

# FLAVOBACTERIUM SUAVEOLENS, A NEW SPECIES OF AROMATIC BACILLUS ISOLATED FROM DAIRY WASTES<sup>1</sup>

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## INTRODUCTION

In a large group of organisms isolated from dairy wastes were found several which produced an aromatic odor from all of the mediums containing protein. The odor is sweet-scented, very pleasing during the first two days' incubation at 22° C. but in four to six days it changes to a decided cheesy odor which persists for two months. At 37° the cheesy odor develops in two days. During the three years these organisms have been under observation, this property of aroma production has always been manifested in subcultures, apparently undiminished in intensity.

As the aroma-producing property seemed to be associated with the nitrogenous organic matter in the medium, it was anticipated that the organism was an active proteolyzer. Inoculated into a 1½ per cent gelatin with an initial P<sub>H</sub> of 7.3 and held at 22° C. for six days, the amino and ammoniacal nitrogen increased from 50 to 950 p. p. m. Inoculated into skim milk and kept under similar conditions, the amino and ammoniacal nitrogen increased from 30 to 300 p. p. m.

## MORPHOLOGY

Smears from plain agar (12 hours—7 days) are always Gram-negative. Milk powder agar cultures, 12 to 16 hours old, are Gram-positive and become Gram-negative on further incubation; spores were not observed when tested by spore stains (24-hour to 7-day old agar culture) or by exposure to temperatures of 60° to 80° C.; growth was not obtained after heating either a young or old culture at 60° for 10 minutes or at 80° for 5 minutes; size varies from 1.0μ to 1.2μ by 0.6μ to 0.8μ; rods have rounded ends; actively motile, position of flagella peritrichous.

## CULTURAL CHARACTERISTICS

Records are for 22° C. for 48 hours unless otherwise stated. The P<sub>H</sub> of media employed ranged from 6.5 to 7.5

**NUTRIENT-AGAR SLANT.**—Growth is moderate, filiform, flat, glistening, opaque, of butyrous consistency and produces an aromatic odor; pigment is yellow—510.033 shade 2<sup>1</sup>; pigment is insoluble in water, methyl, ethyl, and isoamyl alcohols, benzene, carbon tetrachlorid, and xyol; readily soluble in acetone and slowly soluble in ether and chloroform; in 6 days growth is oleaginous.

**NUTRIENT-AGAR PLATES.**—Colonies small, growth similar to slant; confluence marked in seven days.

**MILK POWDER AGAR SLANT.**—Similar to plain agar but growth more abundant and color deeper—420.042 shade 3<sup>1</sup>; proteolysis distinct.

**NUTRIENT BROTH.**—Moderate uniform clouding, scanty sediment; no surface growth; an aromatic odor which changes to cheesy in four days.

**GELATIN STAB.**—A stratiform liquefaction is visible in one-half day; gelatin completely liquefied in six days; medium brownish and white precipitate settles at bottom by sixth day.

**POTATO SLANT.**—Abundant growth, color more intense than on nutrient or milk powder agar—330.051 shade 3<sup>1</sup>.

<sup>1</sup> Received for publication Jan. 26, 1924.

## PHYSIOLOGICAL REACTIONS

The carbohydrates are weakly attacked. In seven days a slight acidity but no gas can be detected in dextrose, sucrose and glycerin broths<sup>2</sup>; neither acid nor gas in lactose or starch; in a 0.4 per cent caseinate solution plus 1 per cent lactose, the  $P_H$  changed from 7.0 to 6.9 in three to seven days at 22° C.; no diastatic action was evident on starch agar.

MILK.—The organism proteolyzes milk rapidly; the reaction remains unchanged or becomes slightly alkaline; no curd can be detected even by heating but on long incubation a powdery amorphous precipitate develops; litmus reduces in seven days. In whole milk the cream layer is unaffected; tubes of whole milk incubated at 37° C. or at 22° for two months did not have the cream layer visibly altered; the milk beneath the cream layer is digested nearly as rapidly as in skim-milk tubes; the odor remains cheesy, but is not considered putrid.

NO<sub>3</sub> BROTH.—Nitrates are not reduced in 10 days at 22° C.

INDOL PRODUCTION.<sup>3</sup>—Indol present in seven days at 22° C.

H<sub>2</sub>S PRODUCTION.<sup>4</sup>—H<sub>2</sub>S is produced in three to seven days at 22° C.

RELATION TO OXYGEN.—Grows best aerobically.

Omelianski (2)<sup>5</sup> in a recent article quite thoroughly reviews the literature on aroma-producing microorganisms. Several species have been described which bear close resemblance to the organisms under consideration. Among them are *Bacillus praepollens* Maaszen (1) and *Flavobacterium aromaticum* Pammel (3). These, however, differ in several characters. *Bacillus praepollens* of Maaszen is nonmotile, does not produce indol and produces black granules in broth and in gelatin. Dr. Pammel's *F. aromaticum* is indol-negative and produces gas from dextrose and sucrose.

A thorough search of the literature has not revealed a previous description which adequately fits this organism. In the absence of a previous description, the Latin word *suaveolens*, meaning sweet smelling or fragrant, is suggested as the species name. According to Bergey's "Manual of Determinative Bacteriology" (4) it belongs in the genus *Flavobacterium*—hence the name *Flavobacterium suaveolens*.

## LITERATURE CITED

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- (3) PAMMEL, L. H., and PAMMEL, E.  
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Centbl. Bakt. (II), 2: 633-650, illus.
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<sup>2</sup> Medium employed:

1 per cent Andrade's indicator

1 per cent peptone

0.5 per cent NaCl

0.2 per cent K<sub>2</sub>HPO<sub>4</sub>

1 per cent carbohydrate.

<sup>3</sup> This was tested according to Malone and Gore's cotton plug test.

<sup>4</sup> The method of the Society of American Bacteriologists, 1920, was used.

<sup>5</sup> Reference is made by number (italic) to "Literature cited," p. 276.