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Fatty Acid Composition of *Streptomyces fulvoviolaceus* 818, A Producer of Antibiotic Complex

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Abstract
The fatty acid composition of *Streptomyces fulvoviolaceus* 818 producer of antibiotic complex was analysed by capillary gas chromatography. The strain formed significant amounts of 18:2, 16:0 and 18:1 fatty acids. The culture synthesized very long chain fatty acids in the range from 20 to 27 carbon atoms. Among them more abundant levels of 20:0, 23:0 and 24:0 acids were detected. Their occurance might be connected with lipase activity of strain. The total sum of unsaturated fatty acids in *S. fulvoviolaceus* 818 is the highest, the amount of saturated straight-chain fatty acid ranked second.

Key words: Fatty acids, *Streptomyces fulvoviolaceus*, antibiotic producer

Introduction
In the past two decades a great attention has been paid to fatty acids in Actinomycetes. Thus, some of authors have detected the cell fatty acid composition of different species an additional taxonomical criterion (Ballio and Barcellona, 1968; Rezanka *et al*., 1984, 1992; Brondz and Olsen, 1986; Asselineau and Asselineau, 1990). Others investigators have studied fatty acid content of strains producing antibiotics and searched the closed relationhip between fatty acid formation and secondary metabolite synthesis (Kurylowicz *et al*., 1971; Arima *et al*., 1973; Grafe *et al*., 1982; Vancura *et al*., 1987; David *et al*., 1992; Adamidis and Sherman, 1995; Gesheva *et al*., 1997; Mouslim *et al*., 1997).

Streptomyccs fulvoviolaceus 818 produces a new antibiotic complex active aga inst Gram-positive, Gram-negative bacteria, yeast and fungi (Tewfike *et al*., 1 994). The strain 818 belongs to group of violet streptomycetes and we have not found the data for lipids in related species. This work presents the results of investigations on fatty acid composition of *S. fulvoviolaceus* 818.

Materials and Methods
Microorganism and cultural conditions: *S. fulvoviolaceus* 818 described earlier (Tewfike *et al*., 1994) was used in this observation. The strain was grown as two-stage submerged culture in 500 mL Erlenmeyer flasks containing 50 mL of medium on a rotary shaker (220 rev/min) at 28°C. The flasks were inoculated with 5 percent of 40 h culture grown under the same conditions and incubated to reaching of the growth mid-exponential phase. The medium contained (g L^{-1}): glucose, 35; KNO_3,1.5, KH_2PO_4, 1.0, NaCI, 0.5; $CaCO_3$, 2.0, pH was ajusted tp 7.2 before sterilization. For fatty acid analysis mycelium was harvested by centrifugation and treated to the method of Gesheva *et al*. (1997). A gas chromatography was performed on a chromatograph ERBA science 4300. The following operating conditions were used: WCOT column DB5 (Varian)-25 in x 0.22 mm x 0.2 μm and Omegawax 250 (Supelco)-30 m x 0.25 mm x 0.25 μm), initial temperature, 90°C (5 min), program rate, 5°C /min, final temperature, 220°C (5 min), injection and detection temperatures, 240°C, detector FID. The methyl esters of fatty acids were identified by comparing their retention times with appropriate standards from Polyscience.Co., USA.

Results and Discussion
The first experiments were carried out with WCOT column but separation of distinct unsaturated acids was absent. The Omegawax column used in the next investigations favoured their separation.

The fatty acid composition of *S. fulvoviolaceus* 818 is presented on Table 1. Unsaturated 18:2 acid constitued 28.61 percent of all amount acids and 18:1w9 ranked second. The lower content showed 1 6:0 acid. The high proportion of 18:1 was noted in *S. aureofaciens*-16 percent (Kurylowicz *et al*., 1971). The presence of positional isomers of octadecenoic acid in *S. fulvoviolaceus* 818 is not surpricing because similar isomers were detected in *S. cinnamonensis* (Rezanka *et al*.,1984) and *S. aureofaciens* (Behal *et al*., 1969). In *S. hygroscopicus* JA 6595, producer of turirnycin 16:0 acid was 15.7 percent (Grafe *et al*., 1982), while *S. virginiae* contained only 10.6 percent (Rezanka *et al*., 1992). *S. fulvoviolaceus* 818 synthesizes very long chain fatty acids containing from 20 to 27 carbon atoms. Among them more abundant were acids:20:0, 23:0, 24:0. Low content of long fatty acids upto 24 carbon atoms was found in *S. cinnamonensis* by Rezanka *et al*. (1984). More longer chain fatty acids upto 30 carbon atoms were described in some bacteria, moulds and yeast (Rezanka *et al*., 1987). The biological role of very long chain fatty acids is not clear. Welch and Burlingame (1973) suggested those they have a partcipation in membrane functions and Murata *et al*. (1984) assumed that hydrophobicity of plant surface is due to long fatty acids involving in wax composition. Perhaps synthesis of the very long fatty acids changes the hydrophobic properties of cell membrane of *S. fulvoviolaceus* 818 arid thus is favours enzyme formation.

Some authors as Arima *et al*. (1973), Grafe *et al*. (1982), Vancura *et al*. (1987) and David *et al*. (1992) concluded that the biosynthesis of antibiotics in Streptomycetes is closely associated with permeability of cell membrane which is determined by fatty acid composition. It is known that isoand anteiso-branched fatty acids play an important role in regulation of membrane functions. The ratio of certain fatty acids influences polarity of cell membrane and thus may favour a particular antibiotic biosynthesis. In our case, the total percentage of unsaturated fatty acids in *S. fulvoviolaceus* 818 is the highest, the amount of saturated straight-chain acid followed.

Table 1: Fatty acid composition of *S. fulvoviolaceus* 818

Fatty acid	strain 818	Fatty acid	strain 818
1-9:0	0.76	18:1 w9	12.51
1-10:0	0.21	18:1w11	0.91
10:0	0.28	18:2	15.41
10:1	0.21	18:3	0.45
a-11:0	1.57	x	1.13
11:1	0.32	1-19:0	0.18
12:1	2.77	a-1 9:0	1.21
14:0	0.23	19:0	0.43
14:1	0.40	19:1	3.71
1-15:0	1.82	20:0	5.27
a-1 5:0	1.62	20:1	0.49
15:0	0.28	1-21:0	2.57
15:1	3.92	1-22:0	0.86
1-16:0	2.58	23:0	4.95
16:0	11.01	24:0	4.82
16:1	0.63	26:1	2.98
1-17:0	0.51	27:0	3.30
a 17:0	2.75	s	37.10
17:0	1.59	I	9.49
17:1	1.76	a	7.05
18:0	4.96	u	46.36

i, iso-branched fatty acid; a, anteiso-branched acid; s, straight chain acid; x, unidentified acid; u, unsaturated acid

The content of branched fatty acids is lower compared with that of *S. hygroscopicus* strains (Gesheva *et al*., 1997). The differences in contribution of particular fatty acid groups may be explained by distinct chemical nature of antibiotics produced by *S. fulvoviolaceus* and *S. hygroscopicus*.

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