Coagulase negative staphylococci distribution in dairy herds with automatic milking system and their crosstalk with Staphylococcus aureus from IMI and teat apex

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Citation (APA):
Coagulase Negative Staphyloccoci Distribution in Dairy Herds with Automatic Milking System and their Crosstalk with *Staphylococcus Aureus* from IMI and Teat Apex

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**BACKGROUND**

- Longer milking duration and frequent exposure to teat disinfectants may affect the teat apex microbiota.
- Knowledge of epidemiological characteristics of CNS in automatic milking systems (AMS) herds is sparse.
- The role of CNS on the risk to acquire of IMI with *S. aureus* is debated.

**OBJECTIVES**

1. To investigate the distribution of CNS species from aseptically collected quarter milk samples and teat skin in AMS herds,
2. To examine if the isolated CNS influence the expression of *S. aureus* virulence factors controlled by the *agr* quorum sensing system.

**METHODOLOGY**

- **Herd selection:** 8 herds: AMS with ≥3 milking robots and bulk tank PCR Ct-values ≤32 for *S. agalactiae*.
- **Cows selection:** 30-40 cows/herd: SCC: ≥ 200,000 cells/mL, and no antibiotic < 4 weeks prior to sampling.
- **Quarter selection:** RH & LF quarters of cows with odd lab number (1,3,5,..)
- **Teat skin swabs** (modified wet-dry method) and aseptic milk samples collected for bacterial culture using calf blood agar and SA SELECT™.
- **Suspicious CNS colonies** were subjected to MALDI-TOF assay for species identification.
- **Interaction between S. aureus and CNS** investigated with Qualitative Beta-Galactosidase Reporter Plate Assay based on 3 reporter strains of *S. aureus*, *hla* (a-hemolysin), *RNAIII* (key effector molecule of agr) and *spa* (Protein A).

**RESULTS**

- 80% (228/284) quarters (142 cows) had ≥ 1 CNS species.
- 373 isolates, milk (n=105) and teat skin (n=268).
- 16 CNS species: teat skin (n=15), milk (n=10)
- Coinfections (mixed): 11 quarters from milk samples and 66 quarters from teat samples.
- Downregulation of *S. aureus* by some CNS may be explained by its ability to inhibit *S. aureus* agr system through production of auto-inducing peptide (AIP) molecules.
- Table 1 shows CNS species distribution and Figure 1 shows crosstalk between *S. aureus* and CNS.

**CONCLUSIONS**

- *S. epidermidis* and *S. chromogenes* are milk-associated, while *S. equorum* and *S. cohnii* are teat-associated.
- CNS species, habitat type, and herd factors affect CNS and *S. aureus* crosstalk patterns.
- Downregulation of *S. aureus* by some CNS species could explain possible protective effect.

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![Figure 1. Crosstalk patterns between *S. aureus* and CNS](image-url)

<table>
<thead>
<tr>
<th>CNS species</th>
<th>Sample type (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Milk (n=105)</td>
<td>Teat (n=268)</td>
</tr>
<tr>
<td><em>S. arlettae</em> (12)</td>
<td>1 (0.9)</td>
<td>11 (4.1)</td>
</tr>
<tr>
<td><em>S. capitis</em> (3)</td>
<td>---</td>
<td>3 (1.1)</td>
</tr>
<tr>
<td><em>S. chromogenes</em> (16)</td>
<td>11 (10.5)</td>
<td>5 (1.9)</td>
</tr>
<tr>
<td><em>S. cohnii</em> (43)</td>
<td>5 (4.8)</td>
<td>38 (14.2)</td>
</tr>
<tr>
<td><em>S. epidermidis</em> (60)</td>
<td>52 (49.5)</td>
<td>8 (3.0)</td>
</tr>
<tr>
<td><em>S. equorum</em> (122)</td>
<td>6 (5.7)</td>
<td>116 (43.3)</td>
</tr>
<tr>
<td><em>S. haemolyticus</em> (58)</td>
<td>16 (15.2)</td>
<td>42 (15.7)</td>
</tr>
<tr>
<td><em>S. hominis</em> (17)</td>
<td>3 (2.9)</td>
<td>14 (5.2)</td>
</tr>
<tr>
<td><em>S. piscifermentans</em> (2)</td>
<td>---</td>
<td>2 (0.8)</td>
</tr>
<tr>
<td><em>S. saprophyticus</em> (5)</td>
<td>---</td>
<td>5 (1.9)</td>
</tr>
<tr>
<td><em>S. sciuri</em> (9)</td>
<td>---</td>
<td>9 (3.4)</td>
</tr>
<tr>
<td><em>S. simulans</em> (2)</td>
<td>2 (1.9)</td>
<td>---</td>
</tr>
<tr>
<td><em>S. succinicus</em> (2)</td>
<td>---</td>
<td>2 (0.8)</td>
</tr>
<tr>
<td><em>S. vitulinus</em> (1)</td>
<td>---</td>
<td>1 (0.4)</td>
</tr>
<tr>
<td><em>S. warneri</em> (2)</td>
<td>1 (0.9)</td>
<td>1 (0.4)</td>
</tr>
<tr>
<td><em>S. xylosus</em> (19)</td>
<td>8 (7.6)</td>
<td>11 (4.1)</td>
</tr>
</tbody>
</table>

1. 62: *S. arlettae* (teat, H1)
2. 65: *S. arlettae* (milk, H1)
3. 61: *S. chromogenes* (teat, H7)
4. 5: *S. chromogenes* (milk, H3)
5. 62, 65: *S. arlettae* (teat, H7)
6. 6: *S. epidermidis* (milk, H3)
7. 58: *S. epidermidis* (teat, H7)
8. 66: *S. sciuri* (teat, H7)