form, which corresponds to the stage found in the insect vector, respired with an R.Q. of unity and produced large amounts of succinic and acetic acids, as well as smaller amounts of other metabolites; it seems that adaptation to life in the animal has resulted in the loss of much catabolic activity.

SUMMARY

1. *Trypanosoma rhodesiense*, *T. gambiense*, *T. brucei*, *T. evansi*, *T. equinum* and *T. equiperdum* degrade glucose to a mixture of pyruvic acid and glycerol; glycerol production is favoured by anaerobic conditions. The R.Q. is small, usually less than 0.10.

2. *T. cruzi* and *T. lewisi* convert glucose into a mixture of lactic, acetic and succinic acids; *T. congolense* and *T. vivax* produce glycerol, acetic acid and succinic or lactic and pyruvic acids; and *Stringomonas oncopelti* forms glycerol, ethanol, pyruvic and succinic acids. In all cases the R.Q. is high, about unity.

3. The respiration of *T. cruzi*, *T. lewisi* and *S. oncopelti* is very sensitive to cyanide, that of *T. congolense* is slightly sensitive, and the respiration of *T. vivax* and *T. rhodesiense* is insensitive to the inhibitor; cytochrome pigments have been detected in *T. cruzi*, *T. lewisi* and *S. oncopelti*, but not in *T. congolense*, *T. rhodesiense* or *T. equiperdum*.

4. Homogenates of *T. cruzi*, *T. lewisi*, *S. oncopelti*, *T. congolense*, *T. vivax* and *T. rhodesiense* have been examined for cytochrome and succinic-oxidase activity; such activity has been found in all preparations to a varying extent.

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The Component Fatty Acids of *Penicillium lilacinum* Fat

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During study in this Laboratory of the fat-forming potentialities of a selection of mould fungi it was found by one of us (S.S.) that, under certain cultural conditions, *Penicillium lilacinum* Thom can give a high yield of a fat which is solid at ordinary temperature and which is of a very low free acidity—characteristics that are very desirable in edible fats. It was considered of interest to investigate the component fatty acids and glycerides of this fat.

EXPERIMENTAL

The fat was obtained by cultivating *P. lilacinum* Thom as surface cultures for 14 days at 25° on the following medium (g./100 ml.): K₂SO₄, 0.011; NaH₂PO₄.2H₂O, 0.730; MgSO₄.7H₂O, 0.500; ZnSO₄.7H₂O, 0.005; FeCl₃.6H₂O, 0.016; sucrose, 17; NaNO₃, 0.640; made up with distilled water and the pH adjusted to 6.8. The felts were removed and treated as described previously (Singh, Walker & Mearns, 1955) for the extraction of the fat. The product thus obtained was solid at room temperature and had a slight

yellowish tinge. On examination according to British Standard Methods of Analysis of Oils and Fats (British Standards Institution, 1950) the fat showed the following characteristics: saponification equiv. 286.9; iodine value 63.7; free fatty acids (as oleic) 0.2%; unsaponifiable matter 2.9%.

Spectroscopic examination of the mixed fatty acids by the method of Hilditch, Patel & Riley (1951) gave $E_{1\text{ cm.}}^{1\%}$ at 268 m μ . (170°, 15 min.), 2; $E_{1\text{ cm.}}^{1\%}$ at 234 m μ . (180°, 15 min.), 119.5. Assuming that the unsaturated acids present are solely of the C_{18} series, the following composition was deduced: triethenoid acids, trace; diethenoid acids, 13.2; monoethenoid acids, 47.6; saturated acids, 39.2%.

Determination of component fatty acids

The mixed fatty acids were separated into three fractions (*A*, *B*, and *C*) by crystallization from acetone at -65° , and subsequent crystallization of the acetone-insoluble portion from ether at -30° . The results are given in Table 1. Each fraction was methylated and fractionally distilled. The saponification equivalents and iodine values of the ester fractions obtained for each group are recorded in Table 2. From the analytical data recorded in Tables 1 and 2 the composition of each acid group and finally of the whole fat was deduced (Table 3) by the method adopted previously (Singh *et al.* 1955).

Table 1. Fractionation of mixed fatty acids by low-temperature crystallization

Group	Conditions	Acids			
		Wt. (g.)	% (w/w)	Iodine value	$E_{1\text{ cm.}}^{1\%}$ (234 m μ)*
<i>A</i>	Insoluble in 10 vol. acetone at -65° and in 10 vol. ether at -30°	53.80	44.2	8.3	18.7
<i>B</i>	Insoluble in 10 vol. acetone at -65° , soluble in 10 vol. ether at -30°	54.03	44.4	94.9	95.6
<i>C</i>	Soluble in 10 vol. acetone at -65°	13.81	11.4	157.2	676.6

* After isomerization with alkali.

Table 2. Fractionation of methyl esters of acids of groups *A*, *B* and *C*

Fraction	Wt. (g.)	Saponification equivalent	Iodine value
Methyl esters of acids <i>A</i>			
<i>A</i> ₁	1.42	268.1	0.0
<i>A</i> ₂	2.15	271.5	3.2
<i>A</i> ₃	2.81	272.1	5.1
<i>A</i> ₄	3.15	272.5	5.2
<i>A</i> ₅	3.80	272.6	5.7
<i>A</i> ₆	3.72	274.7	6.1
<i>A</i> ₇	4.30	277.6	7.7
<i>A</i> ₈	4.16	279.9	8.8
<i>A</i> ₉	3.69	286.1	12.4
<i>A</i> ₁₀	2.07	293.2	12.6
<i>A</i> ₁₁	1.73	314.1*	22.2
Methyl esters of acids <i>B</i>			
<i>B</i> ₁	1.61	286.1	81.2
<i>B</i> ₂	1.86	287.2	84.1
<i>B</i> ₃	3.50	289.1	84.3
<i>B</i> ₄	3.13	289.4	87.7
<i>B</i> ₅	3.47	290.4	89.6
<i>B</i> ₆	3.83	293.4	91.5
<i>B</i> ₇	4.42	295.0	93.1
<i>B</i> ₈	3.62	296.4	95.3
<i>B</i> ₉	2.51	296.5	95.7
<i>B</i> ₁₀	1.84	307.9*	84.2
Methyl esters of acids <i>C</i>			
<i>C</i> ₁	1.44	284.7	137.7
<i>C</i> ₂	1.39	291.2	150.1
<i>C</i> ₃	1.81	293.2	151.0
<i>C</i> ₄	2.11	294.8	151.3
<i>C</i> ₅	1.52	294.4	152.2
<i>C</i> ₆	1.70	312.3*	140.9

* Equivalents of esters (freed from unsaponifiable matter): *A*₁₁, 313.3; *B*₁₀, 307.5; *C*₆, 301.8.

Identification of fatty acids

Palmitic acid (m.p. 61.5–62.8°) and stearic acid (m.p. 69.2–70.0°) were recovered from appropriate fractions, and the identity of the oleic acid was confirmed by its conversion into 9:10-dihydroxystearic acid (m.p. 129–130°). Linoleic acid was characterized by conversion into tetrabromostearic acid (m.p. 112.5–113.2°). None of these samples showed depression of m.p. on admixture with an authentic specimen of the appropriate reference substance.

DISCUSSION

From the figures for component fatty acids of *P. lilacinum* fat recorded in Table 3 it is clear that the proportion of saturated acids in this fat is markedly greater than has been found in most of the fats of microbiological origin which have so far been examined. The palmitic acid constitutes about 75% of the total saturated acids and it accords with the amount usually associated with the fats from cryptogams.

The hexadecenoic acid content of *P. lilacinum* fat is of the order that is normal for this acid in fat-rich micro-organisms. The proportion of hexadecenoic acid in the fat-poor micro-organisms is usually high, but it appears to fall with an increase in the reserve fat (Holmberg, 1948).

The amount of linoleic acid in *P. lilacinum* fat (13.4%) is quite moderate. It appears therefore that the fat should possess inherently good resistance to oxidative rancidity.

The most interesting feature of *P. lilacinum* fat is its close resemblance in component fatty acid

Table 3. *Component fatty acids of Penicillium lilacinum fat*

	Acid groups (%)*			Total fatty acids excluding unsaponifiable matter (%)	
	A (44.2%)†	B (44.4%)†	C (11.4%)†	(w/w)	(mol.)
Myristic	0.3	—	—	0.1	0.1
Palmitic	67.6	5.3	—	32.3	34.4
Stearic	21.0	0.3	—	9.4	9.0
Arachidic	3.2	—	—	1.4	1.2
Hexadecenoic	—	6.8	3.5	3.4	3.7
Oleic	5.5	75.4	23.1	38.6	37.3
Linoleic	2.4	9.6	70.6	13.4	13.1
Unsaturated C ₂₀	—	2.6	2.4	1.4	1.2
Unsaponifiable	—	—	0.4	—	—

* Component acids as percentage (w/w) of group.

† Groups as percentage (w/w) of total acids.

Table 4. *Component acids of pig fat, palm oil, and Penicillium lilacinum fat*

	Iodine value	Saturated				Unsaturated				
		C ₁₄	C ₁₆	C ₁₈	C ₂₀	C ₁₄ (-2.0 H)	C ₁₆ (-2.0 H)	C ₁₈ (-2.0 H)	C ₁₈ (-4.0 H)	C ₂₀₋₂₂ (-2.0 H)
Pig*	60.0	1.3	28.3	11.9	—	0.2	2.7	47.5	6.0	2.1
Palm†	60.0	1.6	32.3	5.5	—	—	—	52.4	8.2	—
<i>P. lilacinum</i> ‡	63.7	0.1	32.3	9.4	1.4	—	3.4	38.6	13.4	1.4

* Hilditch, Lea & Pedelty (1939).

† Bank, Dean & Hilditch (1935).

‡ Present investigation.

composition to pig fat and palm oil (Table 4). In the triglyceride molecules of the latter fats the fatty acids are not arranged according to the general rule of even distribution, and these fats contain a higher proportion of fully saturated glycerides. It will be of interest to ascertain the glyceride structure of *P. lilacinum* fat. This is now under investigation and will be reported in a later communication.

SUMMARY

1. The fat produced by *Penicillium lilacinum* grown in surface culture on a chemically defined medium of sucrose and inorganic salts is solid at room temperature and has a very low free acidity (0.2% as oleic acid).

2. The component fatty acids of this fat are: myristic, 0.1; palmitic, 32.3; stearic, 9.4; arachidic, 1.4; hexadecenoic, 3.4; oleic, 38.6; linoleic 13.4; C₂₀ unsaturated acids, 1.4%.

3. The hexadecenoic acid content, like that of fats from other fat-rich micro-organisms, is low.

4. The moderate content of linoleic acid in this fat implies low liability to oxidative rancidity.

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