

36. Siderophores could be better related to Fe limitation in high-pH environments.

Page 15, lines 382-386: Added ‘In sandy soils with low organic matter content, iron is commonly present as insoluble Fe^{3+} oxides, which limit its uptake by plants (Singh et al., 2022; Yamagata et al., 2022). Iron deficiency can affect various physiological processes (Singh et al., 2022). In response, many siderophore-producing rhizobacteria can chelate these Fe^{3+} forms and mobilize them into soluble complexes that enhance iron bioavailability (Yamagata et al., 2022).’

37. The Discussion could more explicitly interpret:

✓ **Why *P. protegens* performs better enzymatically,**

Page 15, lines 369-379: Added ‘*Pseudomonas protegens* P79, were able to solubilize tricalcium phosphate into soluble forms that can be readily absorbed by plants. Additionally, the increase in dry weight observed with *Pseudomonas protegens* P79 may be attributed to its metabolic versatility and its ability to produce a wide array of extracellular enzymes, which facilitate organic matter decomposition and nutrient release under nutrient-limited conditions (Daunoras et al., 2024), but also to its ability to synthesize phytohormones such as IAA.’

✓ **Why *P. sesami* exhibits high antifungal activity,**

Page 15, lines 391-399: Added ‘Also, *Pseudomonas sesami* R8 was able to promote the root dry weight of *L. creticus*, underscoring its potential role in nutrient cycling (Kumar et al., 2021). However, the strain exhibited relatively low tolerance to abiotic

stress *in vitro* compared with other *Pseudomonas* species. This suggests that plant growth promotion is primarily driven by functional traits, such as phytohormone production and nutrient solubilization, which can stimulate root development independently of stress tolerance (Glick, 2012). Although the strain shows limited stress tolerance under *in vitro* conditions, it can still exert beneficial effects *in vivo* through plant-associated protection and microbial interactions (Compant et al., 2010; Song et al., 2025). Additionally, secondary metabolites associated with biocontrol also contribute to improved rhizosphere competence and root colonization efficiency (Lugtenberg and Kamilova, 2009).’

✓ **Why *P. helleri* and *P. trivialis* promote shoot biomass more strongly.**

Page 15, lines 386-388: Added ‘ In this regard, results from the pot trial indicated that *Pseudomonas helleri* R125 and *Pseudomonas trivialis* R150 markedly improved the shoot and root dry biomass of *Lotus creticus*, likely due to their capacity to mobilize nutrients from the soil, particularly phosphorus and iron’

✓ **Why R15 increases shoot length substantially but not biomass.**

Page 15, lines 388-390: Added ‘In contrast, inoculation of *L. creticus* with *Pseudomonas versuta* R15 led to lower dry biomass but greater shoot length, suggesting that this strain promotes cell elongation, likely through hormonal effects rather than biomass accumulation (Kurepa et al., 2026).’

✓ **Why P79 increases root dry weight despite moderate performance in other traits.**

Page 15, lines 376-379: Added ‘Additionally, the increase in dry weight observed with *Pseudomonas protegens* P79 may be attributed to its metabolic versatility and its ability to produce a wide array of extracellular enzymes, which facilitate organic matter decomposition and nutrient release under nutrient-limited conditions (Daunoras et al., 2024), but also to its ability to synthesize phytohormones such as IAA.’

✓ **R8 increases root dry weight but is among the least stress-tolerant strains**

Page 15, lines 392-407: Added ‘Also, *Pseudomonas sesami* R8 was able to promote the root dry weight of *L. creticus*, underscoring its potential role in nutrient cycling (Kumar et al., 2021). However, the strain exhibited relatively low tolerance to abiotic stress *in vitro* compared with other *Pseudomonas* species. This suggests that plant growth promotion is primarily driven by functional traits, such as phytohormone production and nutrient solubilization, which can stimulate root development independently of stress tolerance (Glick, 2012). Although the strain shows limited

stress tolerance under in vitro conditions, it can still exert beneficial effects in vivo through plant-associated protection and microbial interactions (Compant et al., 2010; Song et al., 2025). Additionally, secondary metabolites associated with biocontrol also contribute to improved rhizosphere competence and root colonization efficiency (Lugtenberg and Kamilova, 2009). Notably, *Pseudomonas sesami* R8 demonstrated strong antifungal activity against all tested fungi. A particular effect that could be attributed to the ability of the strain to produce secondary metabolites, such as ammonia and HCN, which restrict fungal growth, reduce their access to soil nutrients, and enhance rhizosphere health (Sehrawat et al., 2022). These findings suggest a functional bias of *Pseudomonas sesami* R8 toward biocontrol rather than abiotic stress tolerance (Sehrawat et al., 2022). In practice, the strain could be applied as a seed coating or soaking treatment to protect *L. creticus* seeds, suppress fungal colonization, and enhance early plant development. Alternatively, they could be introduced directly into the rhizosphere through soil inoculation (Paravar et al., 2023). For foliar pathogens such as *Botrytis cinerea*, spraying bacterial suspensions onto leaves may inhibit spore germination and lesion development (Roca-Couso et al., 2021).'

Technical Corrections

Summary : The manuscript was revised to improve clarity and consistency across all technical and formatting aspects. Abbreviations are now defined at first use, numerical values have been standardized, and units and spacing were made consistent throughout the text. Figures and tables were also clarified by indicating that values are presented as mean $\pm$ SD and by specifying the number of replicates ($n = 3$). In addition, typographical issues-including pH notation and the formatting of Latin binomials-were corrected. Overall, these changes enhance the readability and presentation of the manuscript:

38. Ensure all abbreviations (CFU, SI, ACCD) are defined at first appearance.

Corrected

39. Some numerical values in tables should be harmonized to avoid differing precision (e.g., 150.5 vs 59.70).

Corrected

40. The Discussion sometimes repeats results instead of interpreting them-condensation and synthesis would improve flow.

Revised as cited above

41. Figures 4 and 5: The error bars appear highly asymmetrical at times; verify whether they represent SD or SE.

Page 8, lines 225-226: Added ‘All data are presented as means $\pm$ standard deviation (SD).’

- 42. The figures do not specify the value of n (number of individuals per treatment). This information should be Added for clarity and reproducibility.**

Page12, lines 328: Added ‘Values are expressed as mean $\pm$ SD of three independent replicates ($n = 3$ pots).’

Page12, lines 305-306: Added ‘Values are expressed as mean $\pm$ SD of three independent replicates ($n = 3$ pots).’

Page12, lines 339-340: Added ‘Values are expressed as mean $\pm$ SD of three independent replicates ($n = 3$ pots).’

- 43. Inconsistent spacing before units: Some concentrations are written with or without a space before the unit (e.g., “150.5 mg·L⁻¹” vs “150.5mg·L⁻¹”). This should be standardized throughout the manuscript.**

Corrected

- 44. Incorrect capitalization of pH: The term *pH* appears at times as “PH” in uppercase. Please correct these occurrences.**

Corrected

- 45. Incorrect formatting of Latin binomials: Latin species names must always appear in italics, with the genus capitalized and the species in lowercase.**

Corrected

- 46. *Pseudomonas Helleri* (species name must not be capitalized).**

Corrected

- 47. *Lotus creticus* is occasionally written without italics.**

Corrected