Y E A S T S

A News Letter for Persons Interested in Yeast

November 1958 Volume VII, Number 2

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Name	Page
N.J.W. Kreger van Rij, Delft, Holland	18
J.P. van der Walt, Stellenbosch, South Africa	19
John M. Carpenter, Lexington, Kentucky	20
Minoru Yoneyama, Hiroshima City, Japan	21
A. Capriotti, Universita Di Perugia, Italy	22
Rodolpho de Camargo, Piracicaba, Sao Paulo, Brasil	25
K. Kodama, Akita Prefecture, Japan	25
Thomas D. Brock, Cleveland 6, Ohio	27
L. J. Wickerham, Peoria, Illinois	28
R. K. Mortimer, Berkeley, California	29
Carl C. Lindegren, Carbondale, Illinois	29
Caroline Raut Hebb, Detroit 1, Michigan	30
T. R. Thyagarajan, Bangalore 3, India	30
R. C. Artagaveytia-Allende & A. Chaves Batista, PernAmbuco, Brasil	31
P.K.C. Austwick, Surrey, England	31
H. O. Halvorson, Madison, Wisconsin	32
Siegfried Windisch, Berlin, Germany	32
H. J. Phaff, Davis, California	33
John G. Kleyn, Seattle, Washington	34
Tommaso Castelli, Perugia, Italy	35
Miscellaneous News Items	35
Letters to the Editor (L. J. Wickerham	37

The Editor takes pleasure in thanking all those who have contributed to this issue and he would like to invite others to send in contributions for future issues. It is planned to publish the next issue of the News Letter in May 1959. It would be appreciated if anyone would notify the Editor of additional people in our field who would like to receive the Yeast News Letter.

Many thanks to those who have contributed financially to the Yeast News Letter during the past year. It would be appreciated if those, who have not sent in a contribution for some time, would send $0.50 to help finance the issues for 1959. Contributions, however, are voluntary.

The Editors

I. C.B.S., Delft, Holland. Communicated by Dr. N. J. W. Kreger van Rij.

List of strains present in the collection of the Yeast Division at Delft, not yet mentioned in the catalogue of the Centraal Bureau voor Schimmelcultures 1957.

Brettanomyces schanderlii Peynaud et Domercq
(E. Peynaud et S. Domercq, Archiv. Mikrobiol., 24, 266, 1956)
Candida anomala Ramirez
(C. Ramirez Gomez, Microbiologia Española, 10, 215, 1957)
Candida bovina v. Uden et do Carmo Sousa
(N. van Uden and L. do Carmo Sousa, J. Gen. Microbiol., 16, 385, 1957)
Candida majoricensis Genestar
(R. Genestar Serra, Microbiologia Española, 9, 275, 1956)
Candida muscorum di Menna
(M.E. di Menna, J. Gen. Microbiol., 18, 269, 1958)
Candida natalensis v.d. Walt et Tscheuschner
(J.P. v.d. Walt and I.T. Tscheuschner, Antonie van Leeuwenhoek, 23, 184, 1957)
Candida slooffii v. Uden et do Carmo Sousa
(N. van Uden and L. do Carmo Sousa, Portug. Acta Biol., Serie A, 4, 7, 1956)
Candida tamarindi Lewis et Johar
(Y.S. Lewis and D. S. Johar, Science and Culture, 21, 220, 1955)
Citeromyces matritensis Santa Maria
(J. Santa Maria, Anales Inst. Nac. Invest. Agronóm., 5, 151, 1956; J. Santa Maria, Anales Inst. Nac. Invest. Agronóm., no. 37, 269, 1957)
Cryptococcus gastricus Reiersöl et di Menna
(S. Reiersöl and M. di Menna, Antonie van Leeuwenhoek, 24, 27, 1958)
Debaryomyces castellii Capriotti
(A. Capriotti, Archiv. Mikrobiol., 28, 344, 1958)
Hansenula beijerinckii v. d. Walt
(J.P. v. d. Walt, Antonie van Leeuwenhoek, 23, 23, 1957)
Kluyveromyces africanus v.d. Walt
(J.P. v.d. Walt, Antonie van Leeuwenhoek, 22, 321, 1956)
Pachysolen tannophilus Boidin et Adzet
(J. Boidin et J. Adzet, Bull. Soc, Mycol. France, 73, 331, 1957)
Pichia bovis v. Uden et do Carmo Sousa
(N. van Uden and L. do Carmo Sousa, J. Gen. Microbiol., 16, 385, 1957)
Pichia indica Bahadur
(K. Bahadur, Z. Bakt. Parasitenk. II Abt., 110, 305, 1957).
Pichia membranaefaciens Hansen var. sicereum Santa Maria
(J. Santa Maria, Anales Inst. Nac. Invest. Agronóm., 5, 167, 1956)
Pichia pijperi v.d. Walt et Tscheuschner
(J.P. v.d. Walt and I.T. Tscheuschner, Antonie van Leeuwenhoek, 23, 184, 1957)
Pichia terricola v. d. Walt
(J. P. v. d. Walt, Antonie van Leeuwenhoek, 23, 23, 1957)
Rhodotorula graminis di Menna
(M.E. di Menna, J. Gen. Microbiol., 18, 269, 1958)
Rhodotorula macerans Sonne Frederiksen
(P. Sonne Frederiksen, Friesia, 5, 234, 1956)

Saccharomyces acidifaciens (Nickerson) Lodder et van Rij var. halomembranis Onishi
(H. Onishi, Bull. Agricult. Chem. Soc. Japan, 21, 151, 1957)
Saccharomyces fragilis Jörg. var. bulgaricus Santa Maria
(J. Santa Maria, Anales Inst. Nac. Invest. Agronóm., 5, 163, 1956)
Saccharomyces italicus Castelli var. melibiosi v. Uden et Assis-Lopes
(N. van Uden and L. Assis-Lopes, Portug. Acta Biol. Serie A, 4, 323, 1957)
Saccharomyces lodderi v.d. Walt et Tscheuschner
(J.P. v.d. Walt and I.T. Tscheuschner, Antonie van Leeuwenhoek, 23, 184, 1957)
Saccharomyces rouxii Boutroux var. halomembranis (Etchells et Bell) Onishi
(H. Onishi, Bull. Agricult. Chem. Soc. Japan, 21, 151, 1957).
Saccharomyces tellustris v.d. Walt
(J.P. v.d. Walt, Antonie van Leeuwenhoek, 23, 23, 1957)
Schizosaccharomyces gambettakesi Ramirez
(C. Ramirez Gomez, Microbiologia Española, 10, 215, 1957)
Schwanniomyces castellii Capriotti
(A. Capriotti, Archiv. Mikrobiol., 26, 434, 1957)
Sporobolomyces albidus Ramirez
(C. Ramirez Gomez, Microbiologia Española, 10, 215, 1957)
Sporobolomyces boleticola Ramirez
(C. Ramirez Gomez, Microbiologia Española, 10, 215, 1957)
Sporobolomyces hispanicus Pelaez et Ramirez
(F. Pelaez y C. Ramirez Gomez, Microbiologia Española, 9, 37, 1956)
Torulaspora franciscae Capriotti
(A. Capriotti, Archiv. Mikrobiol., 28, 338, 1958)
Torulaspora nilssoni Capriotti
(A. Capriotti, Archiv. Mikrobiol., 28, 247, 1958)
Torulopsis apicola Hajsig
(M. Hajsig, Antonie van Leeuwenhoek, 24, 18, 1958)
Torulopsis apis Lavie
(P. Lavie, Compt. rend. Acad. Sci., 238, 947, 1954)
Torulopsis buffoni Ramirez
(C. Ramirez Gomez, Microbiologia Española, 10, 215, 1957)
Torulopsis halophilus Onishi
(H. Onishi, Bull. Agricult. Chem. Soc. Japan, 21, 151, 1957)
Torulopsis nodaensis Onishi
(H. ONishi, Bull. Agricult. Chem. Soc. Japan, 21, 151, 1957)

II. South African Council for Scientific and Industrial Research, Wine Industry Research Group, C/o W.P. Fruit Research Station, Stellenbosch, C.P. Communicated by Dr. J. P. van der Walt.

The Taxonomy of the Brettanomyces species associated with South African wines.

In view of the close similarity of several apecies of the genus Brettanomyces (in sensu Lodder et Kreger van Rij), the fermentative and assimilative properties of the following species were re-investigated; Brett. lambicus, Brett. bruxellensis and its variety non-membranaefaciens, Brett. anomalus, Brett. claussenii, Brett. vini and Brett. schanderlii. For the assmilation tests the customary 30 carbon compounds were employed while for the fermentation tests 10 sugars were used.

It was established that

i) Brett. lambicus, Brett. bruxellensis and its variety non-membranaefaciens represent a single species for which the name Brett. lambicus is proposed. One strain labelled Brett. bruxellensis appeared to be a mislabelled strain of the latterly described species, Brett. vini.

ii) Biochemically, the other species, Brett. anomalus, Brett. claussenii, Brett. vini and Brett. schanderlii appear to be well-defined.

iii) Tracing the origin of the mislabelled strain, it was discovered that it had originally been isolated by Krumbholz and Tauschanoff from wine and described by them in 1933 as Mycotorula intermedia. Custers in 1940 transfered it to the genus Brettanomyces as Brett. bruxellensis. In view of this, the species epithet intermedius has priority over vini.

iv) Seventy one of the seventy eight strains locally isolated from wines all corresponded to Brett. intermedius. The remaining seven corresponded to Brett. schanderlii.

It would appear as if Brett. intermedius and Brett. schanderlii occur only in vinous products while Brett. lambicus, Brett. anomalus and Brett. claussenii are restricted to beers. From an ecological point of view, it will be interesting to learn which species of this genus are associated with other fermented beverages such as cider, for example.

New Yeasts:

Endomycopsis wickerhamii nov. spec.

At the suggestion of Dr. L. J. Wickerham, the yeast flora associated with the insect larvae infesting the South African Encephalartos species, was given some attention. From the male cone of a natural hybrid Enceph. altensteinii X Enceph. lehmanii an undescribed heterothallic yeast was isolated. The species forms hat-shaped spores (1-4) which are soon liberated. Mating types for the species have been isolated.

According to Dr. Wickerham, the species shows some similarity to Petasospora rhodanensis, but differs from the latter in that the new species assimilates α-methyl glucoside, adonitol and potassium 5-ketogluconate. Genetically, the new species is quite distinct and no cross-mating occurs between it and Petasospora rhodanensis.

The new species is provisionally retained in the genus Endomycopsis until the genera Endomycopsis and Petasospora have been defined more satisfactorily.

III. University of Kentucky, Dept. of Zoology, Lexington, Kentucky. Communicated by Dr. John M. Carpenter.

STUDIES ON THE ECOLOGY OF DROSOPHILA

The collection and identification of yeasts taken from the crops of Drosophila continues. Over 145 strains have now been analyzed. Among these there were 24 different species of yeasts. Approximately 400 strains

remain yet to be determined as to species. One hundred of these strains (69%) were of 4 genera: Pichia (2 species), Kloeckera (2 species), Saccharomyces (6 species), and Candida (4 species).

Although results are still tentative and await analysis of the complete data, certain tendencies may be pointed out. Kloeckera and Candida species appear to be more common in the cool months, Saccharomyces species more common in the warm to hot months, and Pichia species relatively common to all months collected.

There also seems to be further indication of a correlation between seasonal fluctuations in the yeasts collected and in the Drosophila species collected; Drosophila affinis, for example, is found most commonly in the cool months. During these months the yeast genera Kloeckera and Candida are also most common. Other such correlations are becoming evident but their interpretation awaits further data analysis and study.

IV. Biological Institute, Minami-Bunko, Hiroshima University, Hiroshima City, Japan. Communicated by Minoru Yoneyama.

The writer has been interested in the bark-inhabiting yeasts, especially those of deciduous Quercus trees. It was found that Schizosaccharomyces versatilis Wickerham et Duprat and Saccharomyces cerevisiae var. tetrasporus Phaff et al., or a yeast closely related to it, were present in the bark of deciduous Quercus trees such as Q. acutissima, Q. aliena, Q. mongolica var. grosseserrata, Q. serreata, and Q. variabilis in almost the whole of Japan. Regarding strains of the latter yeast, some ferment maltose and others do not; some assimilate methyl- α -glucoside and others do not. The present studies of the writer are along the following lines: (1) Further attempts to isolate the yeast from the bark of deciduous Quercus trees of various parts of the world, (2) Examination of the ability of fermentation of maltose of the isolates, (3) Examination of the ability of assimilation of methyl- α -glucoside of the same isolates.

Dr. Kendo Saito and Dr. Hirosuke Naganishi, old investigators of yeasts in Japan, are very well. Dr. Naganishi, who lives near the writer, sends the following messages: (1) He is very glad to read "A News Letter for Persons Interested in Yeast" because he can follow present developments in the worldwide study of yeast. (2) Ascocybe grovesii (cf. A News Letter for Persons Interested in Yeast, 6, No. 1, p. 6) seems to be closely related to Cephaloascus fragrans Hanawa*, which perhaps has been kept in the C.B.S. culture collection until now, he supposes. (3) The new genera Debaryoliponyces (Yeast News Letter 6, No. 1, p. 4) and Pachysolen (Yeast News Letter 7, No. 1, p. 4-5) are most interesting to him. He wants to get some cultures belonging to the new genera.

Recent publications:

Studies of Yeasts isolated from Pine Honey II. (1957)
The Botanical Magazine, Tokyo 70: 92-96.

Pine Honey and the Yeasts found there. (1957) Transactions of the Mycological Society of Japan, No. 6: 9-10 (Japanese)

*Studien über die auf gesunder und kranker Haut angesiedelten Pilzkeime. Japanische Zeitschrift für Dermatologie und Urologie: 20, Feb. 1920

Some observations of the multiplication and sporulation of Schizosacch. versatilis. (1958) The Jornl. of Biological Soc. of the Hiroshima University 8: 9-13

Studies on natural habitats of yeasts - Bark-inhabiting Yeasts-. Journal of Science of the Hiroshima University, Series B, Div. 2 (Botany). Vol. 8 (in press)

V. Istituto Di Microbiologia Agraria E Tecnica Dell'Universita' Di Perugia (Italia). Communicated by Professor A. Capriotti. Papers published in 1957-1958.

1) Ricerche microbiologiche su alcuni materiali insilati
Annali della Facolta di Agraria dell'Universita di Perugia: Vol. XIII°(1957)

For many years the author has concerned himself with the occurrence of yeasts in nature and with the connections between the different genera and the materials utilized by them. I have performed researches on grape-musts from several regions of Holland and Italy, on soils from Italy, Holland, Spain, Sweden and Finland, on flowers, on cheeses, on wines spoiled by film forming yeasts, on spoiled fish, on fruits, on tonsillary patinae, and so on. These researches have the aim of explaining the influence of the climate on the distribution of different species.

In this paper the author took under consideration 6 samples: 4 from silos containing a mixture of olive husks, molasses, whey and tomato rinds; one from a silo containing crushed acorns and one from a silo containing pulp of cider apples.

63 yeast strains were isolated belonging to the following species: from samples 1-2-3 (olive husks, molasses and whey) examined before and after the silage, 4 yeast species were isolated: Zygosaccharomyces nov. sp., Torulopsis nov. sp., Candida parapsilosis - var. intermedia and Candida pelliculosa.

In the samples taken before silage 6,5 million yeasts/gram were found whereas in the 45 days old mixture there were 55 million/gram. The most important species were: Torulopsis nov. sp. and Zygosaccharomyces nov. sp.

From sample 4 (olive husks, tomato rinds and whey) we isolated mostly Candida mycoderma - (8 million cells per gram of material).

From sample 5 (crushed acorns) we isolated Saccharomyces ellipsoideus- whereas from sample 6 (pulp of cider apples) Zygosaccharomyces florentinus, Saccharomyces pastorianus, Saccharomyces ellipsoideus and Kloeckera apiculata were isolated.

2) I lieviti dei carciofini conservati sott'olio
Industria conserve: no. 1, Vol. XXXIII°(1958)

The researches performed lead the author to the conclusion that the clots and the white-yellowish and mucous patinae, frequently occurring on the bracts of artichokes in olive oil, are of yeast origin.

These clots and patinae can be observed a few days after the preparation of artichokes but gradually they cover the whole surface of the material, softening the tissues and spoiling the product. From these materials we have isolated 41 cultures.

The prevailing species is Pichia membranaefaciens. We isolated two cultures of Zygosaccharomyce nellis. The 2 asporogenous species were Candida melibiosi and Candida mycoderma. The second one was isolated only from one sample in which, however, it was clearly prevailing. Only one strain of Candida melibiosi was isolated.

These yeasts grow well in alcohol as sole carbon source and in wine or vinegar.

3) Las levaduras de algunos terrenos españoles
Revista de Ciencia Aplicada: Num. 61, Ano XII-Fasc. 2, Madrid, 1958

The author examined in 1955 8 soil samples from Central and Southern Spain and isolated 12 different yeast species, 8 of them sporogenous and 4 asporogenous.

Saccharomyces ellipsoideus (18 strains)
Saccharomyces mangini (5)
Saccharomyces elegans (4)
Zygosaccharomyces sp. (4)
Zygosaccharomyces paradoxus (4)
Torulaspora franciscae nov. sp. (13)
Torulaspora rosei (21)
Schwanniomyces nov. sp. (2)
Candida albicans (1)
Kloeckera apiculata (2)
Cryptococcus albidus (10)
Aureobasidium pullulans (1)

These results were compared with those obtained by the author in previous researches on soils from Holland and Italy.

The most wideapread species in Holland was Kloeckera apiculata (81% frequency) followed by Torulopsis inconspicua and Hansenula saturnus (with 37 and 33% frequency).

In Italian soils the highest frequencies were reached by Saccharomyces ellipsoideus (83%), Torulaspora rosei (66%), Saccharomyces nicroellipsodes (66%), Zygosaccharomyces sp. I (50%), Kloeckera apiculata (50%), Zygosaccharomyces sp. II (33%), Candida mycoderma (33%) and Aureobasidium pullulans (33%).

The situation of the Spanish soils is not very different from that of Italian ones. Except for the low frequency of Kloeckera apiculata and the large distribution of Cryptococcus albidus (50%) and Saccharomyces mangini and Zygosaccharomyces sp. I (33%), all the other species were found only in one of the soils. These species, namely Sacch. elegans, Zygosacch. sp. II, Candida albicans, Torulaspora franciscae nov. spec., Schwanniomyces nov. spec. and Aureobasidium pulluans have no importance in the soil because

of their very low distribution.

The cuases determining the differences and the analogies among the yeast florae of the three soils, are not too clear: We can see the influence of the presence of grapes or other sugary fruits, but we cannot evaluate the effect of the climate on the distribution of the yeasts.

4) Torulaspora nilssoni nov. spec.
Archiv für Mikrobiologie: 28, 247-254 (1958)

A new species of Torulaspora was described; it was isolated from some Swedish soils. This species is named Torulaspora nilssoni nov. spec. (in honour of Prof. Ragnar Nilsson - director of Institute of Microbiology, Royal Agriculture College of Sweden, Uppsala - and his assistant Dr. Per Eric Nilsson).

Abbreviated description

Culture on slide: No formation of pseudomycelium
Sporulation on malt agar, Gorodkowa agar and gypsum blocks, began after 48 hours and continued for more than three months; no cases of conjugation were observed. Asci contained 1 or 2 and, more rarely, even 3 or 4 spores. On must gelatin we have observed sometimes cells in conjugation.
Fermentation: glucose +; galactose +; maltose -; saccharose +; raffinose + (total); inulin +; dextrin -.
Assimilation: glucose +; galactose +; maltose -; saccharose +; raffinose +; lactose-; ethanol growth scarce.

5) Debaryomyces castellii nov. spec.
Archiv für Mikrobiologie, 28, 344-348 (1958)

Origin of strains: 32 strains studied, all isolated from samples of soil coming from ULTUNA (Uppland): Sweden. This soil was cultivated with wheat and Brassica napus, argillous, pH 5.6-6.7 and 0-6% of $CaCO_3$.
Slide culture: No pseudomycelium.
Sporulation: Abundant on normal substrates. Generally production of heterogamous asci with 1-2-3 and even 4 spores. There are (but not very often) isogamous and "parthenogetic" asci. The spores are round with a fat globule in the center and with warty wall. The warts can be observed in old cultures.
Fermentation: glucose +; galactose -; maltose + (weak); Saccharose +; raffinose 2/3 (slow); inulin -; dextrine - (very weak).
Assim: glucose +; galactose +; maltose +; saccharose +; raffinose +; lactose +, alcohol growth scarce.

6) Torulaspora franciscae nov. spec.
Archiv für Mikrobiologie: 28, 338-343 (1958)

Origin of strains: 13 strains studied, all isolated from a vineyard soil with pH 7.2-7.4 and with 32% of $CaCO_3$ (from Tambleque Toledo (Spain).
Sporulation: on wort agar or Gorodkowa agar. 1-2 spores per ascus. Wall smooth. Usually conjugation between mother cell and bud or between two cells.

Slide culture: No pseudomycelium.
Fermentation: glucose +; galactose +; maltose + (slow); saccharose +; raffinose + 1/3; lactose -; inulin +; dextrin -.
Assimilation of organic acids: (pH 4.5): tartaric -; citric -; ossalic -; succinic -; L-malic -; DL- malic -; lactic +; pyruvic ±.
Assimilation: glucose +; galactose +; maltose +; saccharose +; raffinose +; lactose -, alcohol growth scarce.

VI. Universidade De S. Paulo, Instituto Zimotechnico, Piracicaba, São Paulo, Brasil. Department of Microbiology. Communicated by Mr. Rodolpho de Camargo.

1)S. Joly and R. de Camargo - During the last two months we have studied the biochemical and taxonomic characteristics of an organism which seems to be a strain of Pullularia, isolated from a brazilian fruit, Achreas sapota, L. This organism is very peculiar and attention is given to its biochemical activities which seem related to those of Escherichia coli.

2)R. de Camargo - We have visited some cocoa plantations near the Atlantic Ocean, S. Paulo State, where the cocoa farming is gaining rapid importance. During this first visit samples were taken from raw fruits, fermenting fruits, dried fruits, etc. Several yeasts were isolated and are now under taxonomic study. From the fermenting fruits the organism with highest incidence was Geotrichum candidum. This work will be continued next year.

VII. Laboratory of Kodama Brewing Co. Ltd., Iitakawa-Machi, Akita Prefecture, Japan. Communicated by Dr. K. Kodama. The following are partial abstracts of the article "Studies on film yeasts isolated in Japan" (in Japanese) by K. Kodama, T. Kyono, and S. Kodama. The Journal of Fermentation Technology 1958 (80 pp.).

Pichia Sake (Naganishi) Ohara et Nonomula Group

1. Pichia Sake (Naganishi) Ohara et Nomula
   Syn. Zygopichia Sake Naganishi (1938)

2. Pichia Sake (Naganishi) Ohara et Nonomula form, α (by Kodama et al.)
   Syn. Pichia Miso Mogi (1939)
   Zygopichia Miso Mogi (1942)
   Pichia Mogii Ohara et Nonomula (1954)

a. Historical survey

Naganishi isolated this organism from a deposit in the bottom of spoiled Sake and named it ZygoPichia Sake. Ohara et Nonomula (1954) studied this strain and named Pichia Sake (Naganishi) Ohara et Nonomula according to Lodder's proposal.

Pichia Miso, Zygopichia Miso isolated from "Miso" (Japanese soybean past) was described by Mogi.

Pichia Mogii strain K5-1 isolated from "Tamari Koji" was described by Ohara et Nomula.

Recently I have isolated 23 strains from many kinds of "Miso" or "miso Koji" closely resembling Mogi et Ohara's strains. Since the results

of my studies on these strains are in good agreement with Pichia Sake in many mycological points, I propose to name these strains (including Mogi et Ohara's strains) Pichia Sake (Naganishi) Ohara et Nonomula form. α.

b. Standard description of Pichia Sake Group

Growth in malt extract: Cells are mainly round, short oval, 3.0-6.3μ 4.7-8.0 x 4.0-5.5μ (in form a mainly oval, ellipsoidal round, rarely somewhat long oval 2.0-7.0 x 4.0-12.0μ not so elongated as Pichia farinosa, single or in short chains. A thick dry white or grayish white, wrinkled pellicle is formed. Weak fermentation is observed.

Growth on malt agar: Streak culture is dry white or nearly white, raised, remarkably wrinkled or roughly netted.

Slide cultures: Pseudomycelium develops well, blastospores are spherical or short oval, there is clear difference between short blastospores and long pseudomycelial cells.

Sporulation: Spores may be formed after heterogamous conjugation or rarely without immediately preceding conjugation. The spores are round to short-oval, without irregular or angular. 2.4-2.8 μ (in form a 1.6-3.3 μ) 1-4 per ascus with an oildrop inside.

Maximum temperature for growth and sporulation: 46°C, 42.5-44°C (in form α 44.5-45°C, 39-41°C) respectively.

Fermentation: glucose +, galactose + (weak), saccharose ± ?, maltose -, raffinose -, lactose -.

Sugar assimilation: glucose +, galactose +, saccharose +, maltose -, lactose -.

Assimilation of potassium nitrate: absent

Ethanol as sole source of carbon: good growth; wrinkled pellicle is formed.

Splitting of arbutin: very weak or absent.

c. Discussion

This species differs from other species belonging to Pichia hitherto reported in the following points.

i. Cells in malt or Koji extract are mainly reound to short oval, (in form α mainly oval, ellpsoidal) not so elongated as Pichia farinosa. In this respect, this species is closely related to Pichia vanriji (recently isolated by Van der Walt).

ii. Blastospores in slide cultures (potato agar) are spherical or short oval. There is clear difference between blastospores and pseudomycelial cells.

iii. Maximum temperatures for growth and sporulations are remarkably higher than other species (ie 44.5-46°C, 39-44°C respectively)

A new key to the genus Pichia (based to a large extent on the shape of the spores) is given in English on pg. 42 of this publication.

VIII. Department of Biology, Western Reserve University, Cleveland 6, Ohio. Communicated by Dr. Thomas D. Brock.

Research in progress

1. Recent work has demonstrated fairly conclusively that the agglutination reaction exhibited by mating types of Hansenula wingei is due to reaction between a protein component of strain 21 and a polysaccharide component of strain 5. It has only been possible to prove the presence of the polysaccharide composition of the strain 5 component recently, using the technique of periodate oxidation. In 0.001 M sodium periodate, strain 5 is affected but strain 21 is not. Periodate is a specific reactant with molecules containing adjacent hydroxyl or hydroxyl and amino groups. The only substances present in biological materials which meet these criteria are the polysaccharides and related substances. When polysaccharides are oxidized by periodate, aldehydes are produced which will react with Schiff type reagents, giving a specific staining of polysaccharide materials.

2. The presence of mannans on the surface of yeasts may be of taxonomic significance, since some genera contain them and some do not. A simple indirect way of determining their presence has been discovered. I have not examined the technique critically, but present it for any one who might be interested in following it up. It makes use of the fact that boric acid or borax will react with sugars having adjacent hydroxyl groups in the cis position. In yeasts, the only sugars in this category are galactose and mannose. If a suspension of yeast is treated with 0.5 M boric acid, the boric acid combines with the mannans on the cell surface and remains attached. These cells can now be washed and retain the borate attached to them. If one now adds a metal, such as magnesium ion, the yeast cells are agglutinated. This can be determined visually quite readily. I have screened a number of yeasts very simply by taking a loopful of cells from an agar slant, suspending them in boric acid, and then adding magnesium sulfate. It seems to give quite clear-cut results, such yeasts as Schizosaccharomyces not reacting, while Hansenula and Saccharomyces both reacted. Not all species of Saccharomyces reacted, however. This technique might be a new type of taxonomic criterion, and it is much simpler than using chemical analysis of the cell wall.

3. Work has begun on the physiology of conjugation in Hansenula wingei. Up to 80% conjugation can be obtained in 5 hours in a non-growth medium containing only glucose, potassium phosphate and magnesium sulfate. A method has been developed for quantitating this conjugation. I hope to present results of this at the S.A.B. in the spring.

4. A graduate student of mine, Alberta Herman, has begun work on the genetics of Hansenula wingei. We have evidence that diploid formation does not occur after conjugation, and a heterokaryon is set up which may be

carried for many generations and be later segregated out into the component haploids, under appropriate conditions. We hope to begin extensive genetic work with this organism in the near future, concentrating first on the haploid-diploid relationships until we have found better methods of inducing sporulation.

IX. Northern Utilization Research and Development Division, U.S.D.A., Peoria, Illinois. Communicated by Dr. L. J. Wickerham.

We are continuing our work on sexual agglutination in yeasts. A brief report should soon be published in Science, reporting the discovery of sexually agglutinative species in four genera of yeasts. One of the genera, Saccharomyces, contains a phylogenetic line in which all species are sexually agglutinative. They are the most highly evolved of all known yeasts, and readily produce what are almost undoubtedly unisexual triploids and tetraploids. We would be happy to make haploids and unisexual diploids, triploids and tetraploids available to anyone that would like to ascertain their ploidy by determining their deoxyribonucleic acid content, by determining their death rate by X-rays, or by any other procedure.

We have recently published two papers which report that contrary to universally accepted belief, actively metabolizing cells of most yeasts which ferment sucrose do secrete invertase into the medium. The amount of invertase secreted varies from strain to strain. The references are:

Wickerham, L. J. 1958. Evidence for the production of extracellular invertase by certain strains of yeasts. Archives of Biochemistry and Biophysics, 76 (2): 439-448.

Dworschack, R. G., and L. J. Wickerham. 1958. Production of extracellular invertase by the yeast, Saccharomyces uvarum NRRL Y-972. Archives of Biochemistry and Biophysics, 76 (2): 449-456.

Recently we received a letter from Dr. Hirosuke Naganishi, professor of Hiroshima Jogakuin College, Japan. It ran as follows:

"Dear Dr. Wickerham,

I read the reprint of your paper on "Presence of nitrite-assimilating species of Debaryomyces in Lunch Meats" (J. Bact., 74: 832-833, 1957. I identified this property in the strains of Debaryomyces some years ago, and sent in a report to the J. Fermentation Technology, Osaka, in 1937. And, heretofore, I have been using this characteristic for the classification of Debaryomyces.

I don't think you have read this record since it was written in Japanese, so I would like to send you a reprint of it. Furthermore, I will enclose the original paper of Debaryomyces membranaefaciens Naganishi, and send it to you by separate post.

Very sincerely yours,"

We regret that we did not know before the note was published that Dr. Naganishi had many years previously found D. membranaefaciens to assimilate nitrite.

X. Donner Laboratory of Biophysics and Medical Physics, University of California, Berkeley, California. Communicated by Dr. R. K. Mortimer.

The following two papers have recently been published:

1)"Life span of individual yeast cells" by R. K. Mortimer and J. R. Johnston. Publ. by the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C.

Abstract:

A group of 36 single diploid yeast cells was followed microscopically to observe the maximum number of buds that each could produce. A distribution between 9 and 43 buds was observed, with a median of 24 buds. From the nature of this distribution and the relative sizes of bud scars and cell surface, it is proposed that life-span limitationn is a consequence of accumulation of bud scars until the useful surface area was insufficient to maintain normal metabolic processes.

2)"Radiobiological and genetic studies on a polyploid series (haploid to hexaploid) of Saccharomyces cerevisiae" by R. K. Mortimer. Radiation Research 9, 312-326 (1958).

XI. Southern Illinois University, Carbondale, Illinois. Communicated by Dr. Carl C. Lindegren.

Since the last publication of the Yeast News Letter, the following articles have been published or have been accepted for publication:

1. Lindegren, C. C., Nagai, S. and Nagai, H. The induction of respiratory deficiency in yeast by manganese, copper, cobalt and nickel. Nature 182, 446-448 (1958).

2. Lindegren, C. C. Respiratory deficiency and the zymophage: Two factors capable of causing degeneration in brewery yeasts. Annual Proceedings American Society of Brewing Chemists, p. 86 (1958).

3. Lindegren, C. C. and Pittman, D. D. The effects of environment (radiation, substrate and allelic genes) on the melezitose locus in Saccharomyces. Nature 182, 271-272 (1958).

4. Shult, E. E. The hypothesis of chromatid interference. Experientia 14, 58 (1958).

5. Lindegren, C. C. Priority in gene-conversion. Experientia. Accepted for publication.

6. Hino, S. and Lindegren, C. C. Polyploidy and the effect of anaerobiosis on the production of respiratory deficient yeast. Exptl. Cell Research. Accepted for publication.

Dr. Lindegren attended and gave a talk on "Recombination in Bacteria" at the meetings of the International Congress of Genetics held at McGill University, Montreal, Canada on August 20-27, 1958.

Dr. Lindegren presented a paper entitled "Gene-controlled resistance vs. sensitivity to caffeine and nicotine in Saccharomyces" at the October 10 meeting of the S.I.B. held in Springfield, Illinois.

Dr. Lindegren has been invited to act as Convener for a symposium of the IX International Botanical Congress to be held in Montreal, Canada in August 1959.

Dr. Haig Papazian and Dr. Gladys Krakow have joined the staff of the Biological Research Laboratory in yeast research.

XII. Detroit Institute of Cancer Research, Detroit 1, Michigan. Communicated by Dr. Caroline Raut Hebb.

The following papers have recently been published:

Hebb, Caroline Raut and Slebodnik, Joan, The Effect of Prior Growth Conditions on the Kinetics of Adaptive Enzyme Formation in Yeast. Exptl. Cell Research 14: 286-294 (1958).

Hebb, Caroline Raut, Montgomery, J. D., and Slebodnik, Joan, Particles Exhibiting Oxidative Enzyme Activity in Yeast. Exptl. Cell Research 14: 495-509 (1958).

In addition, the following papers were presented at the genetics meetings in Montreal:

Hebb, Caroline Raut and Singer, Thomas P., The Adaptive Formation of Succinic Dehydrogenase during Aeration of Anaerobically Grown Yeast. Proc. 10th Intl. Congress of Genetics, 117 (1958).

Doyle, Robert J., The Effects of Age of Culture on the Production of Kill and Cytochrome Deficient Yeast by Ultra-violet Light. Proc. 10th Intl. Congress of Genetics, 71 (1958).

XIII. Cytogenetics Laboratory Indian Institute of Science, Bangalore 3, India. Work carried out under the guidance of Dr. M. K. Subramaniam. Communicated by T. R. Thyagarajan.

1. Aswathanarayana, N. V., and Subramaniam, M. K. "An Evaluation of Standards used in the Study of the Yeast Nucleus". Proc. Ind. Acad. Sci. 1958, 47B, 263-273.

2. Thyagarajan, T. R. "The Reaction of Living Vegetative Cells and Zygotes of Saccharomyces carlsbergensis to Neutral Red." J. Ind. Inst. Sci. 1958, 40 (2), 41-49.

3. Royan, S. "The Cyto-Architecture of the Yeast Nucleus". Proc. Ind. Acad. Sci. 1958, 48B, 33-40.

XIV. Instituto De Micologia, Universidad De Recife, PernAmbuco, Brasil. Communicated by Prof. R. C. Artagaveytia-Allende and Prof. A. Chaves Batista.

We have done the following studies:

1. R. C. Artagaveytia-Allende and R. Pessoa Coelho "Candida humicola and Candida curvata" Their synonymy.

2. R. C. Artagaveytia-Allende and J. S. Silveira "Torulopsis glabrata Contribution to the knowledge of its habitat"

3. We are preparing a paper on the need of enriching methods for the study of yeasts in their natural environment.

During the absence of Prof. A. Chaves Batista who attended the Congresso de Medicina Tropical held in Lisbon, September 1958, Dr. R. C. Artagaveytia-Allende has been appointed for 6 months to take charge of the Institituto de Micologia. A medical Mycology Laboratory has been organized and a course was given on the study of yeasts.

The Rector of the Universidade do Recife, Prof. Joaquim Amazonas is offering the best conditions for the installation of a very nice Zymology Laboratory for the purpose of doing research and to conduct training of persons interested in yeasts.

The principal objective now is related to female gynecological yeast problems, especially a skin disease of young babies, which is very common in Brasil.

Some apparently new species of Candida, Torulopsis and Trichosporon have been isolated. These are now being tested experimentally on animals.

XV. Ministry of Agriculture, Fisheries and Food, Central Veterinary Laboratory, New Haw, Weybridge, Surrey, England. Communicated by Dr. P. K. C. Austwick.

Mr. M. Gitter and I have a paper in the press on "Mucormycosis and moniliasis in sucking pigs" (Veterinary Record, Vol. 70: 1958). We isolated Rhizopus microsporus from stomach ulcers and Candida albicans from oral and oesophageal lesions. The yeast was also present in the stomach contents of all five piglets but in one unrelated case, only Candida tropicalis was found (in the absence of moniliasis lesions). Further isolations of C. albicans were obtained from the drinking water, bedding and air of the piglet pen.

Mr. I. F. Keymer and I have investigated an outbreak of moniliasis in artificially-reared young partridges (Perdix perdix). Typical crop lesions were present but in addition other lesions, possibly associated with a deficiency of certain elements of the vitamin B complex were found on the tongue, in the commissures of the mouth and on the feet. C. albicans was recovered from all these lesions and also in quantity from the grass both within and outside the partridge pen. Our preliminary findings tend

to confirm the observations of di Menna in New Zealand on the occurrence of Candida albicans on grass (Nature, 181: 1287-1288; 1958) and perhaps indicate that moniliasis may sometimes be exogenous in origin.

Mr. G. A. Pepin has been appointed as Assistant Mycologist at the Central Veterinary Laboratory.

XVI. University of Wisconsin, Department of Bacteriology, Madison, Wisconsin. Communicated by H. O. Halvorson.

Dr. Jake Duerksen has completed his Ph.D. thesis on "The Properties and Induction of a Yeast Beta-glucosidase", and is currently spending a post doctoral with Dr. Martin Pollock, Mill Hills, England. Part of his thesis has been accepted for publication in the J. Biol. Chemistry.

Jacob D. Duerksen and Harlyn Halvorson, Purification and Properties of an Inducible Yeast Beta-glucosidase.

Mr. Tony McQuillen has just joined our group from the University of British Columbia. He is starting his Ph.D. research on the β -glucosidases of species of Hansenula. The enzyme is similar in enzymic specificity to that observed by Duerksen in Yeast foam, however it may be of smaller molecular weight. He has selected several constitutive mutants and is currently comparing the constitutive and inducible strains.

Mr. Hirozi Kihara has recently arrived from the Cytochemical Laboratory, Yamaguchi Medical School, Ube, Japan. Mr. Kihara, in cooperation with Dr. Bock and his group at the Biochemistry Dept., is isolating amino acid activating enzymes from various yeast stocks. We have thus far been primarily concerned with methods of rupture and removal of soluble ribonucleic acid.

XVII. Institut für Gärungsgewerbe, Mikrobiologische Abteilung, Seestr. 13, Berlin N 65 (West). Communicated by Dr. Siegfried Windisch.

The investigations on film yeasts have been continued. To further elucidate the ability of film yeasts to remain at the surface, the effect of Tween 80 on the film forming ability on the growth of Hansenula anomala and of Candida krusei was investigated. It was shown that the film yeasts adsorbed Tween 80 in liquid cultures. In this way the wettability of the cells is increased and the otherwise so typical film forming ability on liquid media is inhibited.
S. Windisch und C. Emeis: Versuche zur Erklärung der Schwimmfähigkeit von Kahmhefezellen. Archiv für Mikrobiologie 32, 305, 1958.

The requirement of beer yeasts for the 5 vitamins, biotin, pantothenic acid, inositol, thiamine and pyridoxine and its relation to the fermentative behavior and to raffinose fermentation has been investigated on 51 strains. Three groups were found; 1)bottom fermenting yeasts, which ferment raffinose completely 2)bottom fermenting yeasts which ferment raffinose only 1/3. 3)Top fermenting yeasts which also ferment raffinose only 1/3. In the first group 70% of the yeasts needed only biotin. In the second and third group about 65% of the yeasts needed only biotin and pantothenic acid.

Thiamine and pyridoxine were needed only by two top yeasts and two bottom yeasts. The requirement for the last two vitamins can therefore not be used as a characteristic to distinguish top and bottom yeasts. Non-vitamin requiring beer yeasts were not found.
S. Windisch und A.M. Herbst: Zum Wuchsstoffbedarf der Bierhefen. Wissenschaftliche Beilage der Brauerei 11, Nr. 9, 133, 1958.

In the above mentioned investigations it was necessary to carry out many quantitative raffinose fermentations. This is difficult and time consuming with the presently available methods. It became, therefore, necessary to look for a rapid and convenient method with which one cannot only determine whether raffinose is fermented completely or partially but also how it is split. This was done according to the new methods with the aid of three chemical color reactions to check 1) reducing sugar 2) glucose and 3) fructose. These reactions show clearly whether raffinose is fermented 1/3, 2/3 or 3/3. Also the rarely occuring atypical 1/3 fermentation can be clearly recognized by this method.
W. Bronn: Eine neue Methode zur Prüfung der Raffinose-Vergärung von Hefen. Wissenschaftliche Beilage der Brauerei 11, Nr. 9, 156, 1958.

A simple technique was developed which allows one to obtain from a sporulating yeast large numbers of single ascospores without the aid of a micromanipulator. (C. Emeis und H. Gutz: Eine einfache Technik zur Massenisolation von Hefesporen. Zeitschrift für Naturforschung 13 b, 647, 1958). The yeast is disrupted by mild means and then treated with liquid paraffin oil which causes the ascospores to go into the paraffin because of their lipophilic surface. (C. Emeis: Die Gewinnung von Askosporenmassen von Saccharomyces-Arten auf Grund besonderer Oberflacheneigenschaften. Naturwissenschaften 45, 441, 1958). From the paraffin, plating can be done directly on wort agar. This mass isolation technique is particularly suited for investigations dealing with population genetics. (H. Gutz: Über die Anwendung populationsgenetischer Gesichtspunkte für die Züchtung von Hefen mit verbesserten Eigenschaften. Wissenschaftliche Beilage der Brauerei 11, 149, 1958). It is also suitable for genetic analysis on beer yeast which only have a weak sporulation ability and a low percentage of viable spores. (C. Emeis: Untersuchungen an durch Massenisolation gewonnenen Sporen von Saccharomyces carlsbergensis. Wissenschaftliche Beilage der Brauerei 11, 160, 1958). Investigations on the sporulation of beer yeast are in progress.

In an earlier paper (H. Gutz: Planta 46, 481, 1956) a report was given on the selective fluorescent chromogenicity of granules in living yeast cells. These granules posses porperties which correspond partially with mitochondria and partially with the "Sphaerosomes" of higher plants. In newer experiments it was observed that there was a strong influence of the type of light on the fluorescence of Mucor hyphae and Saccharomyces cells which were stained with Nile blue. (H. Gutz; Naturwissenschaften, im Druck).

XVIII. Department of Food Technology, University of California, Davis, California. Communicated by Dr. H. J. Phaff.

Mr. Snyder is continuing his study of an inulin hydrolyzing enzyme produced by Saccharomyces fragilis. The enzyme is found extracellularly and also is found associated with the cells. By following changes in enzyme

concentration outside and inside the cells during growth of the yeast, he is hoping to learn something about the mechanism by which the enzyme is secreted.

J. D. Ferreira and H. J. Phaff have studied the life cycle and nuclear behavior of a species of the yeast genus Schwanniomyces. When young vegetative cells were exposed to X-radiation, the death rate curve was found to be typical of a haploid culture. Vegetative cells are uninucleate, except for a short period following mitosis before the daughter nucleus moves into the newly formed bud. The sexual cycle is as follows: After a mitotic division of the nucleus, the two haploid daughter nuclei presumably fuse in the mother cell and the resulting diploid nucleus moves into a special bud, where it undergoes meiosis and forms a quartet of 4 nuclei. Supernumerary mitoses prior to karyogamy are common, and more than one diploid nucleus may be formed. In this case extra buds in which meiosis takes place are formed on the mother cell. After meiosis the nuclei move back into the mother cell. It appears that as a rule several or all nuclei become incorporated in the developing spore. Uusally one, rarely two spores per ascus are formed. Upon germination, spores bud individually without any evidence of conjugation and they produce haploid vegetative cells. In exceptional cases diploidization occurs as a result of two conjugating haploid cells. The nuclear division appears to occur by a not previously described mechanism. This work will be described and illustrated in detail in a forthcoming publication.

Dr. Wm. Bridge Cooke from the Robert A. Taft Sanitary Engineering Center, U.S. Public Health Service, Cincinnati 26, Ohio, spent 3 weeks at the Dept. of Food Technology to work on a joint project of identifying yeasts found in various sewage disposal systems. The results are being prepared for publication.

The following papers have been accepted for publication.

"A comparative study of the apiculate yeasts" by M.W. Miller and H. J. Phaff - Mycopathologia et Mycologia applicata (in press)

"On the cell wall composition of Saccharomycopsis guttulata". by M. Shifrine and H. J. Phaff. Antonie van Leeuwenhoek (in press).

XIX. Sicks Ranier Brewing Company, 3100 Airport Way, Seattle 4, Washington. Communicated by Dr. John G. Kleyn.

During the past year our laboratory, under the direction of Mr. N. L. Vacano, Brewery Supervisor, has initiated several interesting projects in zymology, some of which we hope to publish in the forthcoming year. Some of the studies we have or are engaged in are as follows:

1. The effect of washing "pitching yeast" with phosphoric acid over a series of generations on the methylene blue stained cell count of this yeast and on the subsequent fermentations.

2. A study of some of the factors involved in the methylene blue staining technique for differentiating viable from dead

yeast cells.

3. Hybridization and sporulation of various brewers yeast strains.

4. Isolation of single cells from a brewer's yeast capable of achieving a lower final beer pH than is produced by other cells (both single and mixed).

5. The effect of a Gram negative rod infection on the subsequent fermentation of a laboratory lager beer.

We shall be delighted to receive correspondence from others engaged in related projects.

Our research staff in addition to Mr. Vacano and myself consists of Dr. Leonard Bieranowski, chief chemist; Mr. David Dixon, quality control engineer, and Mr. Edward Eastland, senior chemist.

XX. Istituto Di Microbiologia Agraria E Tecnica Dell'Universita' - Perugia (Italia). Communicated by Prof. Tommaso Castelli - Director.

1)"Researches on fermentation stoppings" (Italian)
1958. n°. 3. Rivista di Viticoltura ed Enologia: Coneglaiano

The A. carried out a series of chemical analyses on fermentation products of a grape-must sterilized and inoculated with a strain of Saccharomyces ellipsoideus, and stored at 40°C. for different periods of time (1 to 10 days).

Continued exposure to 40°C. has an unfavorable effect on the course of the fermentation process, bringing about a progressive decrease of the alcohol production and of the ratio alcohol/sugars and a progressive increase of the volatile acidity and of the residual sugar.

When the musts stop, it is necessary to favor the quick renewal of the fermentation by means of inoculating a large amount of a young culture of Saccharomyces ellipsoideus with high fermentative power.

2)"Climate and agents of wine fermentation" (English)
American Journal of Enology: Vol. VIII°, N°.4(1957)

XXI. Miscellaneous News Items

1. Dr. K. Sato, director-in-chief of the Institute for Fermentation, 4-54 Jusonishinocho, Higashiyodogawa-ku, Osaka, Japan has sent the Editor a "List of cultures" (molds, yeasts and bacteria) printed in 1956, chiefly in English. This booklet (114 pages) should be useful to anyone interested in cultures available for distribution, especially those isolated and described in the Orient.

The most recent edition of the catalogue of the Centraal Bureau voor Schimmelcultures, Baarn, Holland appeared in 1957 and contains a list of filamentous fungi, yeasts and Actinomycetes (220 pages).

2. Dr. R. S. W. Thorne (Alfred Jörgensen Laboratory for fermentation, Copenhagen, Denmark) has recently published the following paper: "Statistical survey of the fermentation efficiencies of a large number of strains of brewery yeasts and a consideration of the utility of these efficiencies in classification. Jour. Inst. Brewing 64, 411-421 (Sept.-Oct. issue) 1958.

3. Dr. L. do Carmo Sousa (Dept. de Microbiologia, Faculdade de Ciencias, Lisboa, Portugal) writes that Dr. Th. van Uden is spending 3 months in Portuguese East Africa this fall in order to study certain mycological problems related to man and warm blooded animals.

4. Dr. Joshua Lederberg writes:"Notice of change of address -- effective February 1, 1959 -- Prof. J. Lederberg, Department of Genetics, Stanford University, Stanford, California."

The Genetics Department is a newly organized unit in the medical school to be concerned with basic scientific problems in genetics. Special emphasis will be given to the genetics of microorganisms, along the lines of my previous work, together with other aspects of the science pertinent to medicine."

5. Professor R. Ciferri writes: "Prof. O. Verona (Director of the Institute of Agric. and Techn. Microb., University of Pisa) with the collaboration of Porf. R. Ciferri (University of Pavia), prepared a list of genera, species and varieties published between 1952 and 1958 supplementing Lodder and Kreger van Rij's standard work on yeasts.

Morphological, cultural and biochemical characteristics are given as published.

See also "Recenti progressi nella sistematica dei lieviti", by O. Verona 1957. Arquivos de fermentaçao. Published by the Escola National de Quimica. University of Brasil, Rio de Janeiro."

6. Dr. G. Butschek, Norddeutsche Hefeindustrie, Hamburg-Wandsbek 1 Wandsbeker Zollstrasse 59 writes: "It may be of interest that the Fermentation Industry Division of the International Union of pure and applied chemistry has created a sub-committee with the task of working out methods for establishing standards and to evaluate dried yeast. Members of this committee are:

Prof. Lundin	Sweden
Dr. P. Birolaud	France
J. M. Klokgieters	Holland
Prof. H. Jörgensen	Denmark
Prof. Szilvinyi	Austria
Dr. G. Butschek	Germany

The first session of the committee took place in May 1958 in the Hague, Holland.

Dr. Butschek would like to establish contacts with industrial Zymologists in other countries.

An article (40 pages) on yeast technology by Dr. Butschek has appeared in 1957 in the "Ullmanns Encyklopädie der Technischen Chemie". Urban and Schwarzenberg - Munich - Berlin.

7. Dr. C. Ramirez (Instituto Jaime Ferran, Madrid) writes" "The following paper "Studies on the periodicity and the nature of the gas exchange by a yeast: Kloeckera apiculata" (in Spanish) by Prof. F. Chodat and Dr. C. Ramirez will appear in Revista de Microbiologia Espagnola (Madrid).
Brief abstract: A pehnomenon of periodicity has been observed with regard to the intensity of gas exchange and respiratory quotient in K. apiculata. These fluctuations are not only the result of variation in extrinsic factors but are dependent also on an intrinsic periodicity of the yeast, the "endogenous rythm".

LETTERS TO THE EDITOR

Dear Sir:

I have noted with interest in the previous issue a letter to the editor by Dr. Thomas Brock regarding symbolism in the heterothallic yeasts. He favors use of Blakeslee's designations of sex as + and -, primarily because (1) the symbols should be easy to write on any typewriter, (2) they should be easy to speak in oral communication, and (3) if possible, priority should be respected.

I would prefer the small letters a and b. They are easier to type, for on large typewriters shift to capital type is required for + and -, and not all portables have the + symbol. Small a and b are more quickly typed.

To me, sex a or mating type b sound better and make more sense than sex minus, the minus strain, or mating type plus, in oral discourse.

I think priority should be respected only as far as it merits respect, and only so long as it appears to be the most accurate and practical concept or expression. Blakeslee should and will be respected for his scientific advancement, but I think his designation of sex can and should be improved upon, at least so far as yeasts are concerned.

L. J. Wickerham,
Peoria, Illinois