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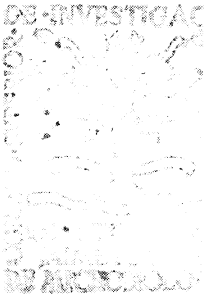

por

R. DÍAZ (**), con la colaboración técnica de NICOLE BOSSERAY

INTRODUCCION

Ha sido demostrado que la reacción cruzada de aglutinación entre el género *Brucella* y *Yersinia enterocolitica* serotipo 9, descrita por Avhonen y colaboradores (1), se debe a la presencia de determinantes antigénicos comunes situados en el lipopolisacárido (antígeno somático 0) de ambas especies (9 y 16).

Por otra parte, Díaz y Levieux (10) han demostrado que el componente antigénico A + M del lipopolisacárido de *Brucella* extraído por el método de Redfearn (21), es el antígeno que juega el papel más importante en las reacciones serológicas de aglutinación, Coombs y Rosa de Bengala, y que los anticuerpos puestos de manifiesto con estas reacciones serológicas son absorbidos con el lipopolisacárido de *Yersinia enteroco-*

(*) Parte de este trabajo fue presentado en el International Symposium on *Yersinia, Pasteurella* and *Franciscella.* Malmö (Suecia), 10-12 de abril, 1972.

(**) Dirección actual: Departamento Interfacultativo de Microbiología y Parasitología, Universidad de Navarra, Pamplona.

litica serotipo 9. Jones y colaboradores (resultados no publicados) han observado que el lipopolisacárido de *Y. enterocolitica* y el antígeno A + M del género *Brucella* fijan el complemento en presencia de sueros procedentes de vacas infectadas con *Brucella.* Estos resultados, por lo tanto, explican, en parte, las observaciones de otros autores (3, 11 y 15) concernientes a la imposibilidad de efectuar un diagnóstico serológico diferencial entre brucelosis y yersiniosis, con el empleo de las pruebas mencionadas.

La reacción de inmunoprecipitación en gel, ha permitido poner de relieve que, a excepción del lipopolisacárido, no se observa comunidad entre otros componentes antigénicos del género *Brucella* y *Yersinia enterocolitica* tipo 9 (9 y 14). Estos resultados sugieren que la demostración de anticuerpos frente a antígenos propios de *Brucella* y *Yersinia enterocolitica* serotipo 9, podría ser un método adecuado para llevar a cabo el diagnóstico serológico diferencial entre brucelosis y yersiniosis. En efecto, Díaz y Dorronsoro (6), mediante el empleo de técnicas de inmunoprecipitación en gel, pusieron de manifiesto que en sueros de pacientes con brucelosis y yersiniosis existen anticuerpos específicos contra antígenos propios del género *Brucella* y *Yersinia*.

Como desconocemos las relaciones antigénicas existentes entre el género *Yersinia* y otras bacterias gram-negativas, el objeto de este trabajo ha sido estudiar dichas relaciones y la especificidad de la reacción de precipitación en gel, antes de ser aplicada al diagnóstico de la yersiniosis.

MATERIAL Y METODOS

En el *cuadro 1* aparecen las cepas microbianas empleadas en nuestro estudio y el origen de las mismas. Los cultivos se efectuaron en medio sólido agar-tripticasa-soja. Las células se precipitaron con 3 volúmenes de acetona a — 20 °C. El precipitado obtenido fue lavado 3 veces con acetona fría y finalmente desecado.

El antígeno soluble (AS) utilizado en las pruebas de inmunoprecipitación en gel se preparó de la manera siguiente: las células muertas y desecadas con acetona, se resuspendieron en agua destilada, a una concentración final del 4 %. A continuación fueron desintegradas en un homogeneizador Braun MSK durante 5 min. Después de la decantación de las perlas de vidrio, el supernadante fue centrifugado a 100.000 × *g*, en

Cuadro 1

Escherichia coli	26 B 6-H	I.N.R.A.
Salmonella abortus ovis	15-5	I.N.R.A.
Shigella flexneri	5236	Institut Pasteur
Klebsiella pneumoniae	52 145	Institut Pasteur
Enterobacter aerogenes	6086	Institut Pasteur
Proteus mirabilis	D3-15-20	I.N.R.A.
Serratia marcescens	D3-7-17	I.N.R.A.
Pasteurella multocida	563	Institut Pasteur
Bordetella bronchiseptica	52 127	Institut Pasteur
Pseudomonas aeruginosa	D3-19-8	I.N.R.A.
Yersinia enterocolitica	MY 79	Dr. P. Ahvonen
Y. pseudotuberculosis	NCTC 8315	Colindale
Y. pestis	TS	Dr. T. W. Burrows
Brucella melitensis	16 M	I.N.R.A.
B. melitensis	115	Dr. L. M. Jones
B. abortus	2308	Dr. L. M. Jones

una ultracentrífuga preparativa Beckman L-2, durante 6 h. El sobrenadante obtenido se liofilizó y constituyó el antígeno AS.

El lipopolisacárido de *Brucella melitensis* y *Yersinia enterocolitica* tipo 9, fue extraído mediante la técnica de Whesphal y colaboradores (25), con las modificaciones introducidas por Redfearn (21). Finalmente, la preparación de polisacárido B se efectuó a partir de *B. melitensis* 115, según el método descrito previamente (10).

Técnicas inmunológicas

La inmunoelectroforesis se realizó según el método de Scheidegger modificado por Chordi y colaboradores (4). La técnica de doble difusión en agar empleada en nuestro estudio es la descrita por Ouchterlony (20).

Preparación de inmunosueros

Dos conejos se hiperinmunizaron con cada cepa bacteriana. La técnica de inmunización se efectuó según el esquema previamente descrito (7).

Las características del suero procedente de vacas infectadas con *Brucella,* han sido publicadas en un trabajo anterior (10).

RESULTADOS

La *figura 1* expresa los resultados del análisis antigénico de los extractos AS de cada especie microbiana, obtenidos por inmunoelectroforesis y doble difusión en agar, frente a los inmunosueros homólogos y heterólogos.

La inmunoelectroforesis de los antígenos AS de *Yersinia enterocolitica, Y. pestis* e *Y. pseudotuberculosis* demostró que las 3 especies poseen al menos 12 componentes antigénicos en común; de 4 a 6 componentes antigénicos comunes con las especies representativas de la familia Enterobacteriaceae y solamente 1 ó 2 componentes comunes con *Pasteurella multocida.* Por otra parte, los sueros anti-*Yersinia* no formaron ninguna banda de precipitación con el antígeno AS de *Pseudomonas aeruginosa.*

El análisis antigénico de los miembros de la familia Enterobacteriaceae incluidos en este estudio, ha demostrado que *Salmonella abortus ovis, Escherichia coli* y *Shigella flexneri* poseen una estructura antigénica muy similar, pues se observaron al menos 10 componentes antigénicos comunes. Sin embargo, un estudio detallado de estas especies reveló que las relaciones antigénicas entre *E. coli* y *Sh. flexneri* son más estrechas que con *S. abortus ovis,* pues se observaron de 5 a 6 líneas de precipitación que no aparecían cuando se empleaba el extracto de AS de *S. abortus ovis.* No obstante, es posible formar un grupo con estas 3 especies, que han demostrado poseer solamente de 4 a 6 componentes antigénicos comunes con *Proteus mirabilis* y *Serratia marcescens.*

Klebsiella pneumoniae y *Enterobacter aerogenes* poseen una estructura antigénica muy similar, demostrándose al menos 8 componentes antigénicos comunes con *Salmonella abortus ovis, Escherichia coli* y *Shigella flexneri,* y de 4 a 6 componentes antigénicos comunes con *Proteus mirabilis* y *Serratia marcescens.*

El estudio de 82 sueros bovinos nos permitió demostrar en uno de ellos la presencia de precipitinas frente al antígeno AS de *Yersinia enterocolitica* serotipo 9. El estudio de este suero frente a los antígenos AS de las especies microbianas pertenecientes a la familia Enterobacteriaceae y

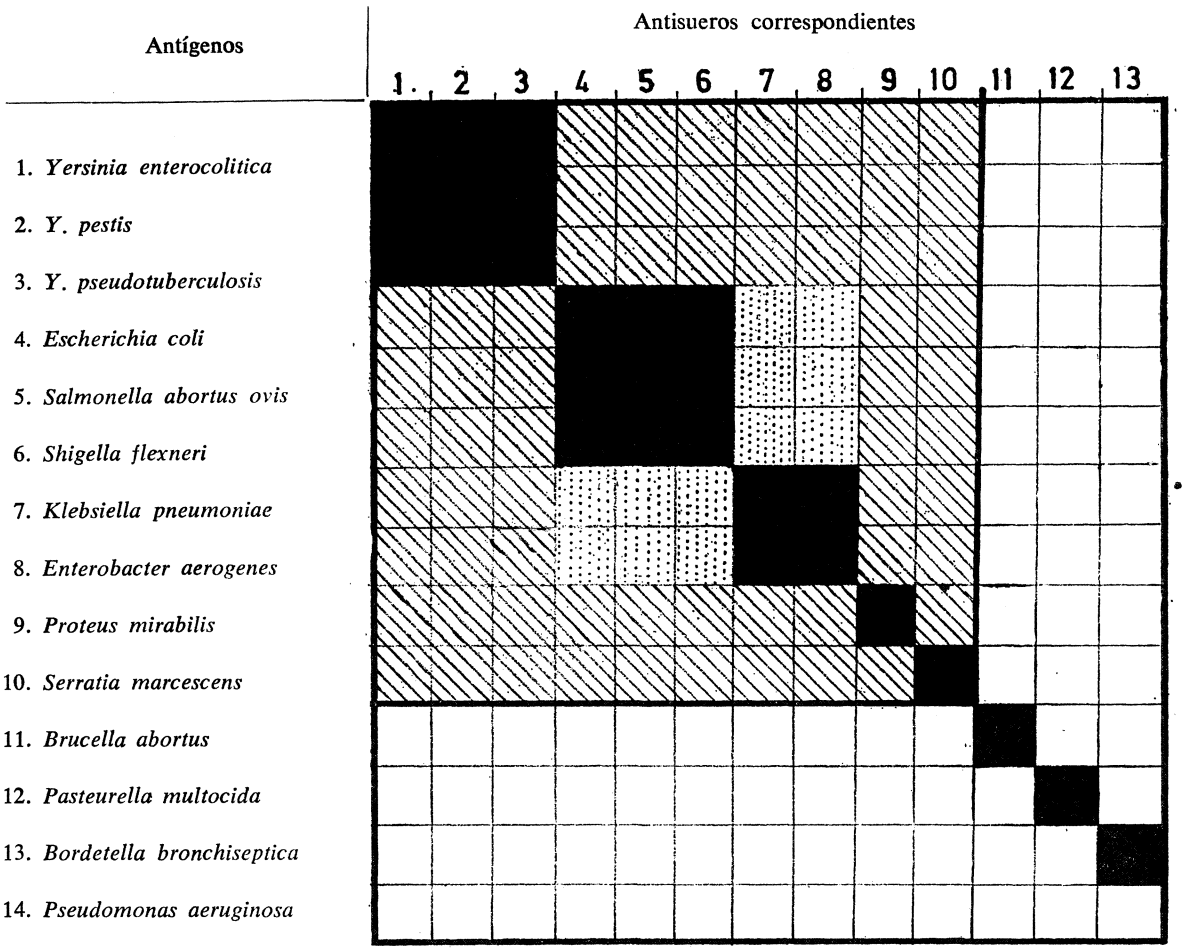

Figura 1. Representación esquemática de las relaciones antigénicas entre las diferentes especies microbianas estudiadas por inmunoelectroforesis. Las zonas negras representan de 12 a 16 líneas de precipitación en común; las zonas punteadas, de 8 a 10 líneas; las zonas rayadas, de 4 a 6, y las zonas blancas corresponden a ausencia de relaciones antigénicas o a la presencia de 1 ó 2 líneas de precipitación en común

al género *Yersinia,* demostró que las líneas de precipitación que desarrollaban frente a *Y. enterocolitica* serotipo 9 eran desarrolladas también frente a las otras especies microbianas *(figura 2).*

Estos resultados indican que la inmunoprecipitación en gel frente a un extracto AS no permite hacer un diagnóstico de yersiniosis, y en efecto, 2 sueros de pacientes de los que se había aislado *Yersinia enterocolitica* serotipo 9, formaron las mismas líneas de precipitación frente a *Escherichia coli, Serratia marcescens* e *Y. enterocolitica.*

Previamente habíamos demostrado que un 6 % de los sueros de pacientes con brucelosis poseían anticuerpos demostrables mediante inmunoprecipitación en gel frente al polisacárido B, es decir, frente al segundo componente antigénico que se extrae mediante el procedimiento de Redfearn y que contamina el antígeno A + M (21). Como habíamos observado que los sueros anti-*Yersinia* no desarrollaban la línea de precipitación correspondiente al polisacárido B, estábamos, por lo tanto, interesados en saber si dicho componente era específico del género *Brucella.*

La *figura 3* es una reproducción fotográfica del análisis antigénico del extracto total obtenido de *Brucella melitensis* 16 M mediante el procedimiento de Redfearn (21). En el canal superior se colocó suero procedente de vacas infectadas y en el canal inferior el mismo suero, pero absorbido con 5 mg/ml de polisacárido B, extraído de *B. melitensis* 115. Se observa la desaparición de la línea de precipitación correspondiente al polisacárido B.

La *figura 4* es una reproducción fotográfica del mismo sistema, pero que en el canal inferior se colocó, esta vez, el suero bovino absorbido con 20 mg/ml de lipopolisacárido de *Yersinia enterocolitica* serotipo 9. Se observa la desaparición de las líneas de precipitación correspondientes al antígeno A + M y polisacárido B. Finalmente, la *figura 5* es una representación fotográfica de la inmunoelectroforesis del polisacárido B desarrollada con el suero bovino, canal superior, y el suero bovino absorbido con el lipopolisacárido de *Y. enterocolitica* serotipo 9, canal inferior. Se observa la desaparición de la línea de precipitación formada por el polisacárido B.

Estos resultados demuestran que el polisacárido B también contiene determinantes antigénicos con *Yersinia enterocolitica* serotipo 9. Sin embargo, el estudio del lipopolisacárido de *Y. enterocolitica* frente al suero bovino nos ha permitido solamente revelar una banda de precipitación

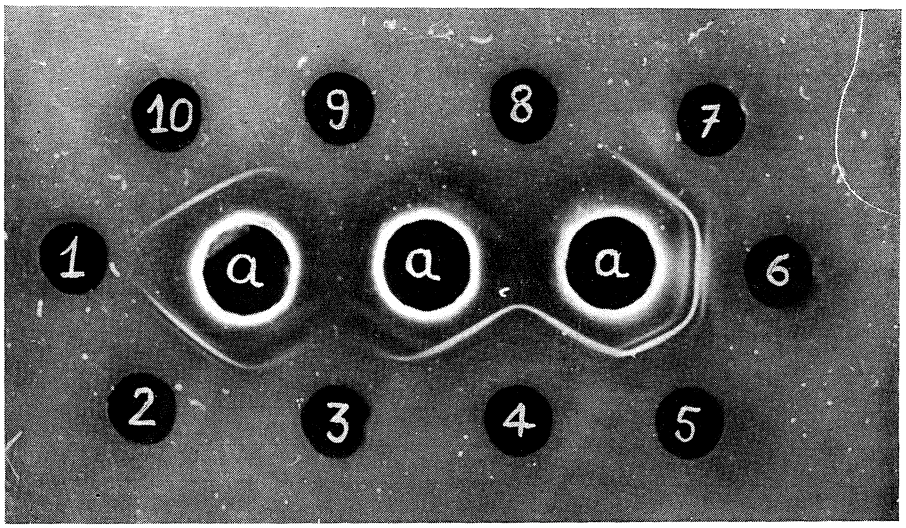

Figura 2. Estudio de la comunidad antigénica entre Yersinia pestis *(2),* Y. pseudotuberculosis *(3),* Y. enterocolitica *(4),* Klebsiella pneumoniae *(5),* Shigella flexneri *(6),* Escherichia coli *(7),* Salmonella abortus ovis *(8),* Serratia marcescens *(9) y* Proteus mirabilis *(10), revelada por un suero de vaca (a). En el pocillo núm. 1 se colocó antígeno SA de* Brucella melitensis *16 M*

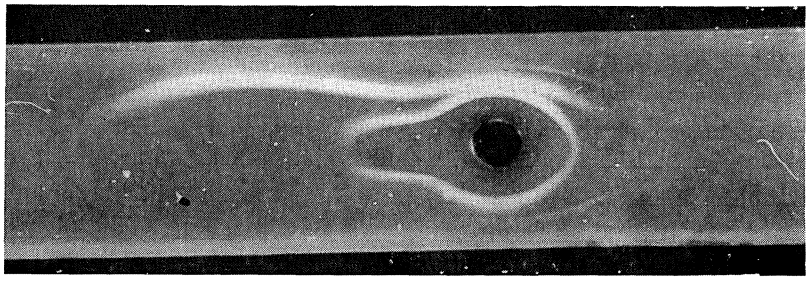

Figura 3. Patrón inmunoelectroforético del lipopolisacárido de B. melitensis *16 M desarrollado con inmunosuero bovino anti-*Brucella *(canal superior) y el mismo inmunosuero absorbido con polisacárido B obtenido de* B. melitensis *115. Se observa la desaparición de la banda correspondiente al polisacárido B*

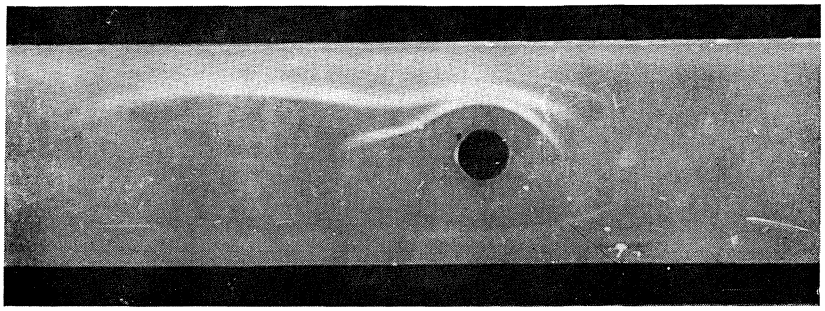

Figura 4. Patrón inmunoelectroforético del lipopolisacárido de B. melitensis *16 M desarrollado con inmunosuero bovino anti-*Brucella *(canal superior) y el mismo inmunosuero absorbido con lipopolisacárido de* Y. enterocolitica *serotipo 9 (canal inferior). Se observa la desaparición de la banda correspondiente al antígeno A+M y polisacárido B*

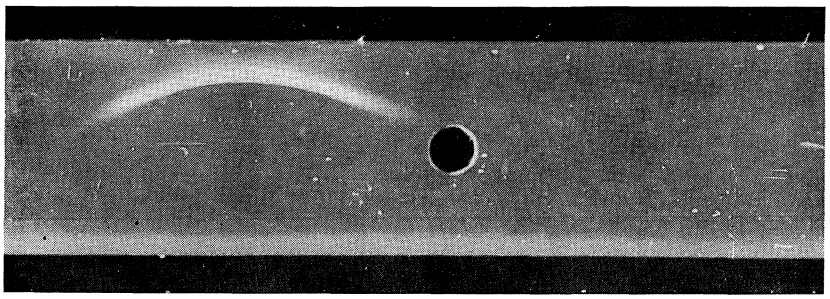

*Figura 5. Patrón inmunoelectroforético del polisacárido B. En el canal superior se colocó inmunosuero bovino anti-*Brucella *y en el canal inferior el mismo inmunosuero absorbido con lipopolisacárido de* Y. enterocolitica *serotipo 9. Se observa la desaparición de la línea de precipitación*

que da reacción de parcial identidad con el antígeno A + M del género *Brucella,* indicando que, por el momento, hemos de pensar que el lipopolisacárido de *Y. enterocolitica* serotipo 9 contiene los determinantes antigénicos comunes con el antígeno A + M y polisacárido B de *Brucella.*

DISCUSION

Van Loghen (18) propuso la creación del género *Yersinia* para incluir las especies *Y. pestis (Pasteurella pestis)* e *Y. pseudotuberculosis (P. pseudotuberculosis),* puesto que sus caracteres morfológicos, serológicos y bioquímicos son diferentes a otras especies incluidas dentro del género *Pasteurella.*

Ritter y Gerloff (22) han demostrado, mediante experiencias de hibridación, que la homología genética entre las dos especies de *Yersina* mencionadas con otros miembros de la familia *Pasteurella* es escasa, por lo que se puede admitir la proposición de Van Loghen como correcta.

En este trabajo hemos estudiado las relaciones antigénicas entre *Yersinia pestis* e *Y. pseudotuberculosis* mediante técnicas de inmunoprecipitación en gel. Nuestros resultados confirman los de otros autores (17) y los obtenidos previamente por Díaz y colaboradores (8), que pusieron de manifiesto la ausencia de comunidad antigénica entre *Pasteurella multocida* e *Y. pseudotuberculosis.*

El hecho de que *Yersinia enterocolitica* posea al menos 12 componentes antigénicos comunes con *Y. pestis* e *Y. pseudotuberculosis,* confirma que esta especie debe de incluirse en el género *Yersinia,* como había sido propuesto por Fredericksen (12).

Brubaker (2) ha sugerido que el género *Yersinia* se incluya dentro de la familia Enterobacteriaceae. Stanier y colaboradores (24), teniendo en cuenta la composición de las bases del ADN y las pruebas bioquímicas, clasifican el género *Yersinia* dentro de la familia Enterobacteriaceae, que a su vez dividen en los grupos siguientes:

1. *Salmonella, Shigella* y *Escherichia.*
2. *Aerobacter, Klebsiella* y *Serratia.*
3. *Proteus.*
4. *Yersinia.*

Los resultados obtenidos por nosotros tras el análisis antigénico realizado mediante pruebas de inmunodifusión en gel, concuerdan con la clasificación de Stanier y colaboradores (24), a excepción de *Serratia marcescens,* que por poseer solamente de 4 a 6 componentes antigénicos comunes con el grupo *Klebsiella-Enterobacter,* podríamos separarla y formar un grupo aparte. Esta proposición puede apoyarse en los resultados obtenidos por McCarty y Bolton (19) que demostraron, mediante experimentos de hibridación, que la homología genética entre *Klebsiella* y *Enterobacter* es superior a la existente entre *Serratia* y *Enterobacter.*

Debido a la simplicidad de la técnica de inmunoelectroforesis, comparada con la complejidad de las técnicas empleadas en el estudio de la homología genética, y la correlación obtenida en los dos casos, creemos que dicha técnica debe continuar valorándose y que puede ser útil para la clasificación de una especie microbiana dentro del género a que pertenece.

El valor de esta técnica ha sido demostrado anteriormente, cuando gracias a ella pudimos incluir dos nuevas especies microbianas en el género *Brucella: B. canis* (8) y *B. ovis* (7). Estos resultados han sido confirmados posteriormente con experiencias de hibridación (13). También nos ha permitido excluir la *B. suis* biotipo 5 como perteneciente al género *Brucella* (5).

Un hecho importante se desprende del conocimiento de la comunidad antigénica entre el género *Yersinia* y las enterobacterias, que es la no especificidad de la reacción de inmunoprecipitación en gel en el diagnóstico de yersiniosis cuando se utiliza un extracto total. Anteriormente, Díaz y Dorronsoro (6) habían demostrado que un 2 % de sueros humanos procedentes de pacientes sin síntomas de brucelosis y yersiniosis formaban, al menos, una línea de precipitación frente al antígeno AS de las tres especies de *Yersinia.* En este trabajo hemos hecho la misma observación con sueros de pacientes, de los que se había aislado *Y. enterocolitica,* y un suero de vaca, que han desarrollado las misma líneas de precipitación frente a *Yersinia* y miembros de la familia Enterobacteriaceae.

El hecho de que los anticuerpos frente al polisacárido B sean absorbidos por el lipopolisacárido de *Yersinia enterocolitica* serotipo 9, indica que sus relaciones antigénicas con el género *Brucella* son más complejas de lo que en un principio habíamos pensado. Por otra parte, se impone la necesidad de estudiar la función biológica del polisacárido B. En el

momento actual no sabemos si es un producto de degradación del antígeno A + M o es un componente distinto. Unicamente sabemos que se comporta como un hapteno y que en las cepas de *Brucella* en fase lisa se encuentra en la superficie celular, pero que en ciertas cepas en fase rugosa se encuentra situado en el citoplasma, por lo que es posible pensar que pueda tratarse también de un precursor del antígeno A + M.

RESUMEN

Las relaciones antigénicas existentes entre el género *Yersinia* y otras bacterias gram-negativas, han sido determinadas por inmunoelectroforesis. *Y. enterocolitica, Y. pestis* e *Y. pseudotuberculosis* poseen una estructura antigénica muy similar. Han podido demostrarse 12 componentes antigénicos comunes. Estas 3 especies, por otra parte, poseen al menos de 4 a 6 componentes antigénicos comunes con miembros de la familia Enterobacteriaceae, 1 a 2 con *Pasteurella multocida,* y ninguno con *Pseudomonas aeruginosa.* El resultado de nuestro análisis antigénico ha demostrado que es posible separar la familia Enterobacteriaceae en 5 grupos: un grupo formado por *Salmonella, Shigella* y *Escherichia coli,* que poseen, al menos, 10 componentes antigénicos en común; un segundo grupo formado por las 3 especies de *Yersinia,* un tercer grupo formado por *Enterobacter* y *Klebsiella,* un cuarto grupo que contiene el género *Proteus* y un quinto grupo en el que se incluye *Serratia.*

Estos 5 grupos poseen antígenos en común, pero cada grupo posee antígenos propios.

En el estudio de 82 sueros de origen bovino, en busca de anticuerpos específicos contra *Yersinia,* se encontró uno que desarrollaba 2 o más bandas de precipitación frente a *Yersinia;* sin embargo, producía las mismas líneas de precipitación frente a antígenos de los miembros de la familia Enterobacteriaceae.

Mediante experimentos de absorción y precipitación en gel se ha demostrado que el polisacárido B de *Brucella* es común con *Yersinia enterocolitica* tipo 9, lo que indica que es necesario determinar con más precisión las propiedades inmunoquímicas de la endotoxina de *Brucella* y *Yersinia.*

SUMMARY

Antigenic relationship of Yersinia enterocolitica *type 9 with other Gram-negative species*

The antigenic relationship between genus *Yersinia* and other Gram negative bacteria were determined by immunoelectrophoresis. *Y. enterocolitica, Y. pestis* and *Y. pseudotuberculosis* were shown to possess a very similar antigenic structure as shown by 12 bands in common. On the other hand these 3 species of *Yersinia* showed only 4 to 6 antigenic components in common with other representatives of the family Enterobacteriaceae, 1 or 2 components with *Pasteurella multocida* and no relationship with *Pseudomonas aeruginosa* or with members of the family Brucellaceae except for the band of precipitation corresponding to the 0-somatic antigen. The results of our analysis showed that it is possible to separate family Enterobacteriaceae into 5 groups as follows: one group for *Salmonella, Shigella* and *Escherichia coli* which have at least 10 antigenic components in common, a second group formed by the 3 species of *Yersinia,* a third group formed for *Enterobacter* and *Klebsiella,* a fourth group containing *Proteus* and a fifth group containing *Serratia.*

These 5 groups possess antigens in common, but each group also has its own specific antigens not shared with the other.

We studied 82 bovin sera in the search for antibodies specificity against *Yersinia.* We found one serum which developed 2 or more bands against *Yersinia* group antigens, however they olso produced the some bands with the Enterobacteriaceae antigens. The results indicate that it is necessary to isolated and purify the specific antigens of genus *Yersinia* before the gel diffusion test can be used for diagnosis of yersiniosis.

By means of absorption experiments and precipitation in gel it was demonstrated that the polisaccharide B of *Brucella* is shared with *Yersinia enterocolitica* type 9 which indicates that it is necessary to be determine more precisely the immunochemical properties of the endotoxin of *Brucella* and *Yersinia.*

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INSTITUTO «JAIME FERRAN», DE MICROBIOLOGIA (C S I C)
DEPARTAMENTO DE MICROBIOLOGIA GENERAL
LABORATORIO DE MICOLOGIA APLICADA

A COMPILATION OF DESCRIPTIONS OF NEW *CANDIDA* SPECIES WITH KEYS TO ALL SPECIES OF THE GENUS DESCRIBED UP TO DATE

by

C. RAMÍREZ

In the period of nearly four years that has elapsed since the publication of the second revised and enlarged Lodder's edition of "The Yeasts" (1970) there has been an increasing interest on yeast taxonomy. This interest has been reflected in the great number of new species that have been discovered during that period of time. The genus *Candida* Berkhout, for example has been enriched with more than thirty new taxa.

In order to facilitate routine laboratory work on yeast taxonomy we have undertaken the task of preparing a new key of the genus *Candida* including all new species described up to date. The key is followed by a short description of the new species. Some of them, that were not described by authors following Lodder's standard description, hace been studied by us uniformly, each by the same method and under the same conditions as to fit standard descriptions.

All species contained in the present key that have been described in the second edition of "The Yeasts" (1970) are referred to the corresponding page of that manual.

Microbiol. Espan., 27 (1974), 15.

SURVEY OF THE NEW SPECIES OF *CANDIDA* BERKHOUT

1. *Candida amylolenta* Van der Walt, Scott et van der Klift 1972.
2. *Candida australis* Goto, Sugiyama et Iizuka 1969.
3. *Candida boleticola* Nakase 1971 (c).
4. *Candida butyri* Nakase 1971 (c).
5. *Candida chilensis* Grinbergs et Yarrow 1970.
6. *Candida chiropterum* Grose et Marinkelle 1968.
7. *Candida citrea* Nakase 1971 (a).
8. *Candida dendronema* Van der Walt, van der Klift et Scott 1971.
9. *Candida edax* Van der Walt et Nel 1968.
10. *Candida entomaea* Van der Walt, Scott et van der Klift 1972.
11. *Candida entomophila* Van der Walt, van der Klift et Scott 1971.
12. *Candida fragicola* Nakase 1971 (b).
13. *Candida fibrae* Nakase 1971 (b).
14. *Candida guilliermondii* (Cast.) Langeron et Guerra var. *japonica.* Sugiyama et Goto 1969.
15. *Candida hydrocarbofumarica* Yamada, Furukawa et Nahara *ex* Ramírez 1974.
16. *Candida hylophila* Van der Walt, van der Klift et Scott 1971.
17. *Candida iberica* Ramírez et González 1972.
18. *Candida incommunis* Ohara, Nonomura et Yamazaki 1965.
19. *Candida insectamans* Van der Walt, Scott et van der Klift 1972.
20. *Candida insectorum* Van der Walt, Scott et van der Klift 1972.
21. *Candida ishiwadae* Sugiyama et Goto 1969.
22. *Candida methanolica* Oki, Kouno, Kitai et Osaki 1972.
23. *Candida nitrativorans* Van der Walt, Scott et van der Klift 1972.
24. *Candida quercuum* Nakase 1971 (c).
25. *Candida rugopelliculosa* Nakase 1971 (a).
26. *Candida silvanorum* Van der Walt, van der Klift et Scott 1971.
27. *Candida silvicultrix* Van der Walt, Scott et van der Klift 1972.
28. *Candida sorboxylosa* Nakase 1971 (a).
29. *Candida suecica* Rodrigues de Miranda et Norkranes 1969.
30. *Candida steatolytica* Yarrow 1969.
31. *Candida terebra* Sugiyama et Goto 1969.
32. *Candida tepae* Grinbergs 1967.

33. *Candida tsukubaensis* Onishi 1972.
34. *Candida valdiviana* Grinbergs et Yarrow 1970.

KEY TO THE SPECIES OF THE GENUS *CANDIDA* BERKHOUT

1a Nitrate assimilated. 2
b Nitrate not assimilated. 25

2a Glucose assimilated; sucrose, maltose and lactose not assimilated. 3
b Glucose and sucrose assimilated; maltose and lactose not assimilated.
Candida curiosa (see "The Yeasts", 1970, p. 946).
c Glucose and maltose (may be weakly) assimilated; sucrose and lactose not assimilated. 5
d Glucose, sucrose and maltose assimilated; lactose not assimilated. 6
e Glucose, sucrose and lactose assimilated; maltose not assimilated.
Candida frigida (see *Leucosporidium frigidum* in "The Yeasts", 1970, p. 787).
f Glucose, sucrose, maltose and lactose assimilated. 20

3a Glucose fermented. 4
b Glucose not fermented.
Candida foliarum ("The Yeasts", 1970, p. 960).

4a Cellobiose and salicin assimilated.
Candida berthetii ("The Yeasts", 1970, p. 924).

4b Cellobiose and salicin not assimilated.
Candida boidinii ("The Yeasts", 1970, p. 930).

5a Melibiose and raffinose assimilated.
Candida javanica ("The Yeasts", 1970, p. 978).

b Melibiose and raffinose not assimilated.
Candida buffonii ("The Yeasts", 1970, p. 934).

6a Fermentation of glucose, other sugars may be fermented. 7
Glucose not fermented. 17

7a Sucrose fermented.
b Sucrose not fermented or fermented latently. 13

8a Melibiose assimilated. 9
b Melibiose not assimilated. 10

9a Melibiose and raffinose fermented.
Candida nitrativorans ..... p. 57.

b Melibiose and raffinose not fermented.
Candida gelida (see *Leucosporidium gelidum,* in "The Yeasts", 1970, p. 789).

10a Raffinose assimilated. 11
b Raffinose not assimilated.
Candida vartiovaarai ("The Yeasts", 1970, p. 1069).

11a Erythritol assimilated.
Candida pelliculosa (see *Hansenula anomala* var. *anomala,* in "The Yeasts", 1970, p. 247).

b Erythritol not assimilated. 12

12a Inulin assimilated.

Candida utilis ("The Yeasts", 1970, p. 1064).

b Inulin not assimilated.
Candida fabianii (see *Hansenula fabianii,* in "The Yeasts", 1970, p. 272).

13a Ribitol assimilated. 15
b Ribitol not assimilated. 14

14a Inositol assimilated.
Candida incommunis ..... p. 51.

b Inositol not assimilated.
Candida bimundalis (see *Hansenula bimundalis,* in "The Yeasts, 1970, p. 257).

15a L-Rhamnose assimilated. 16

b L-Rhamnose not assimilated.
Candida pelliculosa var. *cylindrica* (see *Hansenula anomala* var. *schnegii,* in "The Yeasts", 1970, p. 249).

16a Maltose fermented.
Candida ishiwadae ..... p. 55.
b Maltose not fermented.
Candida silvicola (see *Hansenula holstii,* in "The Yeasts", 1970, p. 279).

17a Raffinose assimilated. 18
b Raffinose not assimilated. 19

18a Melibiose and inositol assimilated.
Candida valdiviana ..... p. 71.

b Melibiose and inositol not assimilated.
Candida scottii (see *Leucosporidium scottii,* in "The Yeasts", 1970, p. 794).

19a Cellobiose and salicin assimilated.
Candida melinii ("The Yeasts", 1970, p. 1004).
b Cellobiose and salicin not assimilated.
Candida diffluens ("The Yeasts", 1970, p. 956).

20a Rhamnose assimilated. 21
Rhamnose not assimilated. 22

21a Erythritol assimilated.
Candida edax ..... p. 39.
b Erythritol not assimilated.
Candida scottii (see *Leucosporidium scottii,* in "The Yeasts", 1970, p. 794).

22a Melibiose assimilated.
Candida aquatica ("The Yeasts", 1970, p. 920).
b Melibiose not assimilated. 23

23a Inulin assimilated.
Candida tsukubaensis ..... p. 70.
b Inulin not assimilated. 24

24a Glucose fermented; L-arabinose assimilated and erythritol assimilated.
Candida chilensis ..... p. 34.

24b Glucose not fermented; L-arabinose and erythritol not assimilated.
Candida muscorum ("The Yeasts", 1970, p. 1014).

25a Glucose assimilated; sucrose, maltose and lactose not assimilated. 26
b Glucose and maltose assimilated; sucrose and lactose not assimilated. 52
c Glucose, sucrose and lactose assimilated; maltose not assimilated. 58
d Glucose, sucrose and maltose assimilated; lactose not assimilated. 60
e Glucose, sucrose, maltose and lactose assimilated. 99

26a Trehalose assimilated. 27
b Trehalose not assimilated. 33

27a L-Rhamnose assimilated.
Candida marina ("The Yeasts", 1970, p. 999).
L-Rhamnose not assimilated. 28

28a L-Arabinose assimilated.
Candida conglobata ("The Yeasts", 1970, p. 944).

b L-Arabinose not assimilated. 29

29a D-Arabinose and D-ribose assimilated.
Candida boleticola ..... p. 31.

b D-Arabinose and D-ribose not assimilated. 30

30a Cellobiose assimilated. 31
b Cellobiose not assimilated. 32

31a Erythritol assimilated.
Candida cacaoi. ("The Yeasts", 1970, p. 935).

b Erythritol not assimilated.
Candida beechii ("The Yeasts", 1970, p. 921).

32a Fermentation of trehalose.
Candida santamariae ("The Yeasts", 1970, p. 1044).
b Trehalose not fermented. 33

33a Sucrose assimilated.
Candida iberica ..... p. 50.
b Sucrose not assimilated.
Candida zeylanoides ("The Yeasts", 1970, p. 1079).

34a Cellobiose assimilated. 35
b Cellobiose not assimilated. 37

35a Erythritol assimilated.
Candida lipolytica var. *deformans* ("The Yeasts", 1970, p. 993).
b Erythritol not assimilated. 36

36a Galactose fermented.
Candida fragicola ..... p. 43.
b Galactose not fermented.
Candida norvegensis ("The Yeasts", 1970, p. 1016).

37a Glucose fermented. 38
b No (or very weak) fermentation of glucose. 46

38a Ribitol assimilated.
Candida diversa ("The Yeasts", 1970, p. 958).
b Ribitol not assimilated. 39

39a Growth at 20-25 °C. 40
b No growth at 20-25 °C.
Candida slooffii ("The Yeasts", 1970, p. 1050).

40a L-Sorbose assimilated. 41
b L-Sorbose not assimilated. 42

41a D-Xylose assimilated.
Candida sorboxylosa ..... p. 64.
b D-Xylose not assimilated.
Candida sorbosa ("The Yeasts", 1970, p. 1053).

42a D-Xylose assimilated.
Candida lambica ("The Yeasts", 1970, p. 987).
b D-Xylose not assimilated. 43

43a Growth at 43-45 °C.
Candida krusei ("The Yeasts", 1970, p. 984).

b No growth at 43-45 °C. 44

44a Growth at 37-39 °C. 45

b No growth at 37-39 °C. 46

45a Lactic acid assimilated; glycerol not assimilated.
Candida rugopelliculosa ..... p. 60.

b Lactic acid not assimilated; glycerol assimilated.
Candida citrea ..... p. 36.

46a Galactose assimilated. 47

b Galactose not assimilated. 48

47a D-Xylose and L-arabinose assimilated.
Candida rugosa ("The Yeasts", 1970, p. 1032).

b D-Xylose and L-arabinose not assimilated. 48
Candida ingens ("The Yeasts", 1970, p. 974).

48a Erythritol assimilated.
Candida lipolytica var. *lipolytica* ("The Yeasts", 1970, p. 992).

b Erythritol not assimilated. 49

49a D-Mannitol and D-glucitol assimilated. 50

b D-Mannitol and D-glucitol not assimilated.
Candida valida ("The Yeasts", 1970, p. 1066).

50a Vitamin-dependent. 51

b Vitamin-independent.
Candida vini ("The Yeasts", 1970, p. 1074).

51a Sorbose assimilated; no growth at 37 °C.
Candida hylophila ..... p. 49.

b Sorbose not assimilated; growth at 37 °C.
Candida silvae ("The Yeasts", 1970, p. 1048).

52a Trehalose assimilated. 53
b Trehalose not assimilated.
Candida brumptii ("The Yeasts", 1970, p. 932).

53a Cellobiose assimilated. 54
b Cellobiose not assimilated. 56

54a Glucose fermented. 55
b Glucose not fermented.
Candida bogoriensis ("The Yeasts", 1970, p. 927).

55a L-Sorbose, L-rhamnose and erythritol assimilated.
Candida terebra ..... p. 68.
b L-Sorbose, L-rhamnose and erythritol not assimilated.
Candida insectamans ..... p. 52.

56a Maltose fermented.
Candida stellatoidea ("The Yeasts", 1970, p. 1055).
b Maltose not fermented. 57

57a Glycerol assimilated.
Candida ravautii ("The Yeasts", 1970, p. 1028).
b Glycerol not assimilated.
Candida catenulata ("The Yeasts", 1970, p. 937).

58a Fermentation of lactose. 59
b Lactose not fermented.
Candida macedoniensis ("The Yeasts", 1970, p. 996).

59a D-Xylose assimilated.
Candida pseudotropicalis ("The Yeasts", 1970, p. 1025).
b Inositol not assimilated. 61
Candida kefyr ("The Yeasts", 1970, p. 981).

60a Inositol assimilated. 70

b Inositol not assimilated. 61

61a Cellobiose assimilated. 62
b Cellobiose not assimilated. 91

62a Raffinose assimilated. 63
b Raffinose not assimilated. 75

63a Melibiose assimilated. 64
b Melibiose not assimilated. 72

64a Melezitose assimilated. 65
b Melezitose not assimilated.
Candida guilliermondii var. *carpophila* ("The Yeasts", 1970, p. 970).

65a Erythritol assimilated. 66
b Erythritol not assimilated. 68

66a Inulin assimilated.
Candida membranaefaciens ("The Yeasts", 1970, p. 1007).
b Inulin not assimilated. 67

67a Melibiose fermented.
Candida friedrichii ("The Yeasts", 1970, p. 963).
b Melibiose not fermented.
Candida silvanorum ..... p. 61.

68a Sucrose fermented. 69
b Sucrose not fermented.
Candida melibiosica ("The Yeasts", 1970, p. 1003).

69a Galactose fermented.
Candida guilliermondii var. *guilliermondii* (in "The Yeasts", 1970, p. 969).
b Galactose not fermented.
Candida guilliermondii var. *japonica* ..... p. 46.

70a Melibiose and raffinose assimilated. 71
b Melibiose and raffinose not assimilated.
Candida capsuligena (see *Leucosporidium capsuligenum,* in "The Yeasts", 1970, p. 783).
c Melibiose not assimilated, raffinose assimilated.
Candida chiropterum ..... p. 35.

71a Melezitose assimilated. 72
b Melezitose not assimilated.
Candida ciferrii ("The Yeasts", 1970, p. 939).

72a Erythritol assimilated. 73
b Erythritol not assimilated. 74

73a Melezitose assimilated.
Candida rhagii ("The Yeasts", 1970, p. 1030).
b Melezitose not assimilated.
Candida fibrae ..... p. 44.

74a D-Galactose and L-sorbose assimilated.
(Haploid strains of *Pichia ohmeri)* (see "The Yeasts", 1970, p. 507.
b D-Galactose and L-sorbose not assimilated.
Candida maritima ("The Yeasts", 1970, p. 1001).

75a L-Rhamnose assimilated. 76
b L-Rhamnose not assimilated. 81

76a Ribitol assimilated. 77
b Ribitol not assimilated.
Candida freyschussii ("The Yeasts", 1970, p. 962).

77a Erythritol assimilated. 78
b Erythritol not assimilated. 79

78a Melezitose assimilated.
Candida diddensii ("The Yeasts", 1970, p. 952).
b Melezitose not assimilated.
Candida dendronema ..... p. 37.

79a Fermentation of cellobiose. 80
b No fermentation of cellobiose.
Candida oregonensis ("The Yeasts", 1970, p. 1020).

80a D-Galactose assimilated.
Candida lusitaniae ("The Yeasts", 1970, p. 994).
b D-Galactose not assimilated.
Candida obtusa ("The Yeasts", 1970, p. 1018).

81a Erythritol assimilated. 82
Candida diddensii ("The Yeasts", 1970, p. 952).
b Erythritol not assimilated. 83

82a D-Galactose, D-xylose and L-arabinose assimilated.
Candida diddensii ("The Yeasts", 1970, p. 952).
b D-Galactose, D-xylose and L-arabinose not assimilated.
Candida mesenterica ("The Yeasts", 1970, p. 1009).

83a D-Galactose assimilated. 85
b D-Galactose not assimilated. 84

84a Melezitose assimilated. 90
b Melezitose not assimilated.
Candida suecica ..... p. 65.

85a Growth at 39 °C. 86
b No growth at 39 °C. 88

86a Fermentation of sucrose.
Candida tropicalis ("The Yeasts", 1970, p. 1061).
b Sucrose not fermented. 87

87a Chlamydospores formed.
Candida albicans ("The Yeasts", 1970, p. 917).
b Chlamydospores not formed.
Candida viswanathii ("The Yeasts", 1970, p. 1076).

88a Chlamydospores formed. 89
b Chlamydospores not formed. 91

89a Sucrose and maltose fermented.
Candida australis ..... p. 30.
b Sucrose and maltose not fermented.
Candida pulcherrima and *Candida reukafii* (see *Metschnikowia pulcherrima* and M. *reukafii,* in "The Yeasts", 1970, pp. 419, 423).

90a D-Mannitol, D-glucitol and citric acid assimilated.
Candida quercuum ..... p. 59.
b D-Mannitol, D-glucitol and citric acid not assimilated.
Candida solani ("The Yeasts", 1970, p. 1051).

91a Trehalose, melezitose and raffinose assimilated.
Candida sake ("The Yeasts", 1970, p. 1035).
b Trehalose, melezitose and raffinose not assimilated.
Candida tepae ..... p. 69.

92a Fermentation of sucrose. 93
b Sucrose not fermented. 97

93a L-Rhamnose assimilated.
Candida langeronii ("The Yeasts", 1970, p. 989).
b L-Rhamnose not assimilated. 94

94a Raffinose assimilated. 95
b Raffinose not assimilated. 96

95a D-Galactose fermented.
(Non-sporulating strains of *Sacch, cerevisiae,* in "The Yeasts", 1970, p. 597).
b D-Galactose not fermented.
Candida mogii ("The Yeasts", 1970, p. 1011).

96a Growth at 37 °C.
Candida tropicalis ("The Yeasts", 1970, p. 1061).
b No growth at 37 °C.
Candida salmonicola ("The Yeasts", 1970, p. 1041).

97a Erythritol assimilated.
Candida veronae ("The Yeasts", 1970, p. 1071).
b Erythritol not assimilated. 98

98a Soluble starch assimilated. 99
b Soluble starch not assimilated.
Candida parapsilosis ("The Yeasts", 1970, p. 1022).

99a Chlamydospores formed.
Candida albicans ("The Yeasts", 1970, p. 917).
b Chlamydospores not formed
Candida claussenii ("The Yeasts", 1970, p. 942).

100a Glucose fermented. 101
b Glucose not fermented. 110

101a Raffinose assimilated. 102
b Raffinose not assimilated. 107

102a Melibiose assimilated. 103
b Melibiose not assimilated. 105

103a Erythritol assimilated. 104
b Erythritol not assimilated.
Candida salmanticencis ("The Yeasts", 1970, p. 1039).

104a L-rhamnose assimilated.
Candida insectorum ..... p. 53.
b L-Rhamnose not assimilated.
Candida entomophila ..... p. 42.

105a Mycelium and pseudomycelium present. 106
b Only pseudomycelium present.
Candida intermedia ("The Yeasts", 1970, p. 976).

106a Erythritol assimilated.
Candida hydrocarbofumarica ..... p. 47.
b Erythritol not assimilated.
Candida steatolytica ..... p. 67.

107a Fermentation of maltose. 108
b Maltose not or very weakly fermented. 109

108a L-Sorbose, L-rhamnose and galactitol assimilated.
Candida entomaea ..... p. 40.
b L-Sorbose, L-rhamnose and galactitol not assimilated.
Candida shehatae ("The Yeasts", 1970, p. 1046).

109a L-Rhamnose and potassium gluconate assimilated; GC content of DNA: 44 %.
Candida tenuia ("The Yeasts", 1970, p. 942).
b L-Rhamnose and potassium gluconate not assimilated; GC content of DNA: 34-34.9 %.
Candida butyri ..... p. 32.

110a Erythritol assimilated. 111
b Erythritol not assimilated.
Candida glaebosa ("The Yeasts", 1970, p. 966).

111a Melibiose assimilated.
Candida humicola ("The Yeasts", 1970, p. 972).
b Melibiose not assimilated. 112

112a Galactitol assimilated.
Candida blankii ("The Yeasts", 1970, p. 926).
b Galactitol not assimilated. 113

113a Raffinose assimilated.
Candida curvata ("The Yeasts", 1970, p. 949).
b Raffinose not assimilated.
Candida aaseri ("The Yeasts", 1970, p. 913).

SYSTEMATIC DESCRIPTION OF THE VARIOUS SPECIES

1. *Candida amylolenta* Van der Walt, Scott et van der Klift 1972

Original description

Growth in glucose-yeast extract-peptone water: After 3 days at 25 °C the cells are spheroidal, ovoid or ellipsoidal, (3.0-6.5) × (3.0-9.0)μ, often encapsulated, and occurring singly or in pairs.

After one month at room temperature a sediment and a thick crispulate, dull, cresping pellicle are formed.

Growth on glucose-yeast extract-peptone agar: After one month at room temperature the streak culture is cream-coloured, crispulate or partly crispulate to smooth, raised and dull.

The margin is lobiform to undulating.

Dalmau plate culture on corn meal agar: Pseudomycelium which may be branched is formed, bearing clusters of blastospores.

Formation of ascospores not observed.

Fermentation absent.

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose + (latent)
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose —
Melibiose +
Raffinose +
Melezitose + (latent)
Inulin —
Soluble starch (Merk's) +
D-Xylose +
L-Arabinose +
D-Arabinose + (slow)
D-Ribose + or —
L-Rhamnose + (latent)
Ethanol +
Glycerol +
Erythritol +
Ribitol +
Galactitol +
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside —
Salicin +
DL-Lactic acid —
Succinic acid +
Citric acid + (weark) or —
Inositol +

Splitting of arbutin: Positive.

Assimilation of potassium nitrate: Absent.

Growth in vitamin-free medium: Absent.

Growth in osmotic medium: Weak.

Growth at 37 °C: Absent.

Formation of amyloid material: Positive.

Hydrolysis of urea: Positive.

Habitat: Three strains were isolated. Two were recovered from frass from the tunnels of *Sinoxylon ruficorne* Fahr., infesting *Dichrostachys cinerea* L. (Wrigth & Arn.) and from frass of the tunnels of *Enneadesmus forficulus* Fairm. in *Dombeya rotundifolia* (Hochst.) Harv., in the Transvaal.

A strain isolated from *Dombeya rotundifolia* is the type strain of the species with the number CBS 6039.

2. *Candida australis* Goto, Sugiyama et Iizuka 1969

Original description

Growth in malt extract: After 3 days at 25 °C cells are globose or ovoid, (2-5) × (3-10)μ, singly or in pairs, some times in short chains. A sediment and a pellicle may be formed.

Growth on malt agar: After one month at 17 °C the streak culture is brownish-gray, raised and rough.

Dalmau plate culture on corn meal agar: A well differentiated pseudomycelium is abundantly formed. True mycelium also occurs with chlamydospores.

Fermentation:

Glucose +
Galactose + (very weak)
Sucrose +
Maltose +
Lactose —
Raffinose —
Melibiose —

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose +
Sucrose +
Maltose +
Cellobiose (slow) +
Trehalose +
Lactose + or —
Melezitose +
D-Xylose +
D-Ribose + (slow)
Ethanol +
Glycerol +
Erythritol —
Ribitol +
Galactitol —
D-Mannitol +
D-Glucitol +
α-Methyl-D-glucoside +
Salicin +

Melibiose —
Raffinose —
Inulin —
Soluble starch —
L-Arabinose —
D-Arabinose —
DL-Lactic acid + (slow)
Inositol —
Succinic acid —
Citric acid +
L-Rhamnose —

Assimilation of potassium nitrate: Negative.
Splitting of arbutin: Positive (weak).
Formation of amyloid material: Negative.
Growth in vitamin-free medium: Negative.
Temperature of growth 0-33 °C.

Habitat: Two strains were isolated from penguin dung at Cape Royds, Ross island, J. S.; one strain from soil from the edge of Lake Bonney, J. S.; and three strains from water samples of an inflow stream of Lake Bonney, J. S.

The strain isolated from soil sample of Lake Bonney is the type strain of the species. It is kept in the culture collection of the Department of Botany, Faculty of Sciences, University of Tokyo, Hongo, Bunkyo-ku, Tokyo, Japan, under number TI-0011.

3. *Candida boleticola* Nakase 1971 (c)

Standard description of Candida boleticola

Growth in glucose-yeast extract-peptone water: After three days at 25 °C, the cells are round, short oval to oval, or elongate, (2.5-5) × × (2.5-14)μ, occurring singly, in pairs, or in chains. A ring and a sediment are formed. Some strains also form thick pellicles.

Growth on glucose-yeast extract-peptone agar: After one month at 17 °C, the streak culture is yellowish white to light brownish gray, smooth or delicately wrinkled, soft to butyrous, and has an entire or ciliate marging.

Dalmau plate cultures on corn meal: Pseudomycelia range from primitive to well developed. In some strains, blastospores are oval and occur in clusters.

Sporulation: Absent.

Fermentation: Only glucose is fermented. Galactose, sucrose, maltose, lactose, raffinose and melibiose are not fermented.

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose + (sometimes latent)
Sucrose —
Maltose —
Cellobiose + or —
Trehalose +
Lactose —
Melibiose —
Raffinose —
Melezitose —
Inulin —
Soluble starch —
D-Xylose + (sometimes latent)
L-Arabinose —
D-Arabinose + (sometimes latent)
D-Ribose + (sometimes latent)
L-Rhamnose —
Ethanol +
Glycerol +
Erythritol +
Ribitol +
Galactitol —
D-Mannitol +
D-Glucitol +
α-Methyl-D-glucoside —
Salicin + or —
DL-Lactic acid —
Succinic acid +
Citric acid +
Inositol —
Potassium gluconate + (sometimes latent)
Calcium 2-ketogluconate +

Assimilation of potassium nitrate: Negative.
Splitting of arbutin: Variable.
Production of starch-like compounds: Negative.
Liquefaction of gelatin: Negative.
Maximum growth temperature: 34-38 °C.
Growth in vitamin-free medium: Negative. Biotine is required at 25 °C. Some strains also require thiamine.
Hydrolysis of urea (Christensen's medium): Negative.
Habitat: Eight strains have been recovered from various sources. The type strain IFO 1570 has been isolated from fruiting body of *Astraeus hygrometricus*. (Gasteromicetales). Six other strains were isolated from mushrooms and another one from fruiting body of a *Cortinarius* sp. The type strain IFO 1570 is deposited in the culture collection of the Institute for Fermentation, Osaka, Japan.

4. *Candida butyri* Nakase 1971 (c)

Standard description

Growth in glucose-yeast extract-peptone water: After three days at 25 °C, the cells are short oval, oval or elongate, (1.5-7.5) × 2.5-17.5)μ,

occurring usually in chains or in clusters. A ring and a sediment are formed. After one month at 17 °C, a ring and a sediment are present.

Growth on glucose-yeast extract-peptone agar: After one month at 17 °C, the streak culture is grayish-white to white, smooth or wrinkled, dull, and has a ciliate margin.

Dalmau plate cultures on corn meal agar: Pseudomycelium well developed. Blastospores are round to short oval, usually occurring in chains or in verticils.

Sporulation: Absent.

Fermentation:

Glucose +
Galactose + (latent)
Sucrose — (some strains ferment very weakly and latently)
Maltose — (some strains ferment very weakly and latently)
Lactose —
Melibiose —
Raffinose —

Assimilation of carbon compounds.

Glucose +
Galactose +
L-Sorbose + (often latent)
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose + (often latent)
Melibiose —
Raffinose —
Melezitose +
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose +
D-Arabinose +
D-Ribose +
L-Rhamnose —
Ethanol +
Glycerol +
Erythritol +
Ribitol +
Galactitol —
D-Mannitol +
D-Glucitol +
α-Methyl-D-glucoside + (sometimes latent)
Salicin +
DL-Lactic acid —
Succinic acid + (weak)
Citric acid + (weak)
Inositol —
Potassium gluconate —
Calcium 2-ketogluconate —

Assimilation of potassium nitrate: Negative.
Splitting of arbutin: Positive.
Starch-like compounds production: Negative.

Liquefaction of gelatin: Negative.

Maximum growth temperature: 38-40 °C.

Growth in vitamin-free medium: Negative. Biotine and thiamine are required.

Hydrolysis of urea (Christensen's medium): Negative.

Habitat: Four strains of this species have been recovered from butter and another strain from onions.

The type strain IFO 1571 is deposited in the culture collection of the Institute for Fermentation, Osaka, Japan.

This species is very similar in the assimilation pattern to *Candida tenuis* Diddens et Lodder, but clearly differs in the GC content of DNA. The type strain of *Candida tenuis* CBS 615 has a GC content of 44 % while *Candida butyri* has 34-34.9 %.

5. *Candida chilensis* Grinbergs et Yarrows 1970

Standard description of Candida chilensis

Growth in malt extract: After 48 hr at 25 °C the cells are spherical or short-oval, (3.5-6) × (4-7)μ; singly, in pairs or in short chains. A sediment is formed.

Growth on malt agar: After 48 hr at 25 °C the cells are similar in shape and size to those in malt extract, though mycelial elements up to 20 μ long may also be present.

After one month at room temperature the streak is yellowish, moist and glistening, raised and wrinkled in the centre with a smooth margin.

Dalmau plate cultures on corn meal agar: Mainly pseudohyphae but also true mycelium are formed. Elastospores are arranged in dense verticils and occur mainly at the end of the hyphal cells.

Ascospores were not observed either in the individual strains or in a mixture of them.

Fermentation: Only glucose is fermented.

Assimilation of carbon compounds:

Glucose +	D-Ribose +
Galactose +	L-Rhamnose —
Saccharose +	Ethanol +
Maltose +	Glycerol +
Lactose +	Erythritol +
L-Sorbose +	Ribitol +
Trehalose +	Galactitol —

Melibiose —
Raffinose —
Melezitose +
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose +
D-Arabinose +
D-Mannitol +
Glucitol +
α-Methyl-D-glucoside +
Cellobiose +
Salicin +
D-L-Lactic acid +
Succinic acid +
Citric acid +
Inositol —

Assimilation of potassium nitrate: Positive.
Splitting of arbutin: Positive.
Growth in vitamin free medium: Negative.
Growth at 37 °C: Negative.
Formation of starch-like compounds: Negative.
Acid production on Custer's medium: Negative.
Hydrolysis of urea (Christensen's medium): Negative.
Fat splitting (Eijkmann test): Negative.
Habitat: Two strains of this species have been isolated from rotting wood.

The type strain no. CBS 5719 is deposited in the Collection of the Centraalbureau voor Schimmelcultures, Delft, Holland.

6. *Candida chiropterum* Grose et Marinkele 1968

Standard description of Candida chiropterum

Growth in malt extract: After three days days at 25 °C, the cells are round to oval, (2.1-5.6) × (4.2-12.1)μ. True mycelium and pseudomycelium are present. After one month at 20 °C, a loose sediment and a broad ring may be present.

Growth on malt agar: After one month at 17 °C, the streak culture is cream-coloured, though, raised, coarsely wrinkled and hairy.

Dalmau plate cultures on corn meal agar: True mycelium and pseudomycelium are abundantly produced with predominance of true mycelium. Blastospores are round and are born on sterigmata-like cells that originate directly by budding from the mycelium.

Fermentation: Absent.

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose +
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose —
Melibiose —
Raffinose —
Melezitose —
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose +
D-Arabinose —
D-Ribose —
L-Rhamnose +
Ethanol — or + (weak)
Glycerol +
Erythritol +
Ribitol + (slow)
Galactitol +
D-Mannitol +
D-Glucitol + (slow)
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid — (toxic)
Succinic acid + (weak; toxic)
Citric acid — (toxic)
Inositol +

Assimilation of potassium nitrate: Negative.

Growth in vitamin-free medium: Negative.

Growth at 37 °C: Positive.

Splitting of arbutin: Positive.

Growth in tissue culture: Intracellular and extracellular growth in L-929 cells in 24 hr with budding forms, mycelium with lateral blastospores. No chlamydospores. Pathogenic for C.F.W. mice.

Habitat: Twenty three strains of this species of yeast were recovered from the organs of 19 Colombian bats belonging to 4 species *(Carollia perspicillata, Desmodus rotundus, Mormoops megalophylla* and *Natalus tumidirostris).*

The type strain no. 6031 isolated from the liver of a *Mormoops megalophylla* bat is kept at the culture collection of the University of Bogotá, Colombia, and in the culture collection of the Centralbureau von Schimmelcultures, Delft, Holland, as CBS 6064.

7. *Candida citrea* Nakase 1971 (a)

Standard description of Candida citrea

Growth in glucose-yeast extract-peptone water: After 3 days at 25 °C the cells are short oval, oval to long oval, (2-6.5) × (2.5-15)μ, and occur singly or in pairs. A thin, smooth and incomplete pellicle may be formed.

Growth on glucose-yeast extrac-peptone agar: After one month at 20 °C the streak culture is pale yellow to pale brown, smooth or slightly wrinkled, mat, soft to butyrous and has an entire margin.

Dalmau plate culture on potato-glucose agar: Pseudomycelium present. Blastospores are short oval to oval or elongate, and occur in verticils.

Fermentation: Only glucose is rapidly fermented. No other sugars are fermented.

Assimilation of carbon compounds:

Glucose +	D-Ribose —
Galactose —	L-Rhamnose —
L-Sorbose —	Ethanol +
Sucrose —	Glycerol +
Maltose —	Erythritol —
Cellobiose —	Ribitol —
Trehalose —	Galactitol —
Lactose —	D-Mannitol —
Melibiose —	D-Glucitol —
Raffinose —	α-Methyl-D-glucoside —
Melezitose —	Salicin —
Inulin —	DL-Lactic acid —
Soluble starch —	Succinic acid +
D-Xylose —	Citric acid —
L-Arabinose —	Inositol —
D-Arabinose —	

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Negative.

Growth in vitamin-free medium: No growth; biotin and thiamine are required at 25 °C.

Maximum temperature of growth: 31-34 °C.

Liquefaction of gelatin: Negative.

Hydrolysis of urea: Negative.

Habitat: Three strains have been isolated from fruits.

The type strain AJ-4769 was isolated from lemon and is kept in the culture collection of The Central Research Laboratories, Ajimoto Co. Inc., Kawasaki, Japan, and in the culture collection of the Centraalbureau voor Schimmelcultures, Delft, Holland, as CBS 6374.

8. *Candida dendronema* Van der Walt, van der Klift et Scott 1971

Standard description of Candida dendronema

Growth in glucose-yeast extract-peptone water: After three days at 25 °C, the cells are spheroidal, ovoid to cylindrical, (1.5-5.0) × × (2.9-9.0-12)μ, and occur singly, in pairs or in small clusters or short

chains. Pseudomycelium is also present. Triangular, curved and more or less amoeboid cells may occur. A thin dull, incomplete, creeping pellicle is formed.

After one month at room temperature a pellicle and a sediment are present.

Growth on glucose-yeast extract-peptone agar: After one month at room temperature the streak culture is cream-coloured, rather flat, raised, crispulate and somewhat pitted along the centre, smooth along the margin, somewhat shiny. The margin is lobate to crenate.

Dalmau plate cultures on corn meal agar: Pseudomycelium is abundantly produced under both aerobic and anaerobic conditions and is usually ramified with chains or clusters of blastospores. Triangular blastospores are occasionally present.

Ascospores have not been observed in individual strains or in mixed cultures of these strains.

Fermentation:

Glucose + (slow)
Galactose + (slow)
Sucrose —
Maltose —
Lactose —
Raffinose —
Melibiose —

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose +
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose —
Melibiose —
Raffinose —
Melezitose —
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose +
D-Arabinose +
D-Ribose +
L-Rhamnose +
Ethanol +
Glycerol +
Erythritol +
Ribitol +
Galactitol + (slow occasionally)
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid —
Succinic acid +
Citric acid +
Inositol —

Splitting of arbutin: Positive.
Assimilation of potassium nitrate: Negative.
Growth in vitamin-free medium: Negative.
Growth in osmotic medium: Positive.
Growth at 37 °C: Negative.

Habitat: Five strains of this species were recovered from the frass of Cerambycid larvae infesting *Diospyros inhacaensia* F. White near Lake Sibaya and *Acacia karroo* Hayne near Mtunzini in Natal, South Africa.

The strain which derives from *Diospyros inhacaensis* is the type for the species and has been deposited in the collection of the Yeast Division of the Centraalbureau voor Schimmelcultures in Delft, Holland as no. CBS 6270.

9. *Candida edax* Van der Walt et Nel 1968

Standard description of Candida edax

Growth in malt extract: After three days at 25 °C the cells are spheroidal to cylindrical, (2.0-5.5) × (3.0-17.5)μ, and occur singly, in pairs occasionally in short chains. Pseudomycelium is produced. A sediment and a thin, dry, creeping pellicle are formed. After one month at room temperature a sediment and a thin dry pellicle are present.

Growth on malt agar: After three days at 25 °C the cells are spheroidal to cylindrical, (2.0-3.5) ×(3.0-12.0)μ, and occur singly, in pairs and ocasionally in short chains. Pseudomycelium is produced. The streak culture is cream-coloured, butyrous, flat, smooth, rather shiny, with an entire, undulating or lobiform margin.

After one month at room temperature the culture is yellowish-cream, butyrous, flat, slightly shiny, finely pitted at the centre, but smooth to finely striated along the margin. The margin may be entire, undulating or lobiform.

Dalmau plate culture on corn meal agar: Pseudomycelium is abundantly formed aerobically, but very sparsely in the areas under the coverslips. Blastospores may occur singly, in pairs, short chains or clusters along the pseudomycelium. Sections of the pseudomycelium may be coiled. True mycelium is also formed. Aerial pseudomycelium may be present.

Ascospores have not been observed in any of the three strains nor in mixed cultures of these strains.

Fermentation: Absent.

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose +
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose + (slow)
Melibiose +
Raffinose +
Melezitose + (slow)
Inulin + (weak and slow)
Soluble starch + (weak and slow)
D-Xylose +
L-Arabinose +
D-Arabinose + (occasionally slow)
D-Ribose + (occasionally slow)
L-Rhamnose + (occasionally slow)
Ethanol +
Glycerol + (occasionally slow)
Erythritol +
Ribitol + (occasionally weak and slow)
Galactitol + (occasionally slow)
D-Mannitol +
D-Glucosamine hydrochloride +
Hexadecane +
D-Glucitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid + (slow)
Succinic acid + (slow)
Citric acid + (slow)
Inositol + (slow)
Potassium gluconate + (slow)
Decane +

Splitting of arbutin: Positive.
Assimilation of potassium nitrate: Positive.
Ethylamine hydrochloride: Positive.
Growth in vitamin-free medium: Positive.
Growth en 50 % (w/w) glucose yeast extract agar: Absent.
Growth at 37 °C: Positive.
Growth with 100 p.p.m. actidione: Positive.
Hydrolysis of urea: Very weak.
Formation of starch-like compounds: Negative.
Hydrolysis of fat: Negative.

Habitat: Three strains of this species have been isolated from frass recovered from deserted subcortical insect galleries in *Sclerocarya caffra* Sond. in the Transvaal, South Africa.

The type strain CBS 5657 is deposited at the Centraalbureau voor Schimmelcultures in Delft, Holland.

10. *Candida entomaea* Van der Walt, Scott et van der Klift 1972

Standard description of Candida entomaea

Growth in glucose-yeast extract-peptone water: After three days at 25 °C the cells are ovoid, ellipsoidal, cylindrical or elongate, (1.5-4) ×

× (2.5-8.0-13)μ, and occur singly, in pairs, small clusters or short chains. Pseudomycelium is formed.

After one month at room temperature a floccose sediement and a dull, creeping pellicle are present.

Growth on glucose-yeast extract-peptone agar: After one month at room temperature the streak culture is cream-coloured, butyrous, flat, smooth with some structure along the centre and somewhat shiny. The margin is lobate.

Dalmau plate cultures on corn meal agar: A branched pseudomycelium bearing clusters of blastospores is abundantly produced.

Ascospores have not been observed.

Fermentation:

Glucose + (slow)
Galactose + (slow)
Sucrose + (very slow)
Maltose + (very slow) or —
Lactose —
Raffinose —

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose —
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose + (latent)
Melibiose —
Raffinose —
Melezitose +
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose +
D-Arabinose + (latent)
D-Ribose +
L-Rhamnose +
Ethanol +
Glycerol +
Erythritol +
Ribitol +
Galactitol + (latent)
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid + (slow)
Succinic acid +
Citric acid +
Inositol —

Splitting of arbutin: Positive.

Assimilation of potassium nitrate: Negative.

Growth in vitamin-free medium: Absent.

Growth in osmotic medium: Positive.

Growth at 37 °C: Positive.

Habitat: One strain has been recovered from material from the tunnel

of an unknown pinhole borer in the exotic, *Pinus radiata* in the Southern Cape Province, South Africa.

The type strain CBS 6306 is deposited in the collection of the Yeast Division of the Centraalbureau voor Schimmelcultures in Delft, Holland.

11. *Candida entomophila* Van der Walt, van der Klift et Scott 1971

Standard description of Candida entomophila

Growth in glucosa-yeast extract-peptone water: After three days at 25 °C the cells are spheroidal, ovoid, ellipsoidal to cylindrical, (1.5-6.5) × × (2.5-11.0-16)μ, occasionally triangular to irregular, and occur singly, in pairs or short chains. Pseudomycelium and true mycelium are produced.

After one month at room temperature a mucoid to floccose sediment is formed.

Growth on glucose-yeast extract-peptone agar: After one month at room temperature the streak culture is brownish-cream, rather flat and spreading, crispulate to smooth with structure along the margin. The margin is fimbriate.

Dalmau plate cultures on corn meal agar: Ramified pseudomycelium and true mycelium are abundantly produced. Blastospores may be arranged in small clusters or short chains. Triangular cells are formed.

Ascospores have not been observed.

Spheroidal to ellipsoidal asexual endospores are formed in hyphal segments and were observed in glucose-yeast extract-peptone water after three days at 25 °C.

Fermentation:

Glucose +
Galactose + (slow)
Sucrose + (slow)
Maltose —
Lactose —
Melibiose —
Raffinose + (slow)

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose + (slow)
Sucrose +
Maltose +
Cellobiose +
D-Ribose + (slow)
L-Rhamnose —
Ethanol +
Glycerol +
Erythritol +
Ribitol +

Trehalose +
Lactose +
Melibiose +
Raffinose +
Melezitose +
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose +
D-Arabinose + or —
Galactitol —
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid —
Succinic acid +
Citric acid +
Inositol —

Splitting of arbutin: Positive
Assimilation of potassium nitrate: Negative.
Growth in vitamin-free medium: Negative.
Growth in osmotic medium: Positive.
Growth at 37 °C: Positive.

Habitat: Three strains were isolated from material from the tunnels of *Crossotarsus externedentatus* Fairm. in *Ficus sycomorus* L. and in *Tabernaemontana ventricosa* Hochst. ex A. DC.

The type strain, CBS 6160 was isolated from *Ficus sycomorus* L. and has been deposited in the collection of the Yeast Division of the Centraalbureau voor Schimmelcultures in Delft, Holland.

12. *Candida fragicola* Nakase 1971 (b)

Standard description of Candida fragicola

Growth in malt extract: After three days at 25 °C, cells are oval to long oval or elongate, (2-3.5) × (3.5-30)μ, and occur singly, in pairs, or in chains. Islets and sediment are formed. After one month at 17 °C, a thick pellicle is present.

Growth on malt agar: After one month at 17 °C, the streak culture is yellowish gray, delicately wrinkled, with a ciliate margin.

Dalmau plate culture on corn meal agar: Pseudomycelium abundant. Pseudomycelial cells are slender. Blastospores are usually long oval or elongate, and occur singly or in chains.

Fermentation:

Glucose +
Galactose +
Saccharose —
Maltose —
Lactose —
Raffinose —
Melibiose —

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose —
Sucrose —
Maltose —
Cellobiose +
Trehalose —
Lactose —
Melibiose —
Raffinose —
Melezitose —
Inulin —
Soluble starch +
D-Xylose +
L-Arabinose +
D-Arabinose —
D-Ribose —
L-Rhamnose —
Ethanol +
Glycerol +
Erythritol —
Ribitol +
Galactitol —
D-Glucitol + (latent)
D-Mannitol + (latent)
α-Methyl-D-glucoside —
Salicin +
DL-Lactic acid +
Succinic acid +
Citric acid —
Inositol +

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Positive (weakly).

Gelatin liquefaction: Negative.

Production of starch-like compounds: Negative.

Maximum growth temperature: 34-35 °C.

Growth in vitamin-free medium: Negative; biotin and thiamin are required.

Habitat: A single strain was isolated from strawberries.

The type strain no. IFO 1574 was deposited in the culture collection of the Institute for Fermentation, Osaka, Japan, and in the Centraalbureau voor Schimmelcultures,, Delft, Holland, as CBS 6376.

13. *Candida fibrae* Nakase 1971 (b)

Standard description of Candida fibrae

Growh in malt extract: After three days at 25°C, the cells are spheroidal, oval, cylindrical or elongate, (2.5-7) × (3-7-60) μ, and occur singly, in pairs or in pseudomycelium. Many hyphal fragments are observed. A sediment and a trace of ring are formed. After one month at 17 °C, a thin ring and a sediment are present.

Growth on malt agar: After three days at 25 °C, the streak culture is white. After ane month at 17 °C, the streak culture is yellowish white

to white, hairly all over the surface, partly wrinkled, tough, and has a ciliate margin.

Dalmau plate culture on corn meal agar: True mycelyum develops abundantly. Papillated hyphae are often observed. Blastospores are round to oval, in chains or in clusters.

Fermentation:

Glucose +
Galactose + (slow)
Maltose + (slow)
Sucrose +
Lactose —
Raffinose + (slow)
Melibiose —

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose —
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose —
Melibiose —
Raffinose +
Melezitose —
Inulin —
Soluble starch +
D-Xylose +
L-Arabinose +
D-Arabinose —
D-Ribose +
L-Rhamnose —
Ethanol +
Glycerol +
Erythritol +
Ribitol +
Galactitol —
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid —
Succinic acid +
Citric acid +
Inositol —

Assimilation of potassium nitrate: Negative
Splitting of arbutine: Positive
Liquefaction of gelatin: Positive
Production of starch-like compounds: Negative
Maximum growth temperature: 37-38 °C
Growth in vitamin-free medium: Positive
Hydrolysis of urea: Negative
Habitat: A single strain was isolated from banana

The type strain of this species is deposited as FERM-P 889 in the culture collection of the Fermentation Research Institute, Agency of Industrial Science and Technology, Inage, Japan, and in the culture collec-

tion of the Centralbureau voor Schimmelcultures, Delft, Holland, as CBS 6375.

14. *Candida guilliermondii* (Cast.) Langeron et Guerra var. *japonica* Sugiyama et Goto 1969

Standard description of Candida guilliermondii *var.* japonica

Growth in malt extract: After three days at 25 °C, the cells are oval to long oval (2-5) × (3-7) μ and (2-7) × (3-9) μ, single, in pairs or in chains. A sediment and a thin pellicle are formed.

Growth on malt agar: After one month at 17 °C, the streak culture is cream coloured or coral pink, smooth, shiny, mucous, flat to raised and entire at the margin.

Dalmau plate culture: Pseudomycelium well developed.

Ascospores not observed.

Fermentation:

Glucose +
Galactose — or a few gas bubbles
Sucrose +
Maltose —
Lactose —
Raffinose — or a few gas bubbles
Melibiose —

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose +
Maltose +
Sucrose +
Cellobiose +
Trehalose
Lactose —
Melibiose +
Raffinose +
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose +
D-Arabinose +
Melezitose +
D-Ribose +
L-Rhamnose —
Glycerol +
Erythritol +
D-Mannitol +
D-Glucitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid —
Succinic acid +
Inositol —
Ethanol + or —
Ribitol +
Citric acid + or (weak)
Galactitol +

Assimilation of patassium nitrate: Negative

Splitting of arbutin: Negative

Production of starch-like compounds: Negative

Growth in vitamin-free medium: Negative; biotine and thiamine required.

Temperature range for growth: 0-45 °C.

Habitat: 13 strains of this variety have been isolated from core samples in stratigraphic drillings in Japan.

The type strain TI-0018 is deposited in the culture collection of the Herbarium of the Department of Botany Faculty of Sciences, University of Tokyo and in the culture collection of the Centraalbureau voor Schimmelcultures, Delft, Holland, as CBS 6021.

15. *Candida hydrocarbofumarica* Yamada, Furukawa et Nahara 1970

Standard description of Candida hydrocarbofumarica

Growth in malt extract: After three days at 25 °C, the cells are round, short oval or oval, 2-5) × (2-7) μ, and occur singly, in pairs or in chains. A thin, smooth pellicle and a sediment are formed.

Growth on malt agar: After one month at 17 °C, the streak culture is smooth or slightly wrinkled, dull, soft, and has a ciliate margin.

Dalmau plate culture on corn meal agar: Pseudomycelium and true mycelium develop abundantly. Blastospores are round to oval, in chains, in verticils or in clusters.

Fermentation:

Glucose +	Lactose + (weak)
Galactose +	Melibiose —
Sucrose +	Raffinose —
Maltose + (weak)	Trehalose +

Assimilation of carbon compounds:

Glucose +	D-Ribose + (latent)
Galactose +	L-Rhamnose +
L-Sorbose +	Ethanol +
Sucrose +	Glycerol +
Maltose +	Erythritol +
Cellobiose +	Ribitol +

Trehalose +
Lactose +
Melibiose —
Raffinose + (latent and weak)
Melezitose +
Inulin —
Soluble starch +
D-Xylose +
L-Arabinose +
D-Arabinose —
Galactitol +
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid —
Succinic acid +
Citric acid +
Inositol +

Assimilation of potassium nitrate: Negative
Splitting of arbutin: Positive (weak)
Liquefaction of gelatin: Negative
Growth in vitamin-free medium: Positive
Habitat: A single strain has been isolated from soil

The type strain Et-15-12 is kept in the culture collection of the Central Research Institute of Ajimoto Co. Inc., Kawasaki, Japan.

Since the authors gave no Latin diagnosis for this new species of yeast, this diagnosis is given below. The name of the original authors is maintained under cover of Recommendation 46 C of the International Code of Botanical Nomenclature (Lanjouw *et al.* (Ed.), 1961).

Candida hydrocarbofumarica Yamada, Furukawa et Nakahara *ex* Ramírez

In medio liquido maltato (post dies tres, 25 °C) cellulae sphaericae, ovoidae vel ellipsoidales, (2-5) × (2-7)μ, singulae, binae, in catenis brevis aut in racemis parvis. Pellicula tenuis, nitida et sedimentum formantur. Cultura in agaro maltato (post unum mensem, 17 °C) albida, crispulata aut glabra, mallis. Margo ciliatus. In agaro farinae Zea maïs (post dies septem) pseudomycelium et mycelium formantur. Fermentat glucosum, galactosum, sucrosum, maltosum (parvum), lactosum (parvum) et trehalosum. Assimilat glucosum, galactosum, L-sorbosum, sucrosum, maltosum, cellobiosum, trehalosum, raffinosum (lentum et parvum), melezitosum, amidum, L-arabinosum, glycerinum, D-ribosum, L-rhamnosum, alcohol aethylicum, erythritolum, ribitolum, galactitolum, D-glucitolum, D-mannitolum, α-methyl-D-glucosidum, salicinum, acidum citricum, acidum succinicum et inositolum. Non assimilat melibiosum, inulinum, D-arabinosum, nec acidum lacticum. Nitras kalicus non assimilatur. Arbutinum finditur

(parvum). Ad crescentiam vitaminae externae necessariae non sunt. Typus cultura ex terra isolata, in collectione zymotica Central Research Institute of Ajimoto Co. Inc., Kawasaki, Japan, Et-15-12.

16. *Candida hylophila* Van der Walt, van der Klift et Scott 1971

Standard description of Candida hylophila

Growth in glucose-yeast extract-peptone water: After three days at 25 °C, the cells are spheroidal, ovoid, ellipsoidal or cylindrical, (1.0-3.0) × (1.5-9.0) μ, occasionally triangular or irregular, and occur singly, in pairs, short chains or small clusters. Pesudomycelium is present. After one month at room temperature a granular to floccose sediment, islets and an incomplete ring are present.

Growth on glucose-yeast extract-peptone agar: After one month at room temperature the streak culture is yellowish-cream, crispulate, restricted and dull. The margin is lobate.

Dalmau plate cultures on corn meal agar: A well ramified pseudomycelium is produced both aerobically and anaerobycally. Blastospores are present either in small clusters or short chains. Triangular blastospores are formed.

Ascospores have not been observed.

Fermentation: Absent.

Assimilation of carbon compounds:

Glucose +
Galactose —
L-Sorbose +
Sucrose —
Maltose —
Cellobiose —
Trehalose —
Lactose —
Melibiose —
Raffinose —
Melezitose —
Inulin —
Soluble starch —
D-Xylose —
L-Arabinose —
D-Arabinose —
D-Ribose —
L-Rhamnose —
Ethanol + (weak)
Glycerol +
Erythritol —
Ribitol +
Galactitol —
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside —
Salicin —
DL-Lactic acid —
Succinic acid +
Citric acid —
Inositol —

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Negative.

Growth in vitamin-free medium: Negative.

Growth in osmotic medium: Negative.

Growth at 37 °C: Negative.

Habitat: One strain was isolated from material from the tunnels of *Xyleborus aemulus* Woll. in *Rapanea melanophloeos* (L) Mez, growing near Cape Province, South Africa.

The type strain for this species has been deposited in the collection of the Yeast Division of the Centraalbureau voor Schimmelcultures in Delft, Holland, as CBS 6226.

17. *Candida iberica* Ramírez et González 1972

Standard description of Candida iberica

Growth in glucose-yeast extract-peptone water: After three days at 25 °C, the cells are short ovoid to ovoid, (2.6-6.0) × (3.0-7.0) μ. No pellicle or ring are present. A late ring may be formed.

Growth on glucose-yeast extract-peptone agar: After one month at 25 °C, the streak culture is cream-coloured, semidull, soft and smooth.

Dalmau plate cultures on corn meal agar: pseudomycelium is abundantly formed. It consists of ramified chains of well-developed pseudohyphae, bearing laterally more or less verticilated clusters and chains of blastospores.

No ascopores have been observed.

Fermentation: Slow but complete fermentation of glucose, starting after nine days of incubation and ending after 16 days. No other sugars are fermented.

Assimilation of carbon compounds:

Glucose +
Galactose —
L-Sorbose +
Sucrose +
Maltose —
Cellobiose —
Trehalose +
Lactose —
Melibiose —
Raffinose —
D-Ribose —
L-Rhamnose —
Ethanol —
Glycerol +
Erythritol —
Ribitol +
D-Mannitol +
Galactitol —
D-glucitol +
α-Methyl-D-glucoside —

Melezitose —
Inulin —
Soluble starch —
D-Xylose —
L-Arabinose —
D-Arabinose —
Salicin —
DL-Lactic acid —
Succinic acid +
Citric acid +
Inositol —

Assimilation of potassium nitrate: Negative.

Growth in vitamin-free medium: very weak growth; strong stimulation by biotin, p-aminobenzoic acid and inositol separately; fairly good stimulation by calcium pantothenate, thiamine, nicotinic acid and pyridoxine separately; light stimulation by riboflavin and folic acid separately.

Sodium chloride tolerance: 9-10 %.

Maximum temperature of growth: 34 °C.

Habitat: Four strains of this species have been isolated from sausage.

The type strain is maintained in the culture collection of the Instituto ""Jaime Ferrán" de Microbiología, Madrid, Spain, as IJFM 2044; in the culture collection of the Yeast Division, Centraalbureau of Schimmelcultures, Delft, Holland, as CBS 6391, and in the American Type Culture Collection, Rockville, Maryland, U.S.A., as ATCC 26318.

18. *Candida incommunis* Ohara, Nonomura et Yamazaki 1965

Standard description of Candida incommunis

Growth in malt extract: After three days at 25 °C, the cells are cylindrical, (2-3) × (10-17) μ, single or in short chains. A sediment and a very thin pellicle are formed. After one month at 17 °C, a slimy, thick pellicle is formed.

Growth on malt agar: After three days at 25 °C, cells are cylindrical, (1.5-3) × (10-20) μ. After one month at 17 °C, the surface of streak culture is wrinkled and somewhat spiny.

Dalmau plate culture on corn meal agar: Pseudomycelium is abundantly formed.

Ascospores have not been observed.

Fermentation: Only glucose is fermented.

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose —
D-Ribose —
L-Rhamnose —
Ethanol —

Sucrose +
Maltose +
Cellobiose +
Trehalose —
Lactose —
Melibiose —
Raffinose —
Melezitose +
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose —
D-Arabinose —
Glycerol +
Erythritol +
Ribitol —
D-Mannitol —
Galactitol —
D-Glucitol —
α-Methyl-D-glucoside —
Salicin —
DL-Lactic —
Succinic acid +
Citric acid +
Inositol +

Assimilation of potassium nitrate: Positive.

Splitting of arbutin: Positive.

Growth at 37 °C: Positive.

Habitat: A single strain of this species was isolated from grape must.

The type strain K-52 is deposited with the type culture collection of the Institute of Fermentation, Osaka, Japan, and in the culture collection of the Centraalbureau voor Schimmelcultures, Delft, Holland, as CBS 5604.

19. *Candida insectamans* Van der Walt, Scott et van der Klift 1972

Standard description of Candida insectamans

Growth in glucose-yeast extract-peptone water: After three days at 23 °C, the cells are spheroidal, ovoid, ellipsoidal to cylindrical, (1.5-6.5) × × (2.5-6.5-12) μ, and occur singly, in pairs or in small clusters. Pseudomycelium is present. After one month at 17 °C, a thick floccose sediment and a ring are formed.

Growth on glucose-yeast extract-peptone agar: After one month at 17 °C the streak culture is cream coloured, crispulate along the centre but smooth near the margin, butyrous to somewhat tenacious, somewhat shiny. Marging undulating, partly fringed with pseudomycelium.

Dalmau plate culture on corn meal agar: A ramified pseudomycelium is abundantly produced both in the aerobic and anaerobic areas. Blastospores may be produced in small clusters or short chains.

Ascospores have not been observed.

Fermentation: Only a very slow fermentation of glucose has been observed.

Assimilation of carbon compounds:

Glucose +
Galactose —
L-Sorbose —
Sucrose —
Maltose +
Cellobiose +
Trehalose +
Lactose —
Melibiose —
Raffinose —
Melezitose +
Inulin —
Soluble starch +
D-Xylose +
L-Arabinose —
D-Arabinose —
D-Ribose +
L-Rhamnose —
Ethanol —
Glycerol —
Erythritol —
Ribitol + (slow)
Galactitol —
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid —
Succinic acid + (slow)
Citric acid + (slow)
Inositol —

Assimilation of potassium nitrate: Negative.
Splitting of arbutin: Positive.
Growth in vitamin-free medium: Negative.
Growth in osmotic medium: Negative.
Growth at 37 °C: Positive.

Habitat: One strain of this species was recovered from the frass of Buprestid larvae infesting a moribund specimen of *Acacia nilotica* L. var. *kraussiana* in the Transvaal, South Africa.

The type strain CBS 6033 is maintained in the Yeast Collection of the Centraalbureau voor Schimmelcultures in Delft, Holland.

20. *Candida insectorum* Van der Walt, Scott et van der Klift 1972

Standard description of Candida insectorum

Growth in glucose-yeast extract-peptone water: After three days at 25 °C, the cells are spheroidal, ovoid, ellipsoidal, cylindrical to elongate, (1.5-5.0) × (2.5-9.5-19) μ, and occur singly, in pairs small clusters or short chains. Pseudomycelium is present. After one month at room temperature a floccose sediment is formed and occasionally an incomplete ring.

Growth on glucose-yeast extract-peptone agar: After one month at room temperature the streak culture is brownish-cream, somewhat shiny to somewhat dull, rather flat, crispulate, occasionally smooth near margin. The margin is undulating to lobiform and fringed with pseudomycelium.

Dalmau plate cultures on corn meal agar: A ramified pseudomycelium is produced in aerobic and anaerobic areas. Blastospores may be born in small clusters or short chains.

Ascospores were not observed.

Fermentation:

Glucose + (slow)
Galactose + (slow)
Sucrose —
Maltose —
Lactose —
Raffinose —
Melibiose —

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose + (latent)
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose + (latent)
Melibiose + (latent)
Raffinose +
Melezitose +
Inulin —
Soluble starch + or —
D-Xylose +
L-Arabinose +
D-Arabinose + (latent)
D-Ribose +
L-Rhamnose +
Ethanol +
Glycerol +
Erythritol +
Ribitol +
Galactitol —
Glucitol +
D-Mannitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid —
Succinic acid +
Citric acid +
Inositol —

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Positive.

Growth in vitamin-free medium: Negative.

Growth in osmotic medium: Positive.

Growth at 37 °C: Variable.

Production of riboflavin: Positive.

Habitat: Three strains of this species were isolated. Two of them were recovered from material of the tunnels of *Cossotarsus externeden-*

tatus Fairm. in *Euclea natalensis* A.D.C. in Natal, South Africa. The third strain was isolated from frass of *Phoracantha recurva* Newman infesting *Eucalyptus maculata* Hook, also in Natal.

The type strain CBS 6213 is the one recovered from the frass of *Phoracantha recurva* and is deposited in the Yeast Collection of the Centralbureau voor Schimmelcultures in Delft, Holland.

21. *Candida ishiwadae* Sugiyama et Goto 1969

Standard description of Candida ishiwadae

Growth in malt extract: After three days at 25 °C, the cells are globose to oval, (3-6) × (3-7) μ, and occur single, in pairs or in chains. Sediment, a ring and a thin pellicle are formed.

Growth on malt agar: After one month at 17 °C, the streak culture is cream-coloured, shiny, mucous, flattened to raised, smooth and entire at the margin.

Dalmau plate culture on corn meal agar: Pseudomycelium is well developed. True mycelium is also formed.

No ascospores were observed.

Fermentation:

Glucose +	Maltose +
Galactose —	Lactose —
Sucrose —	Raffinose —

Assimilation of carbon compounds:

Glucose +	D-Ribose + (1)
Galactose —	L-Rhamnose +
L-Sorbose +	Glycerol +
Maltose +	Ethanol + (weak)
Sucrose +	Erythritol —
Lactose —	Ribitol — (3)
Cellobiose +	Galactitol — (1)
Trehalose +	Glucitol +
Melibiose —	D-Mannitol +
Raffinose —	α-Methyl-D-glucoside + (1)
Melezitose + (1)	Salicin + (2)

(1) Not tested in the original paper.
(2) Negative in the original papel.
(3) Positive in the original papel.

Inulin — (3)
Soluble starch —
D-Xylose —
L-Arabinose —
D-Arabinose — (1)
DL-Lactic acid — (1)
Succinic acid +
Citric acid +
Inositol —

Assimilation of potassium nitrate: Positive (toxic when concentrated).
Splitting of arbutin: Positive (2).
Growth in vitamin-free medium: Negative; biotine is required.
Temperature range of growth: 4-30 °C.
Habitat: Two strains of this species were isolated from core samples in stratigraphic drillings in Japan.
The type strain of this species, TI-0019, is maintained in the culture collection of the Department of Botany, Faculty of Sciences, University of Tokyo, Japan, and as CBS 6022 in the Centraalbureau voor Schimmelcultures in Delft, Holland.

22. *Candida methanolica* Oki, Kouno, Kitai et Osaki 1972

Standard description of Candida methanolica

Growth in malt extract: After three days at 25 °C, cells are short to long oval or elongate, sometimes irregularly shaped, (1.0-5.0) × × (2.0-20.0) μ, and occur singly, in pairs, or in short chains. A ring is formed and a yellowish white, dull, thick, creeping pellicle is also present.
Growth on malt agar: After three days at 25 °C, the streak culture is waxy, slightly raised, smooth with an undulating margin. After one month at room temperature, the streak culture is yellowish-white-coloured, opaque to cretaceous, with surface vesicular or rugose. Margin lobate.
Dalmau plate cultures on corn meal agar: Well-developed pseudomycelium is produced. Blastospores are short oval to oval, occurring singly, in chains or in verticils.
No ascospores have been found.
Fermentation: Only glucose is fermented.
Assimilation of carbon compounds:

Glucose +
Galactose —
L-Sorbose —
Sucrose —
D-Ribose +
L-Rhamnose +
Ethanol +
Glycerol +

Maltose —
Cellobiose —
Trehalose +
Lactose —
Melibiose —
Raffinose —
Melezitose —
Inulin +
Soluble starch +
D-Xylose +
L-Arabinose +
D-Arabinose —
Erythritol +
D-Glucitol +
D-Mannitol +
Ribitol +
Galactitol —
α-Methyl-D-glucoside —
Salicin +
DL-Lactic acid +
Succinic acid +
Citric acid —
Inositol —
Methanol +

Assimilation of potassium nitrate: Positive.

Splitting of arbutin: Negative.

Vitamin stimulating growth: Biotin.

Growth in vitamin-free medium: Negative.

Production of starch-like compounds: Negative.

Sodium chloride tolerance: 10 %.

Growth at 37 °C: Very weak.

Habitat: 14 strains of this species have been isolated from rotten tomatoes.

The type strain of this species, FERM no. 1108 is maintained in the culture collection of the Central Research Laboratories of Sanraku-Ocean Co. LTD., Fujisawa, Japan.

23. *Candida nitrativorans* Van der Walt, Scott et van dar Klift 1972

Standard description of Candida nitrativorans

Growth in glucose-yeast extract-peptone water: After three days at 25 °C the cells are ellipsoidal, ovoid or spheroidal, (1.5-6.) × × (2.5-6.5) μ, and occur singly, in pairs, short chains or small clusters. After one month at 17 °C, a sediment and a ring and occasionally a pellicle are formed.

Growth on glucose-yeast extract-peptone agar: After one month at room temperature the streak culture is cream-coloured, butyrous, flat, smooth and somewhat shiny. The margin is entire to undulating, occasionally with tufts of pseudomycelium.

Dalmau plate cultures on corn meal agar: A branched pseudomycelium with clusters of blastospores is produced. It is more abundant in aerobic areas.

No ascospores have been observed.

Fermentation:

Glucose +
Galactose +
Sucrose +
Maltose + (slow) or —
Lactose —
Melibiose +
Raffinose + 3/3

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose —
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose —
Melibiose +
Raffinose +
Melezitose +
Inulin —
Soluble starch +
D-Xylose +
L-Arabinose +
D-Arabinose + (slow) or —
D-Ribose +
L-Rhamnose +
Ethanol +
Glycerol +
Erythritol +
Ribitol +
Galactitol —
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid +
Succinic acid +
Citric acid +
Inositol —

Assimilation of potassium nitrate: Positive.

Splitting of arbutin: Positive.

Growth in vitamin-free medium: Positive.

Growth in osmotic medium: Positive.

Growth at 37 °C: Negative or weak.

Hydrolysis of urea (Christensen's medium): Negative.

Liquefaction of gelatin: Negative.

Production of starch-like compounds: Negative.

Habitat: Three strains of this species have been recovered from Ambrosia beetles. One was isolated from material from the tunnels of

Xyleborus aemulus Woll. infesting *Celtis africana* Burm. in the Cape Province, South Africa. Two strains were recovered from the tunnels of *Crossotarsus externedentatus* Fairm. infesting *Cryptocarya latifolia* Sond., and *Mimusops caffra* E. Mey *ex* A.D.C., in Natal, South Africa.

The strain recovered from *Cryptocaria latifolia,* which has been deposited as no. CBS 6152 in the collection of the Yeast Division of the Centraalbureau voor Cchimmelcultures in Delft, Holland, is the type for the species.

24. *Candida quercuum* Nakase 1971 (c)

Standard description of Candida quercuum

Growth in glucose-yeast extract-peptone water: After three days at 25 °C, the cells are long oval, or cylindrical, (1.5-4) × (2-7) μ, occurring singly, in pairs, or in chains. A ring and a sediment are formed. After one month at 17 °C, a ring and a sediment are present. Sometimes a thin pellicle is formed.

Growth on glucose-yeast extract-peptone agar: After one month at 17 °C, the streak culture is grayish white, smooth, glistening, soft, and has an entire margin.

Dalmau plate culture on corn meal agar: Pseudomycelium well developed. Pseudomycelial cells are often curved. Blastospores are oval to long oval or elongate, and occur singly, in chains or in verticils.

Sporulation: Absent.

Fermentation: Only glucose is slowly fermented. Galactose, sucrose, maltose, lactose, melibiose and raffinose are not fermented.

Assimilation of carbon compounds:

Glucose +
Galactose —
L-Sorbose —
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose —
Melibiose —
Raffinose —
D-Ribose —
L-Rhamnose —
Ethanol +
Glycerol +
Erythritol —
Ribitol —
Galactitol —
D-Mannitol +
D-Glucitol +
α-Methyl-D-glucoside +

Melezitose +
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose —
D-Arabinose —
Salicin +
DL-Lactic acid +
Succinic acid +
Citric acid +
Inositol —
Potassium gluconate + (latent)
Calcium 2-ketogluconate —

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Positive.

Liquefaction of gelatin: Negative.

Production of starch-like compounds: Negative.

Hydrolysis of urea (Christensen's medium): Negative.

Maximum growth temperature: 39-40 °C.

Growth in vitamin-free medium: Negative. Biotin and thiamine are required at 25 °C.

Habitat: A single strain has been isolated from exudate of *Quercus serrata.*

The type strain IFO 1576 is deposited in the culture collection of the Institute for fermentation, Osaka, Japan.

25. *Candida rugopelliculosa* Nakase 1971 (a)

Standard description of Candida rugopelliculosa

Growth in glucose-yeast extract-peptone water: After three days at 25 °C, the cells are oval, long oval, sometimes elongate, (2-5) × (2.5-10)μ, usually occuring in chains. A thick, strongly wrinkeled and highly creeping pellicle is rapidly formed. The pellicle is yellowish white to pale brown.

Growth on glucose-yeast extract-peptone agar: After one month at 17 °C, the streak culture is white to pale brown, dry, butyrous, and delicately wrinkled all over the surface, and has a lobate margin.

Dalmau plate cultures on corn meal agar: A well-developed pseudomycelium is abundantly formed.

Sporulation: Absent.

Fermentation: Only glucose is fermented rapidly. The other sugars are not fermented.

Assimilation of carbon compounds:

Glucose +
Galactose —
L-Sorbose —
Sucrose —
Maltose —
Cellobiose —
Trehalose —
Lactose —
Melibiose —
Raffinose —
Melezitose —
Inulin —
Soluble starch —
D-Xylose —
L-Arabinose —
D-Arabinose —
D-Ribose —
L-Rhamnose —
Ethanol +
Glycerol —
Erythritol —
Ribitol —
Galactitol —
D-Glucitol —
D-Mannitol —
α-Methyl-D-glucoside —
Salicin —
DL-Lactic acid +
Succinic acid +
Citric acid —
Inositol —

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Negative.

Growth in vitamin-free medium: Positive.

Maximum growth temperature: 38-39 °C.

Hydrolysis of urea: Negative.

Habitat: One strain was isolated from soybeans.

The hype strain AJ-4656 is maintained in the culture collection of the Central Research Laboratories, Ajimoto Co. Inc., Kawasaki, Japan, and in the culture collection of the Centraalbureau voor Schimmelcultures, Delft, Holland, as CBS 6377.

26. *Candida silvanorum* Van der Walt, van der Klift et Scott 1971

Standard description of Candida silvanorum

Growth in glucose-yeast extract-peptone water: After 3 days at 25 °C, the cells are spheroidal, ellipsoidal, ovoid to cylindrical, (1.5-4.5) × × (2.5-14.0) μ, and occur singly, in pairs or in short chains. Triangular to irregularly shaped cells may be present as well as pseudomycelium.

After one month at 17 °C, a floccose sediment and a ring are formed.

Growth on glucose-yeast extract-peptone agar: After one month at 17 °C, the streak culture is cream-coloured, crispulate or somewhat

verrucose along the margin, somewhat shiny. The margin is fringed with pseudomycelium.

Dalmau plate cultures on corn meal agar: Pseudomycelium is abundantly produced and is usually ramified. Blastospores may occur in small clusters or short chains along the peudomycelial hyphae.

Ascospores have not been observed.

Fermentation:

Glucose + (slow)
Galactose + (slow)
Sucrose —
Maltose —
Lactose —
Raffinose —
Melibiose —

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose + (slow)
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose —
Melibiose +
Raffinose +
Melezitose +
Inulin —
Soluble starch +
D-Xylose +
L-Arabinose +
D-Arabinose + or —
D-Ribose +
L-Rhamnose +
Ethanol +
Glycerol +
Erythritol +
Ribitol +
Galactitol —
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid —
Succinic acid +
Citric acid +
Inositol —

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Positive.

Growth in vitamin-free medium: Negative.

Growth in osmotic medium: Positive.

Growth at 37 °C: Positive.

Habitat: Three strains of the species were isolated. One strain derived from material in the tunnels of *Sinoxylon ruficorne* Fahr. in *Combretum apiculatum* Sond. in the Transvaal, South Africa. The second strain was

isolated from material from the tunnels of *Xylion adustus* Fahr. in *Peltophorum africanum* Sond. also in the Transvaal. The third strain was recovered from the lining of a tunnel of *Xyleborus ferrugineus* Fab. infesting *Harpephyllum caffrum* Bernh. *ex* Krauss in Natal, South Africa.

The type strain is the one that was isolated from *Peltophorum africanum* and is maintained in the collection of yeasts of the Centraalbureau voor Schimmelcultures in Delft, Holland, as no. CBS 6274.

27. *Candida silvicultrix* Van der Walt, Scott et van der Klift 1971

Standard description of Candida silvicultrix

Growth in glucose-yeast extract-peptone water: After three days at 25 °C, the cells are ellipsoidal to ovoid, (2.5-5.0) × (3.0-6.5) μ, occurring singly, in pairs, short chains or small clusters. After one month at room temperature a sediment is formed.

Growth in glucose-yeast extract-peptone agar: After one month at 17 °C, the streak culture is cream-coloured, smooth and somewhat shiny. The margin is entire to undulating.

Dalmau plate cultures on corn meal agar: Pseudomycelium is produced more abundantly under anaerobic conditions. Clusters or chains of blastospores are usually present at the nodes of the pseudohyphae.

Ascospores have not been observed.

Fermentation:

Glucose +
Galactose +
Sucrose +
Maltose + (slow)
Lactose —
Melibiose +
Raffinose +

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose —
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose —
D-Ribose +
L-Rhamnose —
Ethanol +
Glycerol +
Erythritol +
Ribitol +
Galactitol —
D-Glucitol +

Melibiose +
Raffinose +
Melezitose +
Inulin —
Soluble starch + or —
D-Xylose +
L-Arabinose +
D-Arabinose + (slow)
D-Mannitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid +
Succinic acid +
Citric acid +
Inositol —

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Positive.

Growth in vitamin-free medium: Positive.

Growth in osmotic medium: Positive.

Growth at 37 °C: Variable.

Habitat: Two strains were isolated from material from the tunnels of *Sinoxylon ruficorne* Fahr. infesting Acacia karroo Hayne in the Orange Free State, South Africa. Two other strains were recovered from an infestation of *Spirostachys africanus* Sond. in the Northern Transwaal, South Africa.

The type strain CBS 6269, recovered from Acacia karroo is maintained in the collection of yeasts of the Centraalbureau voor Schimmelcultures in Delft, Holland.

28. *Candida sorboxylosa* Nakase 1971 (a)

Standard description of Candida sorboxylosa

Growth in malt extract: After three days at 25 °C, the cells are short oval to long oval or elongate, (2-6) × (2.5-11-20) μ, and occur singly, in pairs or in chains. A thin, smooth and creeping pellicle is formed, often incomplete.

Growth on malt extract agar: After one month at 17 °C, the streak culture is pale yellow, smooth, dull, soft and butyrous. The margin is entire.

Dalmau plate cultures on corn meal agar: Usually, pseudomycelium well developed and ramified.

Sporulation: Absent.

Fermentation: Glucose is slowly fermented. No othre sugars are fermented.

Assimilation of carbon compounds:

Glucose +	D-Ribose —
Galactose —	L-Rhamnose —
L-Sorbose +	Ethanol +
Sucrose —	Glycerol +
Maltose —	Erythritol —
Cellobiose —	Ribitol —
Trehalose —	Galactitol —
Lactose —	D-Glucitol —
Melibiose —	D-Mannitol —
Raffinose —	α-Methyl-D-glucoside —
Melezitose —	Salicin —
Inulin —	DL-Lactic acid +
Soluble starch —	Succinic acid +
D-Xylose +	Citric acid +
L-Arabinose —	Inositol —
D-Arabinose —	

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Negative.

Growth in vitamin-free medium: Negative.

Maximum temperature of growth: 37-39 °C.

Liquefaction of gelatin: Negative.

Hydrolysis of urea: Negative.

Habitat: Five strains of this species have been isolated from different material: One strain was recovered from pineapple, one from banana, three strains were recovered from artificial diet for silkworm.

The type strain of this species AJ 4437 was isolated from pineapple. It is maintained in the collection of the Central Research Laboratories, Ajimoto Co. Inc., Kawasaki, Japan, and in the collection culture of the Centraalbureau voor Schimmelcultures in Delft, Holland, as CBS 2121.

29. *Candida suecica* Rodrigues de Miranda et Norkrans 1969

Standard description of Candida suecica

Growth in malt extract: After three days at 25 °C, the cells are oval to long oval, or cylindrical (2.5-7) × (3-18) μ, single, in pairs or short chains. A sediment and islets are formed. After one month at room tem-

perature a yellowish-white, dull, wrinkled, somewhat creeping pellicle is formed.

Growth in malt agar: After one month at 17 °C, the streak culture is whitis-grey, glistening, partly smooth and partly wrinkled. Margin lobate.

Dalmau plate cultures on corn meal agar: The pseudomycelium formation is slow and not abundant. The pseudomycelial cells are sometimes swollen at one end (stalagmoid). Blastospores oval to cylindrica. No true mycelium is formed.

Sporulation: Absent.

Fermentation: Only a slow and weak fermentation of glucose.

Assimilation of carbon compounds:

Glucose +
Galactose —
L-Sorbose +
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose —
Melibiose —
Raffinose —
Melezitose —
Inulin — (or weak)
Soluble starch —
D-Xylose — (or weak)
L-Arabinose —
D-Arabinose — (or weak)
D-Ribose —
L-Rhamnose —
Ethanol +
Glycerol + (weak)
Erythritol —
Ribitol +
Galactitol —
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside +
Salicin + (weak) or —
DL-Lactic acid —
Succinic acid —
Citric acid + (weak)
Inositol —

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Negative.

Growth in vitamin-free medium: Negative; biotine is required.

Growth en 50 % (w/w) glucose yeast extract agar: Positive.

Growth at 37 °C: Negative.

Maximum temperature of growth: ± 20 °C.

Habitat: One strain of this species has been isolated from marine environment.

The type strain CBS 5724 is maintained in the yeast collection of the Centraalbureau voor Schimmelcultures in Delft, Holland.

30. *Candida steatolytica* Yarrow 1969

Standard description of Candida steatolytica

Growth in malt extract: After three days at 25 °C, the cells vary from ovoid to cylindrical, (2-4) × (4.5-10) μ; mycelial elements up to 30 μ in length may also be present. A ring and islets are formed. After one month at 17 °C, a thick, wrinkled, off-white pellicle is present.

Growth on malt agar: The streak culture, after one month at 17 °C, is raised, wrinkled or folded, glistening or dull, cream to tan-coloured, butyrous or membranous.

Dalmau plate cultures on corn meal agar: Both true and pseudomycelium are abundantly produced. They are frequently branched with small ellipsoidal and ovoid blastospores arranged in verticils at the end of the hyphal cells.

Neither ascospores nor conjugation were observed in the individual cultures or in mixtures of them.

Fermentation:

Glucose +
Galactose + or —
Sucrose +
Maltose —
Lactose —
Raffinose + 1/3
Melibiose —

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose + or very weak
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose + or —
Melibiose —
Raffinose + (sometimes latent)
Melezitose + or —
Inulin —
Soluble starch +
D-Xylose +
L-Arabinose +
D-Arabinose + or —
D-Ribose + or —
L-Rhamnose +
Ethanol + or weak
Glycerol +
Erythritol —
Ribitol +
Galactitol + (usually latent)
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside + or —
Salicin +
DL-Lactic acid + or —
Succinic acid +
Citric acid + (sometimes weak)
Inositol +

Assimilation of potassium nitrate: Negative.
Hydrolysis of arbutin: Positive.
Hydrolysis of urea: Negative.
Fat splitting (Eijkmann test): Positive.
Growth in vitamin-free medium: Negative.
Growth at 37 °C: Positive.
Habitat: A single strain of this species was isolated from bovine mastitis in South Africa.
The type species CBS 5839 is maintained in the yeast collection of the Centraalbureau voor Schimmelcultures, in Delft, Holland.

31. *Candida terebra* Sugiyama et Goto 1969

Standard description of Candida terebra

Growth in malt etxract: After three days at 25 °C, the cells are globose to oval, (2-5) × (3-7) μ, single, in pairs or in chains. A sediment and a thin pellicle are formed.
Growth on malt agar: After one month at 17 °C, the streak culture is cream-coloured, flat or raised, shiny, mucous, partly wrinkled. Margin entire.
Dalmau plate cultures on corn meal agar: True mycelium and pseudomycelium are formed; pseudomycelium is of the *Candida* and *Mycotoruloides* types.
Fermentation:

Glucose +	Maltose —
Galactose + (weak)	Lactose —
Sucrose —	Raffinose —

Assimilation of carbon compounds:

Glucose +	D-Ribose +
Galactose +	L-Rhamnose +
L-Sorbose +	Ethanol — or + (weak)
Sucrose —	Glycerol +
Maltose +	Erythritol +
Cellobiose +	Ribitol —
Trehalose +	Galactitol —
Lactose —	D-Glucitol +
Melibiose +	D-Mannitol +
Raffinose —	α-Methyl-D-glucoside +

Melezitose —
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose +
D-Arabinose —
Salicin +
DL-Lactic acid —
Succinic acid +
Citric acid +
Inositol —

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Negative.

Production of starch-like compounds: Negative.

Growth in vitamin-free medium: Negative; biotin is required and thiamine is stimulative of growth.

Temperature range of growth: 4-45 °C.

Habitat: Three strains have been isolated from core samples from stratigraphic drillings in Japan.

The type strain TI-0020 is maintained in the collection of the Herbarium of the Department of Botany, Faculty of Sciences, University of Tokyo, Japan, and in the culture collection of the Centraalbureau voor Schimmelcultures in Delft, Holland, as CBS 6023.

32. *Candida tepae* Grinbergs 1967

Standard description of Candida tepae

Growth in malt extract: After three days at 25 °C, the cells are short oval to oval and ellipsoidal, (2-4) × (3.5-11) μ, occurring in short chains. After one month at 17 °C, a sediment and a ring may be formed.

Growth in malt agar: After one month at 17 °C, streak culture cream-coloured, dull, flat, and soft. Margin undulating.

Ascospores have not been observed.

Fermentation: Absent.

Assimilation of carbon compounds:

Glucose +
Galactose + (latent)
L-Sorbose +
Sucrose +
Maltose +
Cellobiose +
Trehalose —
Lactose —
Melibiose —
D-Ribose —
L-Rhamnose —
Ethanol +
Glycerol +
Erythritol —
Ribitol +
Galactitol —
D-Glucitol +
D-Mannitol +

Raffinose —
Melezitose —
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose —
D-Arabinose —
α-Methyl-D-glucoside —
Salicin —
DL-Lactic acid +
Succinic acid + (weak)
Citric acid + (weak)
Inositol —

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Positive.

Habitat: A single strain of this species has been isolated from *Laurelia philippina* in Southern Chile.

The type strain CBS 5115 is maintained in the yeast collection of the Centraalbureau voor Schimmelcultures in Delft, Holland.

33. *Candida tsukubaensis* Onishi 1972

Standard description of Candida tsukubaensis

Growth in glucose-yeast extract-peptone water: After three days at 25 °C, the cells are long oval to cylindrical (3-6) × (6-12) μ; much longer pseudohyphal cells may occur. A ring, small islets and sediment are formed.

Growth on glucose-yeast extract-peptone agar: After one month at 30 °C, the streak culture is greyish-brown, with the surface wrinkled, dull and soft.

Dalmau plate cultures on corn meal agar: The pseudomycelium consists of ramified chains of coarse pseudohyphae.

Ascospores have not been observed.

Fermentation: Absent.

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose +
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose +
Melibiose —
Raffinose +
D-Ribose + (weak)
L-Rhamnose —
Ethanol +
Glycerol +
Erythritol +
Ribitol + or —
Galactitol —
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside +

Melezitose +
Inulin +
Soluble starch +
D-Xylose +
L-Arabinose +
D-Arabinose —
Salicin —
DL-Lactic acid + (weak)
Succinic acid + (weak)
Citric acid + (weak)
Inositol + or —

Assimilation of potassium nitrate: Positive.

Splitting of arbutin: Positive.

Growth on 50 % (w/v) glucose-yeast extract agar: Weak after 14 days.

Sodium chloride tolerance: 6-9 % (w/v).

Growth in vitamin-free medium: Positive.

Growth at 37 °C: Positive.

Formation of starch-like compounds: Negative.

Habitat: One strain of this species has been isolated from a flower in Japan.

The type strain CBS 6389 is maintained in the yeast collection of the Centraalbureau voor Schimmelcultures in Delft, Holland.

34. *Candida valdiviana* Grinbergs et Yarrow 1970

Standard description of Candida valdiviana

Growth in malt extract: After three days at 25 °C, the cells are oval or ovoid, (3.5-6) × (2.5-3.5) μ, occurring in pairs, in straight or branched chains comprising up to ten cells. After one month at 17 °C, a ring and a sediment are present. Sometimes an incomplete pellicle is formed.

Growth on malt agar: After one month at 17 °C, the streak culture is yellowish, rough and wrinkled.

Dalmau plate cultures on corn meal agar: True mycelium and pseudomycelium are abundantly formed.

Ascospores have not been observed.

Fermentation: Absent.

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose +
Sucrose +
Maltose +
D-Ribose —
L-Rhamnose —
Ethanol +
Glycerol +
Erythritol —

Cellobiose +
Trehalose +
Lactose —
Melibiose +
Raffinose +
Melezitose +
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose —
D-Arabinose —
Ribitol +
Galactitol +
D-Glucitol +
D-Mannitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic + (weak)
Succinic + or —
Citric + or —
Inositol +

Assimilation of potassium nitrate: Positive.
Splitting of arbutin: Positive.
Growth in vitamin-free medium: Negative.
Growth at 37 °C: Negative.
Formation of starch-like compounds: Negative.
Acid production on Custer's medium: Negative.
Hydrolysis of urea (Christensen's medium): Negative.
Fat splitting (Eijkmann test): Negative.
Habitat: One strain of this species has been isolated from decomposed wood of *Notophagus* sp.

The type strain CBS 5721 is maintained in the Yeast Collection of the Centraalbureau voor Schimmelcultures in Delft, Holland.

SPECIES THAT HAVE NOT BEEN INCLUDED IN THE PRESENT SURVEY

Candida requinyii Szép et Novák 1963 and *Candida soosii* Novák 1964, were not included because they have been found to be identical to *Candida krusei* (Cast.) Berkhout.

Candida parapsilosis (Ashford) Langeron et Talice var. *hokkaii* Goto et Yokotsuya 1962 was not included because, since the pseudomycelium is very primitive or even absent, this strain of yeast does not fulfil the is very primitive or even absent, this strain of yeast does not fulfil tre distinguishing property on which the separation of *Candida* Berkhout from *Torulopsis* Berlese is based. Therefore, it should be transferred to the genus *Torulopsis*.

ADDENDUM

Since two new species of *Candida,* namely *Candida buinensis* Soneda et Uchida 1971 and *Candida ergatensis* Santa María 1971 came belatedly to the attention of the author to be included together with the other species, they will be described in the present addendum.

36. *Candida buinensis* Soneda et Uchida 1971

Standard description of Candida buinensis

Growth in glucose-yeast extract-peptone water: After three days at 25 °C, cells are small, almost short-ovoid, (2.0-3.6) × (2.5-4.0) μ, single or in pairs. A sediment is formed. After one month at 17 °C, a heavy sediment and a moderate ring are present.

Growth on glucose-yeast extract-peptone agar: After one month at 17 °C, the streak culture is yellowish white to cream coloured, semyglossy, soft and delicately wrinkled in the middle part of the streak.

Dalmau plate culture on corn meal agar: Pseudomycelium either primitive consisting of branched chains of cylindrical cells, or displaying long pseudomycelial cells bearing spindle-shaped blastospores.

Fermentation: Absent.

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose +
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose —
Melibiose —
Raffinose —
Melezitose +
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose +
D-Arabinose +
Ribose —
L-Rhamnose —
Ethanol +
Glycerol —
Erythritol —
Ribitol —
Galactitol —
D-Mannitol —
Glucitol —
α-Methyl-D-glucoside +
Salicin —
DL-Lactic acid —
Succinic acid —
Citric acid +
Inositol —
Arbutin —

Assimilation of potassium nitrate: Negative.
Splitting of arbutin: Negative.
Growth in vitamin-free medium: Negative.
Growth at 37 °C: Negative.
Formation of starch-like compounds: Negative.
Hydrolysis of urea (Christensen's medium): Negative.
Acid production on Custer's medium: Negative.

Habitat: One strain of this species no. 65-A was recovered from gelatinous material of a tree fern in Buin, Solomon Islands. It is kept as the type strain in the culture collection of the Department of Botany, National Science Museum, Tokyo, Japan.

Candida buinensis shows some similarities with *Candida sake* (Saito et Oda) van Uden et Bucley and with *Candida aaseri* Dietrichson *ex* van Uden et Buckley. However, marked differences between *C. buinensis* and the latter two species are shown in physiological properties, such as the ability of fermentation of carbon compounds. The former one does not ferment any sugar while *Candida sake* and *Candida aaseri* are fermentative.

37. *Candida ergatensis* Santa María 1971

Standard description of Candida ergatensis

Growth in glucose-yeast extract-peptone water: After three days at 25 °C, the cells are ovoid to elongate, (2.6-8.5) × (4.5-13) μ; much longer pseudomycelial cells up to 30 μ may occur; a sediment is present. After one month at 17 °C, an incomplete ring may be present.

Growth on glucose-yeast extract-peptone agar: After one month at 17 °C, the streak culture is cream-coloured, dull and soft, wholy wrinkled, with margin almost entire.

Dalmau plate cultures on corn meal agar: Pseudomycelium well developed. True mycelium is also present. Blastospores ovoid, single, in pairs, in short chains or in clusters.

Sporulation: Absent.

Fermentation:

Glucose +
Galactose + (slow)
Sucrose —
Maltose —
Lactose —
Melibiose —
Raffinose —

Assimilation of carbon compounds:

Glucose +
Galactose +
L-Sorbose +
Sucrose +
Maltose +
Cellobiose +
Trehalose +
Lactose + (slow)
Melibiose —
Raffinose —
Melezitose —
Inulin —
Soluble starch —
D-Xylose +
L-Arabinose —
D-Arabinose — (1)
Ribose — (1)
L-Rhamnose —
Ethanol +
Glycerol +
Erythritol +
Ribitol +
Galactitol —
D-Mannitol +
Glucitol +
α-Methyl-D-glucoside +
Salicin +
DL-Lactic acid —
Succinic acid +
Citric acid +
Inositol —
Arbutin + (2)

Assimilation of D-glucosamine: Negative as carbon or nitrogen source, (positive in the original papel).

Assimilation of potassium gluconate: Negative, (not tested in the original paper).

Assimilation of ethylammoniun chloride as nitrogen source: Negative, (not tested in the original papel).

Assimilation of potassium nitrate: Negative.

Splitting of arbutin: Positive, (not tested in the original papel).

Growth in vitamin-free medium: Negative.

Biotin, calcium pantothenate and inositol are stimulating vitamins, (not tested in the original paper).

Growth in osmotic medium: Negative.

Growth a 37 °C: Negative.

Production of starch-like compounds: Negative.

Habitat: The strain SBY 1102 has been recovered from larvae of the Cerambicid *Ergates faber*. It represents the type strain of the species and has been deposited in the culture collection of the Department of Biochemistry of the Instituto Nacional de Investigaciones Agrarias, in Madrid, Spain, as SBY 1102; in the culture collection of the Instituto "Jaime

(1) Positive in the original paper.
(2) Not tested by the author in the original papel.

Ferrán", de Microbiología, in Madrid, as IJFM 2272; in the culture collection of the Centraalbureau voor Schimmelcultures in Delft, Holland, as CBS 6248, and in the American Type Culture Collection, as ATCC 22589.

Candida ergatensis shows some physiological similarities with *Candida tenuis* Diddens et Lodder, but the presence of true mycelium in *C. ergatensis* differenciate quite well both species. Furthermore, *C. ergatensis* does not assimilate melezitose and D-ribose, while *C. tenuis* utilises these sugars.

SUMMARY

In the present work the author presents a survey on news species of yeasts belonging to the genus *Candida* Berkhout which have been described by several authors from 1965 to the beginning of 1974. They represent thirty five species which are not included in the second edition of "The Yeasts. A Taxonomic Study" (Lodder, J. Ed. Amsterdam, 1970). The description of these new species is preceded by a general key to all species of *Candida* described up to date.

RESUMEN

Recopilación de descripciones de nuevas especies de Candida *con claves que comprenden todas las especies aceptadas en el género descritas hasta la fecha*

En este trabajo se presentan descripciones de las nuevas especies de levaduras pertenecientes al género *Candida* Berkhout descubiertas por diversos autores desde el año 1965 hasta principios del año 1974, y que no figuran en la segunda edición de "The Yeasts. A Taxonomic Study" "Lodder, J. Ed. Amsterdam, 1970). Incluye además una clave completa de todas las especies de *Candida* descritas hasta la fecha.

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ADDENDUM

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JUNTA DIRECTIVA DE LA SOCIEDAD

En la asamblea general celebrada por la Sociedad Española de Microbiología el día 7 de enero, se efectuó la elección para la renovación parcial reglamentaria de la Junta Directiva, que quedó constituida de la siguiente forma:

Presidente: Dr. Fernando Baquero Mochales.
Secretario: Dr. Antonio Portolés Alonso.
Tesorero: Dr. Domingo Rodríguez Sánchez.
Bibliotecario: Dr. Jorge Francisco López Tello.
Vocal: Dra. Ramona Beltrá Martínez de Velasco.
Vocal: Dr. Emiliano Esteban Velázquez.
Vocal: Dr. Amadeo Foz Tena.
Vocal: Dr. José Olivares Pascual.
Vocal: Dr. Jesús M.ª Repáraz Martínez de Azagra.
Vocal: Dr. Federico Uruburu Fernández.

GRUPO DE VIROLOGIA DE LA SOCIEDAD ESPAÑOLA DE MICROBIOLOGIA

Ha quedado constituído este Grupo cuyos objetivos son: 1) promover el conocimiento de la Virología en nuestro país y despertar el interés por ella en otros grupos profesionales; 2) asesorar en esta materia a cuantos profesionales se interesen por los diversos aspectos de la misma; y 3) relacionar a los diversos profesionales interesados en Virología, proporcionándoles información sobre los distintos grupos que trabajan en nuestro país, instituciones en que desarrollan su actividad, campo de trabajo, medios y personal de que disponen, etc.

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En la asamblea celebrada, fue designada la siguiente Junta Directiva:

Presidente: Dr. Florencio Pérez Gallardo.
Vicepresidente: Dr. Agustín Pumarola Busquets.
Secretario: Dr. Rafael Nájera Morrondo.
Tesorero: Dr. Angel García Gancedo.
Vocal: Dr. Angel Ordás Alvarez..
Vocal: Dr. Antonio Peña Iglesias.
Vocal: Dr. Guillermo Suárez Fernández.
Vocal: Dr. Luis Valenciano Clavel.
Vocal: Dr. Eladio Viñuela Díaz.

El domicilio social del nuevo Grupo, actualmente, es el mismo de la Sociedad Española de Microbiología.

BIBLIOGRAFIA

LYSOTYPIE UND ANDERE SPEZIELLE EPIDEMIOLOGISCHE LABORATORIUMSMETHODEN, publicado por *Helmut Rische*. 1973. VEB Gustav Fischer Verlag, Jena. 588 páginas y 82 figuras.

Esta obra constituye el tomo 14 de la colección de monografías que, con el título "Las enfermedades infecciosas y sus agentes", publica la editorial Gustav Fischer. Está compuesta por H. Rische, perteneciente al Laboratorio Central de Lisotipia, del Instituto de Epidemiología Experimental, de Wernigerode (República Democrática Alemana), con la colaboración de los especialistas más indicados para cada bacteria.

Los métodos bacteriológicos tradicionales son incapaces de aclarar los procesos epidemiológicos, por lo que hoy están en boga la lisotipia, la bioquimiotipia y la colicinotipia, desempeñando la primera el papel principal. El libro que consideramos desarrolla la lisotipia de un modo exhaustivo y añade las otras técnicas cuando juzga conveniente. Los agentes tratados son: *Salmonella typhi, S. paratyphi* B, *S. paratyphi* A, *S. typhimurium, Escherichia coli, Shigella flexneri, Sh. sonnei, Klebsiella, Proteus, Yersinia enterocolitica, Pseudomonas aeruginosa, Brucella, Corynebacterium diphtheriae, Staphylococcus aureus* y *Vibrio comma*. De cada uno se hace un estudio microbiológico, seguido de la lisotipia y de los otros métodos cuando es oportuno, terminando por una interpretación de los resultados y una bibliografía amplísima, con alguna cita española, aunque muy pocas.

El tratamiento modernísimo y completo del tema permite recomendar esta obra no sólo a los epidemiólogos, sino a todos los microbiólogos.

L. VILAS

Depósito legal: M. 702 - 1968.

Artes Gráf. REYES - Jerónima Llorente, 15. Madrid