parasitoid takes into account the increase in the energy content of the host subsequent to parasitization. It also accounts for the energy expended on metabolism by the host. Table 1 provides estimates of the host energy available and that ingested by *A. prodeniae* parasitizing on *S. exigua*.

1. Prakash, R. N. and Pandian, T. J., *Oecol. (Berl.)*, 1978, **33**, 209.
2. Howell, J. and Fisher, R. C., *Ecol. Entomol.*, 1977, **21**, 143.
3. Fisher, R. C., *Biol. Rev.*, 1971, **46**, 243.
4. Senthamizhselvan, M., *Ecophysiological studies on chosen insect pests, predators and parasities*, Ph.D. thesis, Madurai Kamaraj University, Madurai, 1987, p. 172.

10 January 1989; revised 15 May 1989

Nutritional value of the newly isolated *Saccharomyces cerevisiae* of palm wine

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An analysis of the newly isolated *Saccharomyces cerevisiae* showed that this strain could be a better feed/food supplement in terms of nutrition. The treatment of this strain with the mutagen *N*-methyl-*N'*-nitro-*N*-nitroso guanidine increased the thiamine content 3-fold, thus rendering the organism more nutritive.

YEASTS are used as food/feed supplement because of its protein, amino acid and vitamin B contents. Among the yeasts, *Candida utilis*, *Kluyveromyces fragilis* and *Saccharomyces cerevisiae* are generally used as nutritional sources[1]. When yeasts were given as feed supplement to animals, there was an improvement in weight, egg size and increased disease resistance[2–4].

The palm sap or wine obtained from palm trees used as a beverage particularly in South India, harbors many yeast strains. These have not been properly exploited for nutritional purposes. We have isolated several yeast strains from palm wine of local palm trees. One of the isolates was identified as *S. cerevisiae* which gave better biomass and ethanol yield compared to others (Table 1). This strain was further evaluated for its nutritive value in terms of cell protein, amino acid composition and thiamine (vitamin B_1). The effect of *N*-methyl-*N'*-nitro-*N*-nitroso guanidine (MNNG), a potent mutagen, on the nutritional improvement of this strain was also studied.

S. cerevisiae isolated from palm wine on YEPD medium (yeast extract-1%, peptone-2% and dextrose-2%) was stored on the slants layered with paraffin oil at 4°C.

The biomass of the culture was estimated by drying the cells to a constant weight. Protein was estimated by determining the nitrogen content of the cells using the Microkjeldahl method[5]. The thiamine and riboflavin contents were estimated by chemical methods[6,7]. The amino acid composition of the cellular protein was determined by subjecting it to HCl hydrolysis and analysing the amino acid contents using an automatic Beckman amino acid analyser (119 CL).

The cells were treated with 0.2 mM MNNG (Sigma) for 210 min by the method described by Fahrig[8]. The cells after treatment were washed free of the mutagen and plated on YEPD medium with 1.5% agar. About 20 colonies were selected at random after incubation at 28°C and analysed for their nutritive value.

The newly isolated yeast strain of *S. cerevisiae* was found to contain 47% protein and 180 μg and 40 μg of thiamine and riboflavin/g dry weight of cells respectively. These values are comparable to the U.S. National Formulary (N.F × 1) 1960[1].

In general, the contents of some of the essential amino acids of the total cellular proteins were

Table 1. Ethanol and biomass yield of various isolates of yeasts after 72 h incubation at 28°C in a shaker.

Source of isolation	Predominant yeast	Ethanol yield in g/g glucose	Biomass yield in g/g sugar/l
Grape (Anabshahi)	*Hansenula* spp.	0.22 ± 0.005	0.3 ± 0.08
Grapes (Anabshahi)	*Hansenula* spp.	0.15 ± 0.005	0.2 ± 0.06
Seedless grapes	*Hansenula* spp.	0.23 ± 0.01	0.3 ± 0.01
Seedless grapes	*Hansenula* spp.	0.19 ± 0.005	0.19 ± 0.01
Grapes (Bangalore blues)	*Hansenula* spp.	0.175 ± 0.005	0.19 ± 0.09
Soil	*Saccharomyces* spp.	0.24 ± 0.005	0.31 ± 0.009
Soil	*Saccharomyces* spp.	0.25 ± 0.007	0.32 ± 0.008
Soil	*Saccharomyces* spp.	0.23 ± 0.006	0.28 ± 0.009
Palm wine (Toddy)	*S. cerevisiae*	0.27 ± 0.005	0.34 ± 0.009
Palm wine	*S. cerevisiae*	0.25 ± 0.004	0.30 ± 0.01
Palm wine	*S. cerevisiae*	0.24 ± 0.005	0.3 ± 0.009
Palm wine	*S. cerevisiae*	0.18 ± 0.005	0.19 ± 0.01
Palm wine	*S. cerevisiae*	0.16 ± 0.004	0.17 ± 0.009
Palm wine	*S. cerevisiae*	0.3 ± 0.005	0.4 ± 0.01
Mutagen-treated sample 17	*S. cerevisiae*	0.325 ± 0.006	0.42 ± 0.01

Mean of 5 individual experiments carried out in duplicates.

Table 2. Composition of amino acids of *Saccharomyces cerevisiae* of palm wine in comparison to FAO standard.

Amino acids	Amino acids in g/100 g of protein	
	*S. cerevisiae** palm wine	Recommended** FAO standard
Lysine	7.7	4.2
Methionine	1.0	2.2
Alanine	5.6	—
Valine	4.8	4.2
Histidine	1.6	—
Isoleucine	4.0	4.2
Phenylalanine	4.0	—
Leucine	7.0	4.8
Tyrosine	2.0	—

*Amino acid composition of palm yeast is similar to that of *C. utilis* and soybean[9,10].
**Cited from Prior *et al.*[9].

Table 3. Effect of MNNG treatment on protein, biomass and thiamine content of *Saccharomyces cerevisiae* of palm wine.

Culture	Protein (%) dry wt	Biomass in g/g glucose/l	Thiamine µg/g dry wt
Original isolate[a]	47 ± 3.0	0.44 ± 0.01	180 ± 0.5
MNNG-treated culture[b]	47 ± 3.0	0.46 ± 0.01*	540 ± 1.0*

[a]Mean of 5 individual experiments carried out in duplicates.
[b]Mean of 20 samples isolated after MNNG treatment.
*Significant at 5%.

comparable to that of FAO standard[9], *C. utilis*[9] and soybean[10] (Table 2). Therefore, this strain of yeast could be used as feed supplement and as a substitute for soybean meal.

MNNG treatment resulted in 25% survival of the cells. Twenty colonies which were isolated and examined showed no change in its protein content (i.e. 47%). However, the biomass of these cultures increased by 0.02/g sugar/l (from 0.44 to 0.46 g) which was statistically significant. The thiamine content also showed a three-fold increase (from 180 to 540 µg/g dry wt of cells) (Table 3).

This new isolate of *S. cerevisiae* may serve as a good nutritional source for food/feed purposes. The culture has been deposited at the National Collection of Industrial Microorganisms, NCL, Pune, India (Acc. No: 3558).

1. Reed, G., *Food Technol.*, 1981, **35**, 1.
2. Tegbe, S. B. and Zimmerman, D. R., *J. Anim. Sci.*, 1977, **45**, 1309.
3. Greive, D. G., *Can. J. Anim. Sci.*, 1979, **59**, 89.
4. Kargi, F. and Shuler, M. L., *Biotechnol. Lett.*, 1981, **3**, 409.
5. Jackson, M. L., *Soil Chemical Analysis*, Prentice Hall, London, 1958, p. 183.
6. Hennessy, J. D. and Cerecedo, L. R., *J. Am. Chem. Soc.*, 1959, **61**, 179.
7. Bessey, O. A., Lowry, O. H. and Love, R. H., *J. Biol. Chem.*, 1949, **180**, 755.
8. Fahrig, R., *Mol. Gen. Genet.*, 1979, **168**, 125.
9. Prior, B. A., Botha, M., Custers, M. and Castaleggio, C., in *Advances in Biotechnology* (eds. Moo-young, M. and Robinson, C. W.), Pergamon Press, New York, 1981, vol. 2, p. 337.
10. Davy, C. A. E., Wilson, D. and Lyon, J. C. M., in *Advances in Biotechnology* (eds. Moo-young, M. and Robinson, C. W.), Pergamon Press, New York, 1981, vol. 2, p. 343.

ACKNOWLEDGEMENT. We thank CSIR, New Delhi, for financial assistance.

16 December 1988; revised 16 June 1989

Effect of uniconazol on transpiration of excised soybean leaves

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The synthetic plant growth-regulator uniconazol decreased transpiration rates in soybean. An analysis of transpiration decline curves reveals that uniconazol reduced the transpiration rate by decreasing stomatal transpiration through partial stomatal closure.

It has been reported earlier[1-3] that synthetic growth-regulators like morphactins, benzothiadiazoles and ethephon are effective in controlling transpiration in sesame, growing under sub-optimal water irrigation. Uniconazol, a new synthetic plant growth-regulator, acts as antigibberellin and is known to inhibit excessive vegetative growth in plants[4,5]. Information available about its role in transpiration in plants is meagre and hence an attempt has been made in this study to understand the role of uniconazol.

The experiment was conducted during the 1988 *kharif* season. The three genotypes of *Glycine max* L., viz. *monata*, *macs-13* and *gaurav* served as experimental materials. The plants were raised in 30 cm earthenware pots filled with alkaline calcareous soil. Fifty-five days after sowing, the plants received soil application of 100 ml of 2 ppm of uniconazol (200 µg/pot), and untreated plants served as control. This concentration was selected after preliminary trials. Treatment combinations were replicated thrice. Transpiration of untreated leaves and those treated with uniconazol was measured 60 days after sowing according to the method described earlier[2,6]. To derive the transpiration decline curve, the decline of logarithm of the reduced fresh weight was plotted on the ordinate and the time (in minutes) on the abscissa. Waisel *et al.*[6] showed that analysis of stomatal response by this method is useful for comparison of stomatal responses of leaves of different physiological and ecological constitution.

Figure 1*a* reveals that uniconazol decreased transpi-