

A STUDY OF THE MARINE YEASTS IN TAIWAN

II. Yeasts Isolated from Tideland Mud, Kuan-to, Tanshui, and Keelung Districts**

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Seven strains of marine yeasts isolated from the tideland mud at Wuchi district have been described in a previous paper (9). These studies been extended to the northern part of this island, including Kuan-to, Tanshui and Keelung districts. Materials and methods employed were the same as previously described in the earlier paper.

Results and Discussion

Ten strains of marine yeasts belonging to six genera have been isolated from the tideland mud collected from Kuan-to, Tanshui and Keelung.

Strain #2. Related to *Rhodotorula mucilaginosa*

(Jorg) Harrison Fig. (1, 2)

Strain #8. Cells round or oval, (2.5-5) x (3-9) μ ; budding, single or in pairs. Sediment and ring formed in M-Y broth. On dalmau plate, streak culture red to orange red, surface smooth, not mucous. No pseudomycelium formed at covered portion.

Fermentation: Negative
 Assimilation: Glucose + Maltose +
 Galactose - Lactose -
 Sucrose + Nitrate +

Related to *Rhodotorula glutinis* (Fres.) Harrison

Fig. (3, 4)

Strain #9. Cells almost round, (2-6) μ ; budding, single or in pairs. Sediment, ring and wrinkled pellicle formed in M-Y broth. On dalmau plate, the streak culture cream to tea color, surface smooth, soft with irregular margin. No pseudomycelium formed at covered portion.

Sporulation: Spores round, 2 per ascus.
 Fermentation: Glucose + Maltose -
 Galactose - Lactose -
 Sucrose +

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** This project was supported by a grant from the National Council on Science Development.

Assimilation: Glucose + Maltose +
Galactose + Lactose -
Sucrose + Nitrate -

Related to *Sacchaomyces veronae* Nov. Spec.

Fig. (5, 6)

Strain #10. Cells round or oval, (2-5) x (2-6) μ ; budding, single or in pairs. Sediment and ring formed in M-Y broth. On dalmau plate, the streak culture cream color, surface smooth, glistening, margin smooth. No pseudomycelium formed at covered portion.

Sporulation: Spores saturn shaped with an oil drop inside. 1-4 per ascus.

Fermentation: Glucose + Maltose -
Galactose - Lactose -
Sucrose -

Assimilation: Glucose + Maltose -
Galactose - Lactose -
Sucrose + Nitrate +

Related to *Hansenula californica* (Lodder) Wickerham

Fig. (7, 8)

Strain #11. Cells oval or elongate, (3-5) x (5-9) μ , some pseudomycelial cells up to 35 μ ; single or in chains. Sediment, broad ring and pellicle formed in M-Y broth. On dalmau plate, the streak culture yellowish-white color, surface wrinkled and hairy. Pseudomycelium, true mycelium, blastospores and arthrospores formed at covered portion.

Fermentation: Glucose + Maltose -
Galactose - Lactose -
Sucrose +

Assimilation: Glucose + Maltose +
Galactose + Lactose -
Sucrose + Nitrate -

Related to *Trichosporon behrendii* Nov. Spec.

Fig. (9, 10, 11)

Strain #12. Cells almost round, occasionally short oval, (2-6) μ ; budding, single or in pairs. Cells usually surrounded by a capsule in old cultures. Heavy sediment, ring and pellicle formed in M-Y broth. On dalmau plate, the streak culture white color, surface smooth and glistening, margin smooth. No pseudomycelium formed at covered portion.

Fermentation: Negative

Assimilation: Glucose + Maltose +
Galactose + Lactose -
Sucrose + Nitrate -

Related to *Cryptococcus neoformans* (Sanf.) Vuill. Fig. (12,13)

Strain #13. Cells oval or long oval to elongate, oval cells are (1.5-3) x (2.5-5) μ , elongate cells are (1.5-2) x (7-12) μ ; budding, single or in pairs. Cells always

surrounded by a capsule. On dalmau plate, the streak culture cream color, surface wrinkled. Pseudomycelium formed at covered portion.

Fermentation: Negative
 Assimilation: Glucose + Maltose +
 Galactose + Lactose -
 Sucrose + Nitrate -

Related to *Cryptococcus luteolus* (Saito) Skinner

Fig. (14, 15)

Strain #14. Cells almost round, occasionally oval, (2-6) μ ; budding, single or in pairs. Heavy sediment, ring and pellicle formed in M-Y broth. Cells usually surrounded by a capsule in old cultures. On dalmau plate, the streak culture white color, surface smooth and glistening, margin smooth. No pseudomycelium formed at covered portion.

Fermentation: Negative
 Assimilation: Glucose + Maltose +
 Galactose + Lactose -
 Sucrose + Nitrate +

Related to *Cryptococcus diffluens* (Zach) Nov. Comb.

(Fig. 16, 17)

Strain #15. Cells round, oval or elongate, (1.2-3) x (1.5-7) μ ; budding, single or in pairs. Only sediment formed in M-Y broth. On dalmau plate, the streak culture cream color, surface smooth, raised at middle, margin irregular. Pseudomycelium formed at covered portion.

Fermentation: Glucose + Maltose -
 Galactose + Lactose -
 Sucrose -
 Assimilation: Glucose + Maltose -
 Galactose + Lactose -
 Sucrose - Nitrate -

Related to *Candida catenulata* Diddens et Lodder.

Fig. (18, 19)

Strain #16. Cells oval or elongate, oval cells measure (2-4) x (2.5-5.5) μ , elongate cells measure (1.5-3) x (8-20) μ ; budding, single or in pairs. Sediment and ring formed in M-Y broth. On dalmau plate, the streak culture yellowish white color, smooth, glistening, margin smooth. Pseudomycelium formed at covered portion.

Fermentation: Glucose + Maltose -
 Galactose + Lactose -
 Sucrose -
 Assimilation: Glucose + Maltose +
 Galactose + Lactose -
 Sucrose + Nitrate -

Related to *Candida parapsilosis* (Ashf.) Langeron et Talice

Fig. (20, 21)

The adsorption of yeasts by tideland mud.

The particle constitution of the tested mud collected from Kuan-to is given in Table I.

Table I.

Diam. of Particle Mud (m.m.)	>1.5	1.5-0.5	0.5-0.3	0.3-0.2	<0.2
No. 1 Surface mud near high tide	0	1.5%	14%	10%	74.5%
No. 2 Depth of 35 cm near high tide	0	0.7%	4.3%	8.25%	86.75%
No. 3 Sandy mud near low tide	1%	10%	30%	6%	53%

The adsorption rates of yeasts by different weights of different muds are shown in Table II.

The tested culture was *Saccharomyces veronae*.

Table II

Weight of Mud Mud (gm)	0.5	1	2	3
No. 1	99.5%	99.9%	99.9%	99.9%
No. 2	99.5%	99.9%	99.9%	99.9%
No. 3	96%	98.8%	99.5%	99.8%

This showed that the adsorption rates were maximum in mud No. 1 and No. 2 when the weight was 1 gm. per 10 millilitres of yeast suspension, and the adsorption rate of mud No. 3 was increased, when the weight of mud was increased. Therefore 1 gm of tested mud was the most favorable weight with which to compare the adsorption rates by muds of different particle constitution. The relations between adsorption rates and the concentrations of yeast suspension are shown in Table III.

The tested mud was 1 gm of mud No.1 and the tested cultures were *Saccharomyces veronae* and *Rhodotorula glutinus*.

Table III

Number of Yeasts Per ml.	10^{5-6}	10^{6-7}	10^{7-8}
Tested Culture 10^{5-6}			
<i>Saccharomyces veronae</i>	99.8%	99.9%	99.5%
<i>Rhodotorula glutinus</i>	68%	70%	66%

From the above table, it is shown that when the concentration was 10^{6-7} /ml. the adsorption rates were maximum. The adsorption rates of yeasts by marine mud are shown in Table IV. The weight of tested mud was 1 gm. and the concentration of yeast suspension was 10^{6-7} /ml

Table IV

Tested Culture	Mud		
	No. 1	No. 2	No. 3
<i>Saccharomyces veronae</i>	99.9%	99.7%	99.5%
<i>Candida parapsilosis</i>	99.1%	99%	98.8%
<i>Cryptococcus luteolus</i>	98.6%	99.2%	98.4%
<i>Rhodotorula glutinus</i>	70%	64%	60%
<i>Rhodotorula mucilaginosa</i>	71%	74.3%	35.7%
<i>Trichosporon behrendii</i>	99.7%	98.5%	99.4%

Table IV illustrates dissimilarities of adsorption rates according to the nature of different species of yeasts and the particle constitution of different muds.

SUMMARY

Ten strains of marine yeasts belonging to six genera have been isolated from the Kuan-to, Tanshui, and Keelung districts. Descriptions of cell morphology, colonial characteristics, asexual reproduction and sporulation, along with observations on pellicle formation and biochemical properties permitted the probable identification of these strains: *Rhodotorula mucilaginosa*, *Rhodotorula glutinus*, *Saccharomyces veronae*, *Hansenula californica*, *Trichosporon behrendii*, *Cryptococcus neoformans*, *Cryptococcus luteolus*, *Cryptococcus diffluens*, *Candida parapsilosis*, and *Candida catenulata*.

The adsorption of yeasts by tideland mud was found to be correlated with the nature of the yeasts, the particle constitution, the amount of the testing mud, and the concentration of the yeast suspension. Based upon the experimental data, the following conclusions have been made:

- (1) The dissimilarities of adsorption rates by tideland mud are related to the nature of the different species of yeasts.
- (2) A larger proportion of smaller particles in a population of mud gives a higher adsorption rate of yeasts.
- (3) One gram of mud per ten millilitres of yeast suspension is the most favorable weight with which to compare the difference between the particle constitution of the mud and the adsorption rate of the yeasts.
- (4) A yeast suspension of 10^{6-7} cells per millilitre gives the maximal adsorption rate.

Literature Cited

1. Kriss, A. E. Marine Microbiology (Eng. Edi.) , pp. 184-236, 1963.
2. Lodder, J. and N. J. W. Kreger-van Rij. The Yeasts, a Taxonomic Study. Interscience publishers, Inc., New York, 1952.
3. Wickerham, Lynferd J. Taxonomy of Yeasts. U. S. Department Agric. Tech. Bull., No. 1029, 1951.
4. Phaff, H. J., E. M. Mrakk and O. B. Williams. Mycologia 44: 443, 1952.
5. Suehiro, Sumio. Sci. Bull. Agri. Kyushu University, 17: 443-449, 1960.
6. —————, ibid, 20: 223, 1963.
7. Waksman, S. A. Sci. Month. 38: 35, 1931.
8. Wood, E.J.F. Australian Jour. Marine and Fresh Water Res. 4: 160, 1953.
9. Sung, Shih-chin, Jour. Sci. and Engineering, Chug Hsing Univ. 2: 201-209, 1964.

臺灣海洋酵母菌之研究

II 關渡、淡水、基隆沿岸潮汐區淤泥中分離之酵母菌

宋世謹*

本文之目的在了解臺灣北部關渡、淡水、基隆沿岸潮汐區淤泥中酵母菌之種類及淤泥粒子對酵母菌之吸着關係。淤泥以滅菌小匙挖取置之滅菌之棉栓試管內，隨即攜返實驗室，加以滅菌海水，振盪製懸濁液，接種於含抗生素 Penicillin 及 Streptomycin 之瓊脂平板上，當菌落生長良好，再移入 M-Y 瓊脂斜管上保存於冰箱內，供形態及生理特徵之觀察，作為鑑定之依據。

分離所得之海洋酵母菌，經整理後共得十菌株，本文觀察各菌株之細胞形態，菌落特徵，生殖方式，孢子形態，培養湯中有無膜之形成，醣類發酵情形，醣類及硝酸鹽之同化情形，依 Lodder 氏檢索表鑑定之，共得十種分隸於六屬如下：*Rhodotorula mucilaginosa*, *Rhodotorula glutinus*, *Saccharomyces veronae*, *Hansenula californica*, *Trichosporon behrendii*, *Cryptococcus neoformans*, *Cryptococcus luteolus*, *Cryptococcus diffluens*, *Candida parapsilosis* 及 *Candida catenulata*。

淤泥粒子對酵母菌之吸着率與菌株之特性，淤泥粒子組成，供試之淤泥重量及酵母菌懸濁液中菌濃度有關：

1. 不同種之酵母菌其吸着率亦不同。
 2. 淤泥粒子組成中小粒子較多者其吸着率亦較高。
 3. 供試之淤泥重量為 1 克時為最適宜，可比較粒子組成不同之各種淤泥對酵母菌吸着率之關係。
 4. 供試之酵母菌懸濁液菌濃度以 10^{2-7} /ml 時其吸着率為最高。
- 3, 4 項之結果與日人 Suehiro 之報告結果相同。

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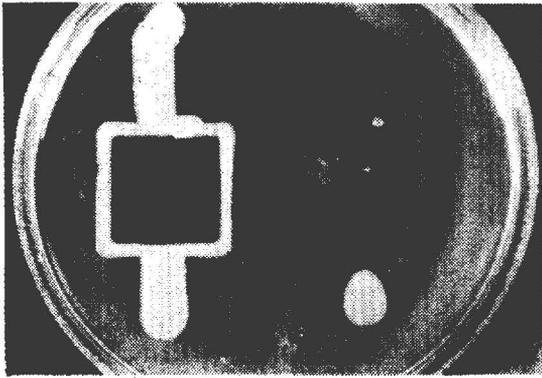


Fig. 1



Fig. 2 $\times 1500$

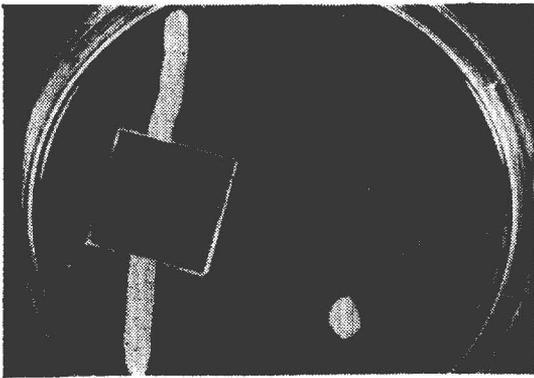


Fig. 3



Fig. 4 $\times 2000$

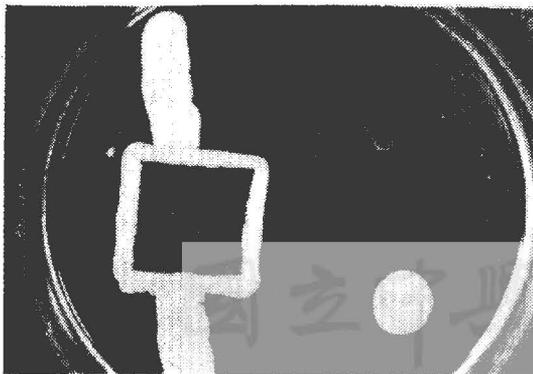


Fig. 5

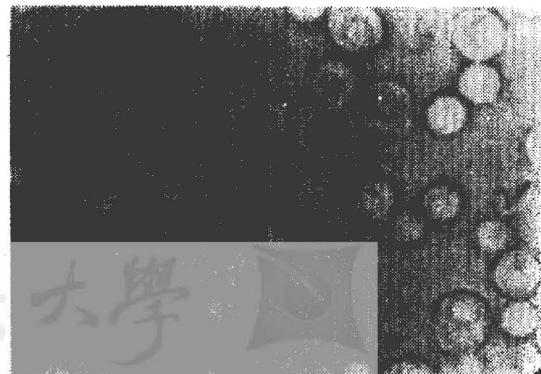


Fig. 6 $\times 2000$

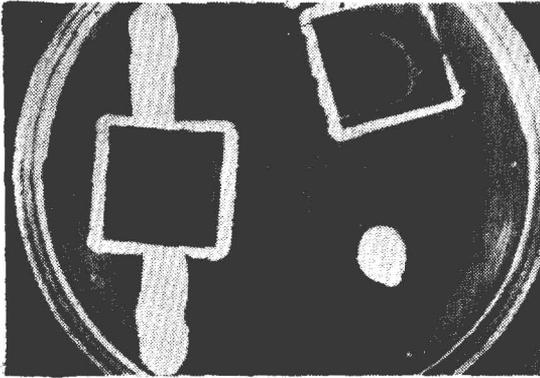


Fig. 7



Fig. 8 $\times 1500$

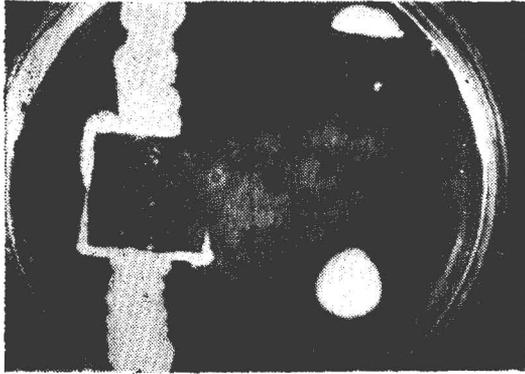


Fig. 9



Fig. 10 $\times 1600$



Fig. 11 $\times 1600$

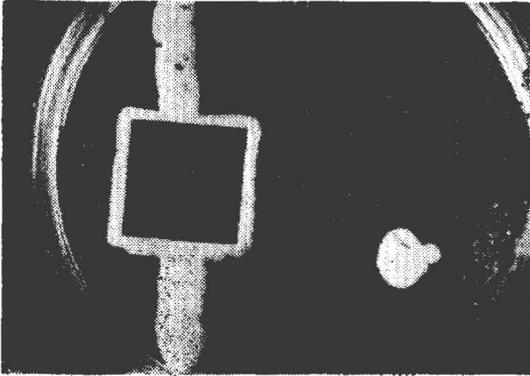


Fig. 12



Fig. 13 $\times 1500$

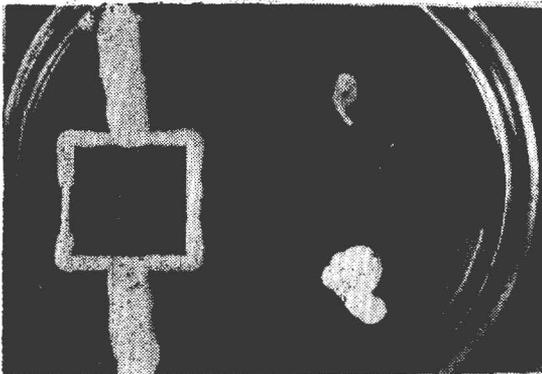


Fig. 14



Fig. 15 $\times 1500$

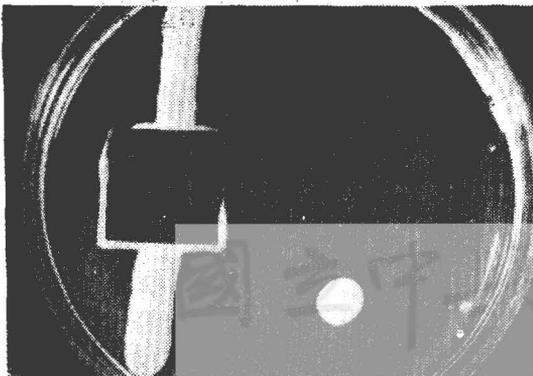


Fig. 16



Fig. 17 $\times 1500$

National Chung Hsing University

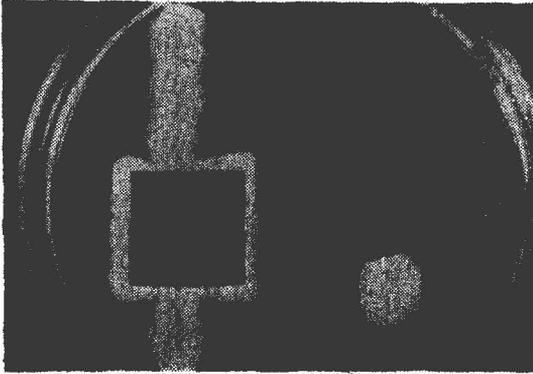


Fig. 18



Fig. 19 ×2000

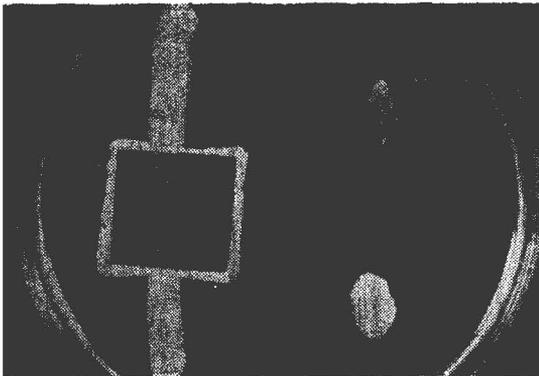


Fig. 20



Fig. 21 ×2000