

## THE MANAGER

## DAIRY RESEARCH

An update on the principal cause of subclinical mastitis on farms with controlled contagious mastitis

By Quality Milk Production Services

# Role of coagulase-negative staphylococci in Bovine Udder Health

Despite substantial research efforts, mastitis remains the most costly disease in dairy cattle. A large number of microorganisms cause udder infections in cows, although staphylococci, streptococci, and coliforms cause the majority. Coagulase-negative staphylococci are emerging as a principal cause of subclinical mastitis on farms where contagious mastitis is well-controlled.

Because of better control of clinical and subclinical mastitis caused by the major pathogens such as *Staphylococcus aureus* and *Streptococcus agalactiae*, the bulk milk somatic cell count has decreased over the last decades in many areas of the world. At the same time, a shift towards a higher incidence of udder infections caused by the so-called environmental pathogens including *Escherichia coli* and *Streptococcus uberis*, and coagulase-negative staphylococci (CNS), has been observed. CNS have become the principal cause of subclinical mastitis on many dairy farms that have controlled contagious mastitis (e.g. *Streptococcus agalactiae* and *Staphylococcus aureus*) through adopting the so-called 5 point mastitis and prevention control program.

The CNS group was considered of minor importance for bovine udder health. Other staphylococci,

such as *Staphylococcus aureus*, are considered major pathogens because of their substantial negative impact on udder health and productivity through clinical mastitis and chronic infections, substantial increase in somatic cell count and decrease in milk yield. As a group, CNS increases somatic cell count moderately and causes mild cases of clinical mastitis. On the other hand, protective aspects of CNS when causing udder infections are also described in literature. This is conflicting information that needs further clarification and is the reason why a number of research groups, including Quality Milk Production Services (QMPS – Cornell University) and the M-teamUGent (Ghent University Belgium), have started to study CNS in more detail.

## Diagnostics

The group of CNS consists of over more than 50 different species and subspecies, with new species of bovine origin being described regularly. Approximately 10 CNS species cause IMI in dairy cows. Some of the conflicting data from literature can be explained by differences in characteristics between species. Still, to study species-specific aspects of CNS, differentiation between species should be performed using accurate tests. This was not the case at the time molecular identification (based on the DNA-patterns of the bacteria) was not yet available and commercially available test kits, developed for differentiation of CNS from human origin, were used. A number of molecular tools are now validated for CNS species identification. They are currently used to elucidate the relevance and epidemiology of CNS species for bovine udder health.

## Epidemiology

The distribution of CNS species in milk and in

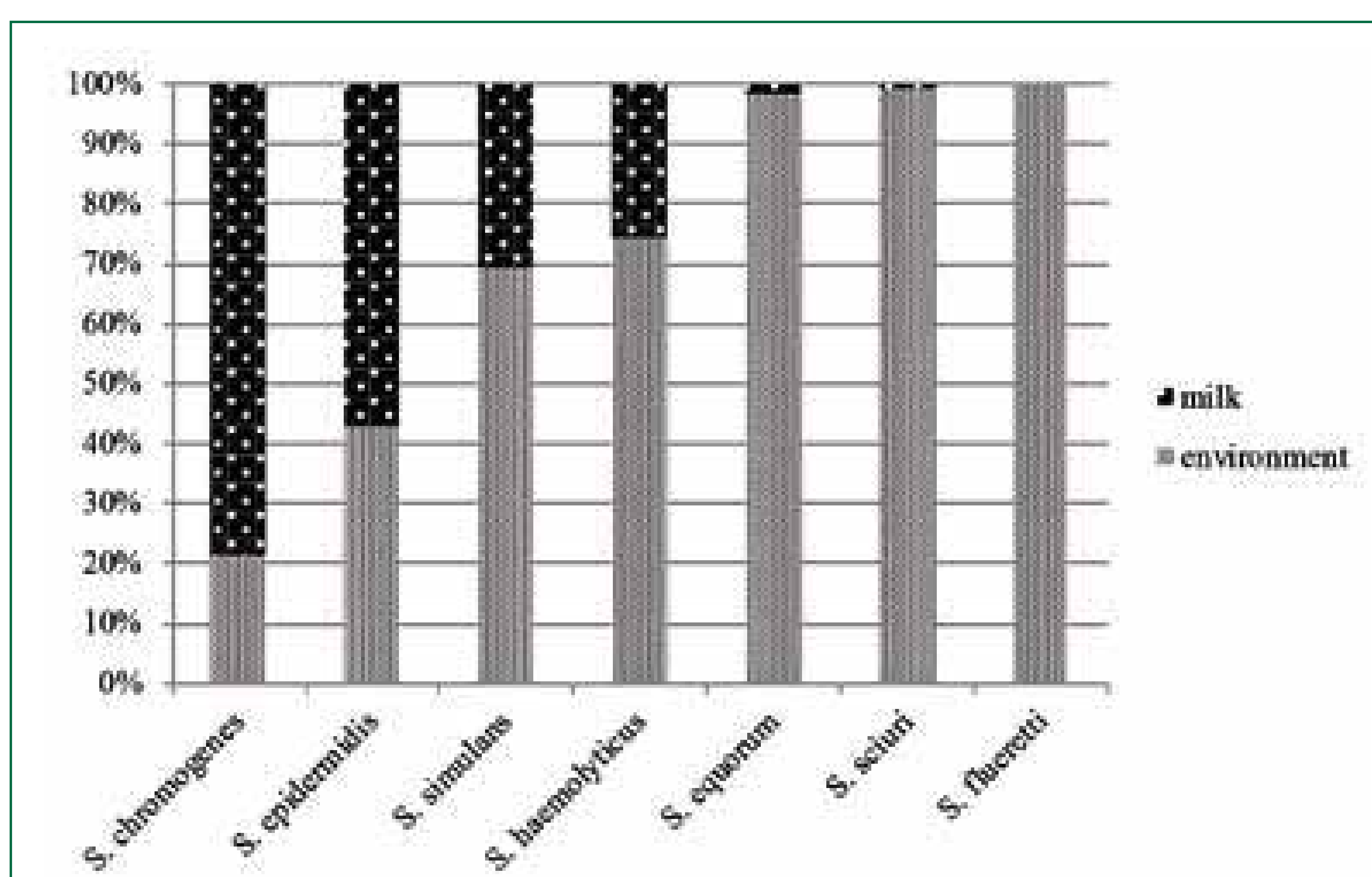


Figure 1: Distribution of the CNS species isolated at least on ten occasions on 6 farms in Flanders (Belgium) from milk or the farm environment.

## FYI

■ QMPS is online at: <http://ahdc.vet.cornell.edu/sects/QMPS/>.



## THE MANAGER



*Coagulase-negative staphylococci on a blood agar plate.*

different niches such as teat liners, hands of the milkers, the stall environment and teat apices are described, in search of sources and vectors for the species that frequently cause udder infections. Based on their epidemiology, the different CNS species can roughly be classified in three categories.

*Staphylococcus chromogenes* and *Staphylococcus epidermidis* are the so-called udder-adapted species as they cause the majority of CNS udder infections and are hardly found in the environment of the cows.

*Staphylococcus simulans* and *Staphylococcus haemolyticus* are considered opportunistic species as they are able to cause udder infections and can also survive in the environment.

Other CNS species such as *Staphylococcus equorum* and *Staphylococcus fleuretti* are the so-called environmental species as they are typically cultured from the environment of cows and hardly found in the milk of cows.

One of the striking research observations is that the distributions of CNS species highly vary between herds. Still, it is yet not clear what factors explain why some species are more found on some farms while other species are more found on other farms.

### Relevance of CNS

A couple of years ago, Dr. Schukken and his team at Quality Milk Production Services, Cornell University, scrutinized the association between udder infections and the composite milk somatic cell count in dairy cows. A total of 352,614 records from 4,200 whole-herd mastitis screening sampling qualified for the study. On average, 15% of the cows sampled within a herd were infected with CNS, ranging between 0 and 100%. The average prevalence of cows with an udder infection caused by CNS and a somatic cell count over 200,000 cells/ml was 2%, with a minimum of 0% and a maximum of 50%. Cows from which no pathogens could be isolated had the lowest somatic cell count. Cows that were infected with CNS or *Corynebacterium bovis* had a moderate increase in somatic cell count, and cows infected with major pathogens such as *Streptococcus agalactiae*, *Streptococcus* spp. and *Staphylococcus aureus* showed an important increase in somatic cell count. Udder infections caused by CNS contributed 17.9% to the bulk milk

somatic cell count in herds with a bulk milk somatic cell count less than 200,000 cells/ml. This percentage decreased to 11.9 and 7.9% in herds with bulk milk somatic cell counts between 200,000 and 400,000 cells/ml and over 400,000 cells/ml, respectively. Dr. Schukken and his colleagues concluded that very few herds with milk quality problems (too high bulk milk somatic cell count) would have an important increase in bulk milk somatic cell count because of udder infections caused by CNS. On the other hand, in herds with low bulk milk somatic cell count (less than 200,000 cells/ml), CNS infections may be an important contributor to the total number of somatic cells in the bulk milk.

Surprisingly, milk production was slightly, but significantly higher, in CNS infected cows compared to cows free of mastitis pathogens. Milk production was strongly reduced in cows with an udder infection caused by major pathogens such as *Staphylococcus aureus*, *Streptococcus agalactiae*, and *Streptococci* spp. Results were similar in another study specifically designed to estimate the pathogen-specific impact of subclinical heifer mastitis on future production: CNS-infected heifers out-produced non-infected herd mates. This finding was explained to some extent by the fact that heifers with CNS udder infections in early lactation were less likely to develop clinical mastitis during first lactation and were therefore protected from the associated milk losses.

Only limited studies have quantified species-specific impact of CNS using molecular speciation. One of the first to do so concluded that CNS as a group was associated with a quarter somatic cell count between that of non-infected quarters and quarters infected with major pathogens. The effect of the most prevalent species on the quarter somatic cell count showed that *Staphylococcus chromogenes*, *Staphylococcus simulans*, and *Staphylococcus xylosus* induced an increase in the somatic cell count comparable with *Staphylococcus aureus*. Also, almost all CNS species were able to cause persistent udder infections (no spontaneous cure), with *Staphylococcus chromogenes* causing the most.

### Conclusions

Coagulase-negative staphylococci are worldwide the most common cause of udder infections. As a group, they are still considered minor pathogenic. Coagulase-negative staphylococci only marginally contribute to the bulk milk somatic cell count on farms with a cell count higher than 400,000 cells/ml and are rarely involved in clinical mastitis. Udder health problems due to CNS can be prevented and controlled by post-milking teat disinfection and the use of long-acting antibiotics at drying-off. In practice, treatment of cows infected with CNS is almost never required. Still, lots of exciting CNS research is currently being undertaken to reveal what was hypothesized before: differences between CNS species exist and are relevant. Some species are more adapted to the mammary gland than others, affect udder health differently, and are more likely to carry virulence and/or resistance genes ... with many more differences between species and within species to be detected.

*M-team and Mastitis en Milk Quality Research Unit, Department of Reproduction, Obstetrics and Herd Health, Faculty of Veterinary Medicine, Ghent University, Belgium, Sarne De Vlieghe and Sofie Piepers*