

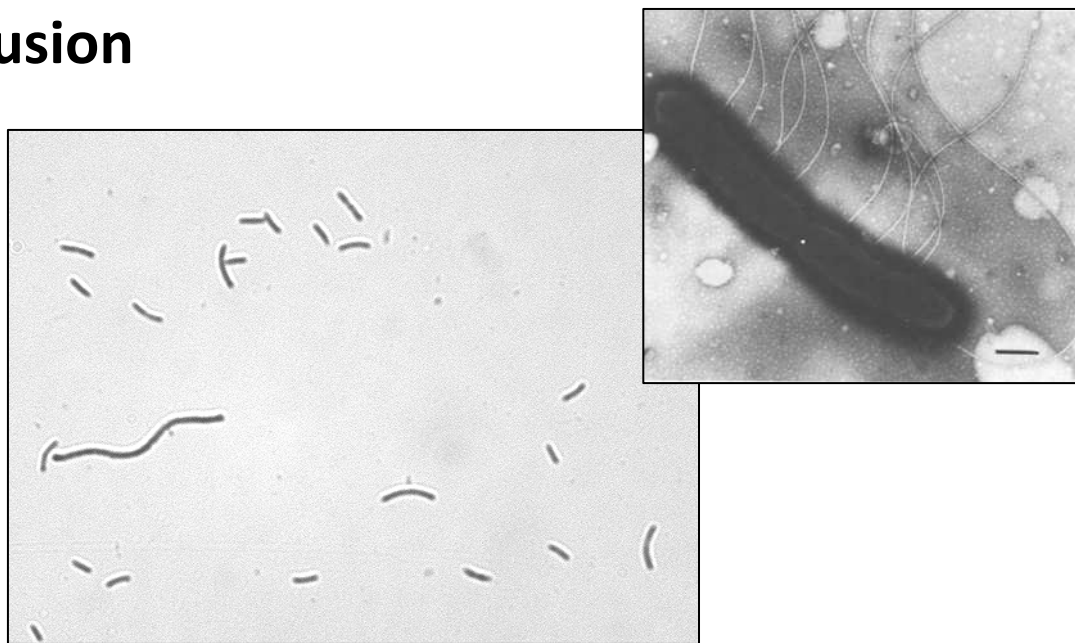
# Strictly anaerobic bacteria in beer and in breweries

## Identification of the genus *Pectinatus*

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## Content

- 1) Strictly anaerobic bacteria involved in beer spoilage
- 2) Genus *Pectinatus*
- 3) Identification of bacteria *Pectinatus*
- 4) Conclusion



**Striktně anaerobní bakterie v pivu a pivovarském provozu**



## Strictly anaerobic bacteria involved in beer spoilage

**Main factors affecting microbiological stability of beer:**

- oxygen
- alcohol content
- hop bitter compounds
- low content of utilizable nutrients
- low pH



**Current trend in bottling technology** – lowering of oxygen tension in finished beer to a minimum (below 1 mg/l)

→ **beer becomes a medium for strictly anaerobic bacteria**

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## Strictly anaerobic bacteria involved in beer spoilage

Strictly anaerobic bacteria adjusted to the brewery environment:

**genera *Pectinatus*, *Megasphaera*, *Selenomonas*, *Zymophilus***  
currently classed into the family Acidaminococcaceae  
(domain Bacteria, phylum Firmicutes, class Clostridia, order Clostridiales)

- ***Pectinatus* and *Megasphaera* are obligate beer spoilers**
- *Zymophilus* and *Selenomonas* are sporadically isolated from contaminated beer and yeast
- mesophilic, nonsporulating, gram-negative or gram-variable bacteria with strictly fermentative metabolism

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## Genus *Pectinatus*

- ***Pectinatus* is the source of 20 to 30% cases of spoilage of bottled beer, often nonpasteurized one**
- mesophilic, nonsporulating, motile straight to curved rods with cell size in the range of 0.4 – 0.9 x 2.0 – 32.0 µm
- motion of young cells resemble the letter X, older cells exhibit snake-like motion
- genus *Pectinatus* is a transitory form between gram-negative and gram-positive bacteria
- **the bacteria tolerate pH 3.0-8.0, alcohol up to 4.5 % (w/v)**
- species: ***P. cerevisiiphilus*, *P. frisingensis*, *P. haikarae***

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## Identification of bacteria *Pectinatus*

- presence of *Pectinatus* in brewery is not revealed by conventional microbiological checks
- **Research Institute of Brewing and Malting has developed selective semifluid medium based on MRS-broth, that allow for detection of *Pectinatus* during 24 – 48 hours after inoculation**
- we compared more than 25 variants of liquid/semifluid media – efficiency was tested in several Czech brewery plants
- **medium composition will be protected - patent application is pending**

**Striktně anaerobní bakterie v pivu a pivovarském provozu**





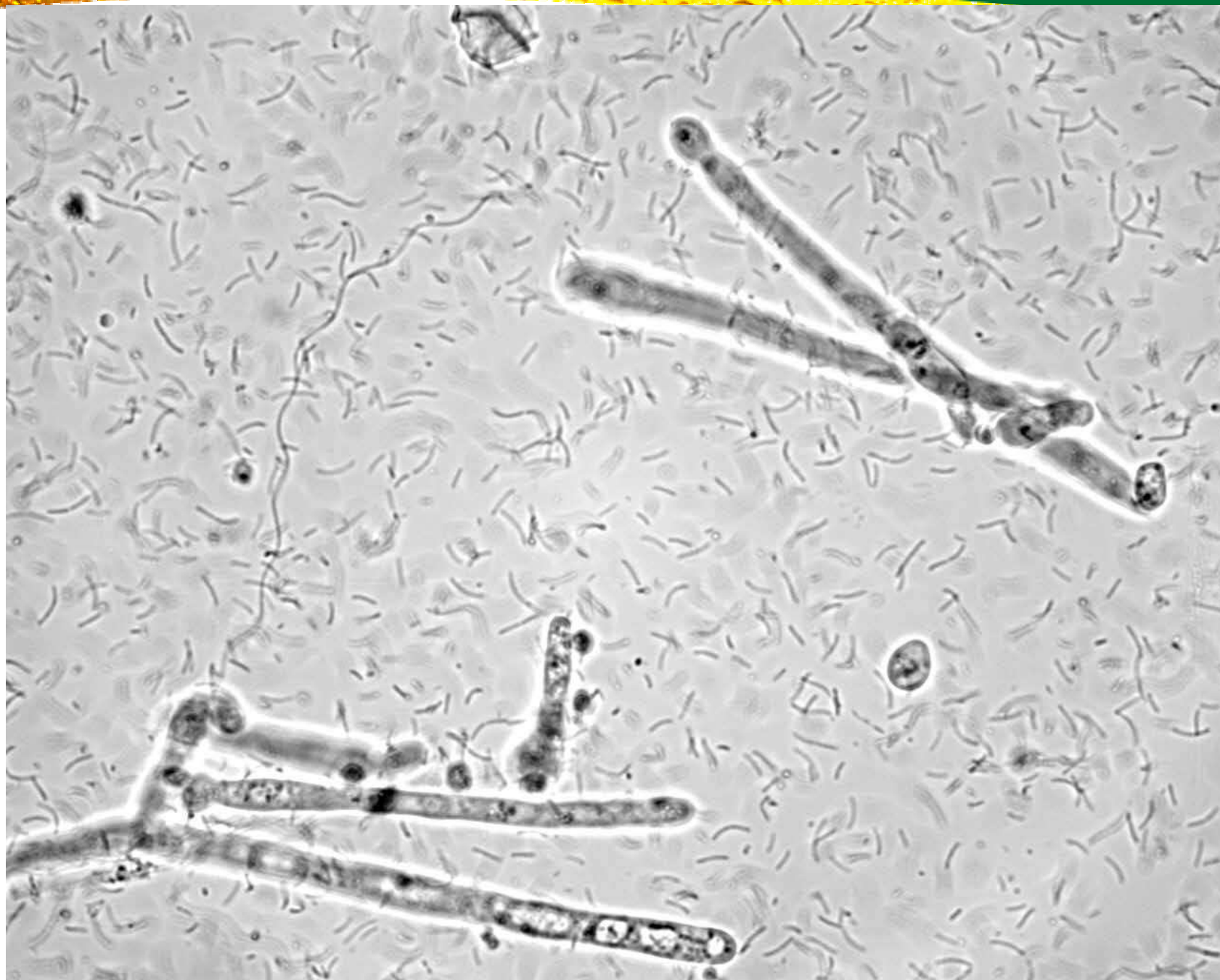
## Sample from brewery

– swab sample taken from filling machine in bottling hall



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## Conclusion

**Aims of our present and future work are:**

- to further accelerate detection of *Pectinatus*
- to find out natural environment of *Pectinatus*
- to explain mode of transfer into the brewery
- find out sources and reservoirs of these bacteria in breweries
- explain the basis of persistence of *Pectinatus* in brewery environment



**Striktně anaerobní bakterie v pivu a pivovarském provozu**



# Thank you for attention

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