Plant growth promoting properties of yeasts isolated from soils

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INTRODUCTION

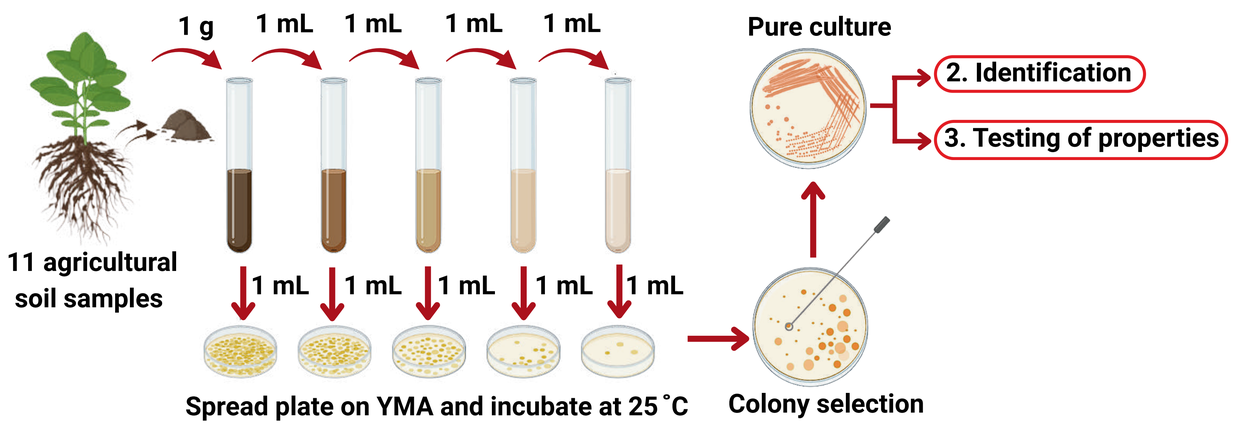
Soil microorganisms play a crucial role in maintaining soil fertility and promoting plant growth [1]. Among them, soil yeasts have recently emerged as promising biological resources due to their diverse potential to enhance plant development through several direct and indirect mechanisms, including the production of phytohormones such as indole-3-acetic acid (IAA), solubilization of insoluble minerals, secretion of siderophores, and production of enzymes [2,3]. Some soil yeasts have been developed as biostimulants and are increasingly applied in agriculture as environmentally friendly alternatives to toxic chemical fertilizers [4,5]. However, research focusing on soil yeast diversity and their plant growth-promoting properties in Northern Thailand remain limited.

OBJECTIVES

1. To isolate and identify yeasts from agricultural soil samples in Northern Thailand
2. To examine their characteristics in terms of their plant growth promoting properties

METHODOLOGY

1. Isolation of yeast



2. Identification of yeast strains



Pure culture → Morphology

DNA extraction → Data analysis

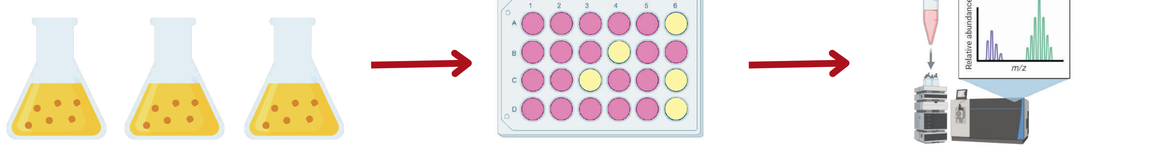
PCR amplification (D1/D2 region of LSU rRNA gene) → Species identification

Sequencing of DNA

Similarity (%)
- Ascomycota : 99.41%
- Basidiomycota : 99.51 %

3. Testing of plant-growth promoting properties

3.1) IAA production

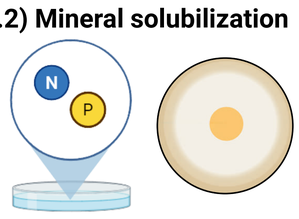


Culture in YM broth with 2 mg/ml L-trytophan

Salkowski test for qualitative IAA screening

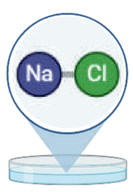
Extraction and quantification of IAA by HPLC analysis

3.2) Mineral solubilization



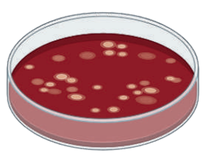
Drop plate on basal medium with ZnO, $ZnCO_3$, $CaCO_3$, $Ca_3(PO_4)_2$, MnO, $FePO_4$, $MgCO_3$ and Kaolin

3.3) Salt tolerance



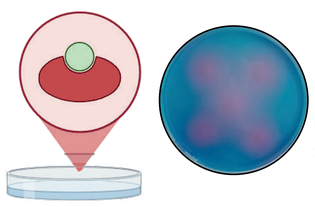
Drop plate on yeast malt agar with 0%, 2.5%, 5%, 7.5% and 10% of NaCl

3.4) Hemolysis assay



Drop plate on blood agar and observe zone of lysis around colony

3.5) Siderophore production

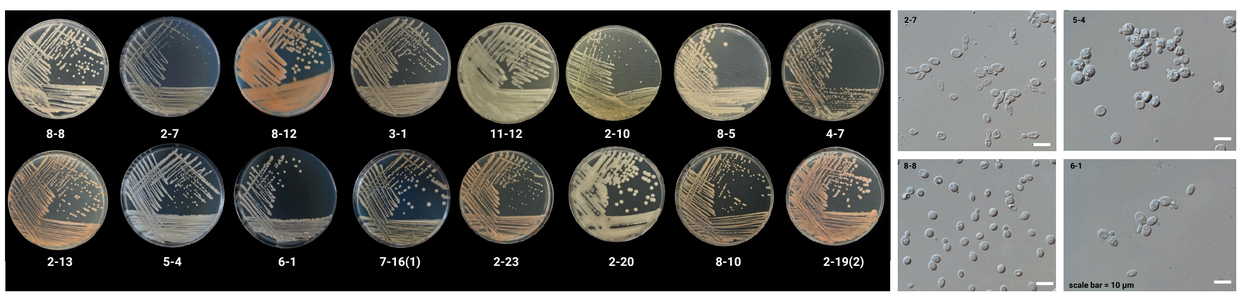


Drop plate on CAS agar and observe pink, purple, or yellow zone surrounding colony

RESULTS

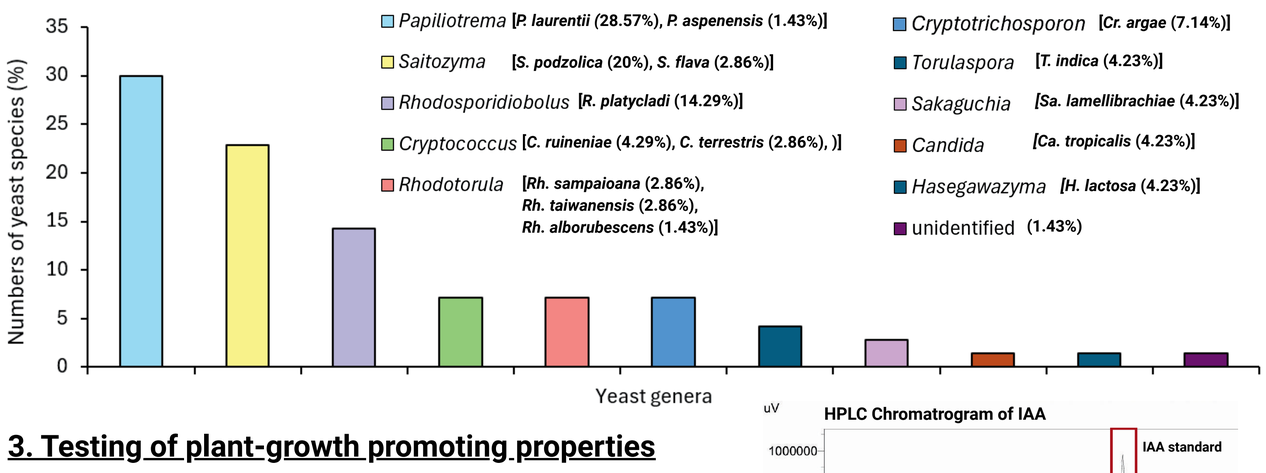
1. Isolation of yeast

A total of 70 isolates were obtained from soil samples collected at 11 sites.



2. Identification of yeast strains

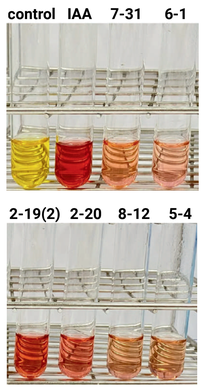
- 11 genera and 16 species were identified
- One yeast strain was designated as an unidentified species



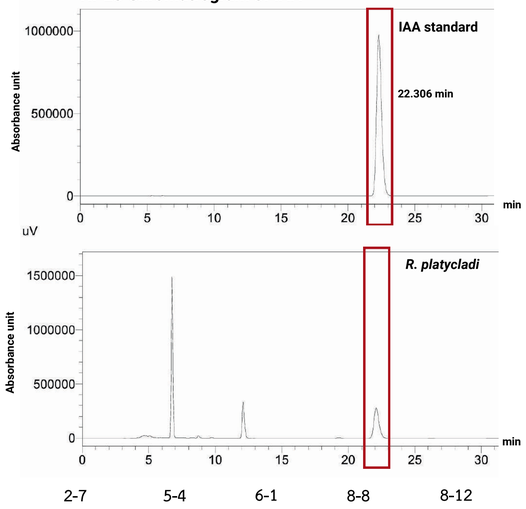
3. Testing of plant-growth promoting properties

3.1 IAA production

Yeast species	Strains	IAA (µg/ml)
R. platycladi	2-19(2)	320.69 ± 8.73
P. laurentii	7-31	51.02 ± 0.60
S. flava	8-15	40.69 ± 2.21
Rh. taiwanensis	8-10	19.90 ± 13.33
Ca. tropicalis	6-1	19.64 ± 12.49
C. ruineniae	2-20	3.67 ± 0.75
T. indica	5-4	2.84 ± 0.48
Cr. argae	2-10	2.21 ± 0.01
Rh. alborubescens	8-5	2.24 ± 0.60
Unidentified	7-16(1)	0.39 ± 0.05



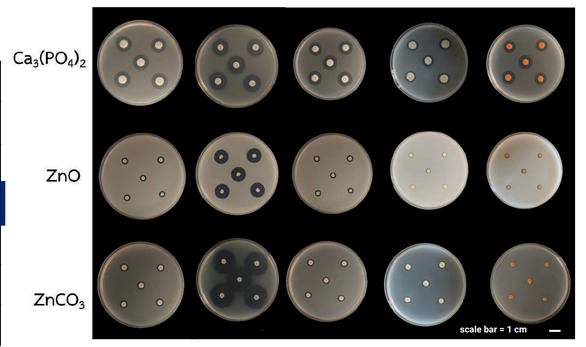
Colorimetric assay



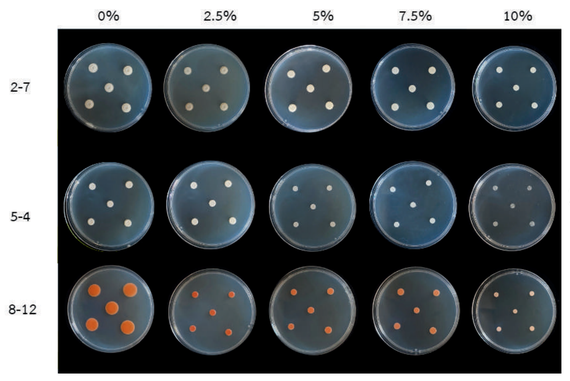
HPLC Chromatogram of IAA

3.2 Mineral solubilization

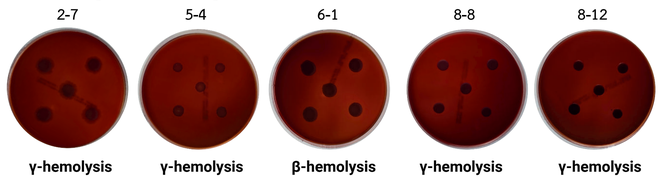
Yeast species	Strains	Solubilization Index		
		$Ca_3(PO_4)_2$	ZnO	$ZnCO_3$
S. podzolica	2-7	1.87 ± 0.11	1.70 ± 0.15	1.59 ± 0.08
T. indica	5-4	2.62 ± 0.08	3.73 ± 0.31	4.00 ± 0.11
Ca. tropicalis	6-1	1.83 ± 0.07	1.53 ± 0.05	1.60 ± 0.00
P. laurentii	8-8	1.83 ± 0.07	1.17 ± 0.00	1.18 ± 0.04
Rh. taiwanensis	8-12	1.83 ± 0.07	1.25 ± 0.00	1.20 ± 0.00



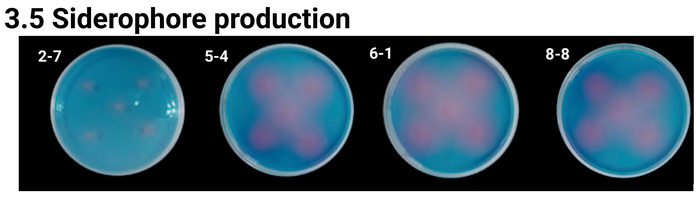
3.3 Salt tolerance



3.4 Hemolysis assay



3.5 Siderophore production



Yeast species	Strains	Growth maximum of NaCl concentration (%)	Hemolysis	Siderophore production
S. podzolica	2-7	10%	γ-hemolysis	+ (pink zone)
T. indica	5-4	10%	γ-hemolysis	+ (pink zone)
Ca. tropicalis	6-1	10%	β-hemolysis	+ (pink zone)
P. laurentii	8-8	7.5%	γ-hemolysis	+ (pink zone)
Rh. taiwanensis	8-12	10%	γ-hemolysis	+ (yellow zone)

CONCLUSIONS

1. A total of 70 yeast strains were obtained and the most abundant recovered species was *Papiliotrema laurentii* (28.57%), followed by *Saitozyma podzolica* (20%), and *Rhodosporidiobolus platycladi* (14.29%).
2. A total of 38 strains produced IAA (0.39 to 320.69 µg/mL), with *Rhodosporidiobolus platycladi* exhibiting the highest production.
3. A total of 66 strains had the ability to solubilize insoluble zinc and calcium minerals.
4. Four strains with high IAA production and mineral solubilization ability demonstrated positive siderophore production, non-hemolytic activity, and salt tolerance.

REFERENCES

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