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Zoonotic Potential of *Staphylococcus schleiferi* Through Adherence to Canine and Human Corneocytes

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Abstract : This study was investigated the zoonotic possibility of *Staphylococcus schleiferi* by adherence to both canine and human corneocytes. *Staphylococcus pseudintermedius, Staphylococcus aureus*, and *S. schleiferi* were prepared and canine and human corneocytes were collected via double-sided tape. Adhesion to human corneocytes was higher for *S. schleiferi* than *S. pseudintermedius* but highest for *S. aureus*. Regarding the canine corneocytes, *S. schleiferi* was the least adhesive strain. Furthermore, *S. pseudintermedius* adhered to the entire surface of both human and canine corneocytes. *S. aureus* and *S. schleiferi*, however, adhered to the corneocyte peripheries. Thus, *S. schleiferi* may have zoonotic potential and the potential is higher than *S. pseudintermedius*.

Key words **:** corneocyte, *S. schleiferi*, *S. pseudintermedius, S. aureus.*

The Staphylococcus genus is the most common pathogen causing pyoderma in dogs and humans. The most common staphylococcal isolate from dogs is *Staphylococcus pseudintermedius*, whereas in humans it is *Staphylococcus aureus* (4,11). *Staphylococcus schleiferi* is a recently emerging staphylococcus, which in humans and dogs. This particular strain of bacteria has been isolated from lesions which are recurrent in pyoderma and chronic otitis externa in dogs as well as in wound infections and endocarditis in humans (2,3,5,6, 9,10,13). Thus far, two subspecies of this bacteria have been reported; *S. schleiferi schleiferi* (coagulase negative) were isolated from humans in 1988 (8) while *S. schleiferi coagulans* (coagulase positive) were isolated from dogs in 1990 (7) and *S. schleiferi* from dogs are phenotypically similar to *S. pseudintermedius*, prompting many veterinarians to have misrecognized *S. schleiferi* as *S. pseudintermedius* (5).

The adherence of bacteria to corneocytes is a necessary process before colonization and infection can occur in the skin. In other words, the ability of these microorganisms to adhere may be closely related to the possibility of infection (1).

In a previous study, *S. pseudintermedius* showed great adherence to canine corneocytes compared to *S. aureus*, whereas the adherence of *S. aureus* to human corneocytes was significantly higher compared to canine corneocytes (12).

The ability of *S. schleiferi* to adhere to corneocytes is an important indicator of potential zoonotic transmission, yet it's unfortunately not routinely tested for. The aim of this study is to compare the adherence of *S. schleiferi*, *S. aureus*, and *S. pseudintermedius* to canine and human corneocytes.

Corneocytes were obtained from ten people (six men, four women), working in an animal hospital and ten beagle dogs (seven males, three females). The standard isolates for the tests were *S. aureus*, *S. peudintermedius* and *S. schleiferi coagulans*. Before the collection of corneocytes, surface debris and most resident bacteria were removed by serial application of four adhesive tapes. Corneocytes were collected from the medial forearm of humans and the ventral abdomen of dogs using double-adhesive tapes. One side of the tape was mounted onto a clean slide glass, while the other side was applied ten times to a clean skin surface using equal force from the same investigator. Four samples were collected from each participant; one for PBS inoculation (control) and the other three samples for inoculation of with the following bacteria: *S. schleiferi, S. aureus*, and *S. pseudintermedius.* 300 μL of each test isolate were incubated in a tryptic soy broth for 18 hours (initial bacterial counts: 1×10^{10}), inoculated on to a slide glass attached with the collect corneocytes, and incubated at 37°C for 90 minutes. After incubation, the slide glasses were washed with PBS and stained with crystal violet. The quantification of the degree of adherence to the corneocytes was conducted by a computerized image analysis technique (Image J). The results of the mean values among the six groups were examined using ANOVA. For the sub-analyses, the adherence to corneocytes of three species *Staphylococci* species from each donor were compared using a paired Student's t-test, while the adherence of the same species of *Staphylococcus* from all donors (humans, dogs) were examined using an unpaired Student's t-test. A *P*-value of < 0.05 was considered to be significant in each case.

Representative micrographs of the staphylococcal adherence pattern to human and canine corneocytes are similar to previous data. *S. aureus* adhered to human corneocytes much greater than *S. pseudintermedius*, whereas *S. pseudintermedius* showed more adhesive ability to canine corneocytes than *S. aureus*. It is interesting to note that *S. schleiferi* had significantly more adhesive ability to human corneocytes than *S. pseudintermedius* but it was also less than that of *S. aureus*.

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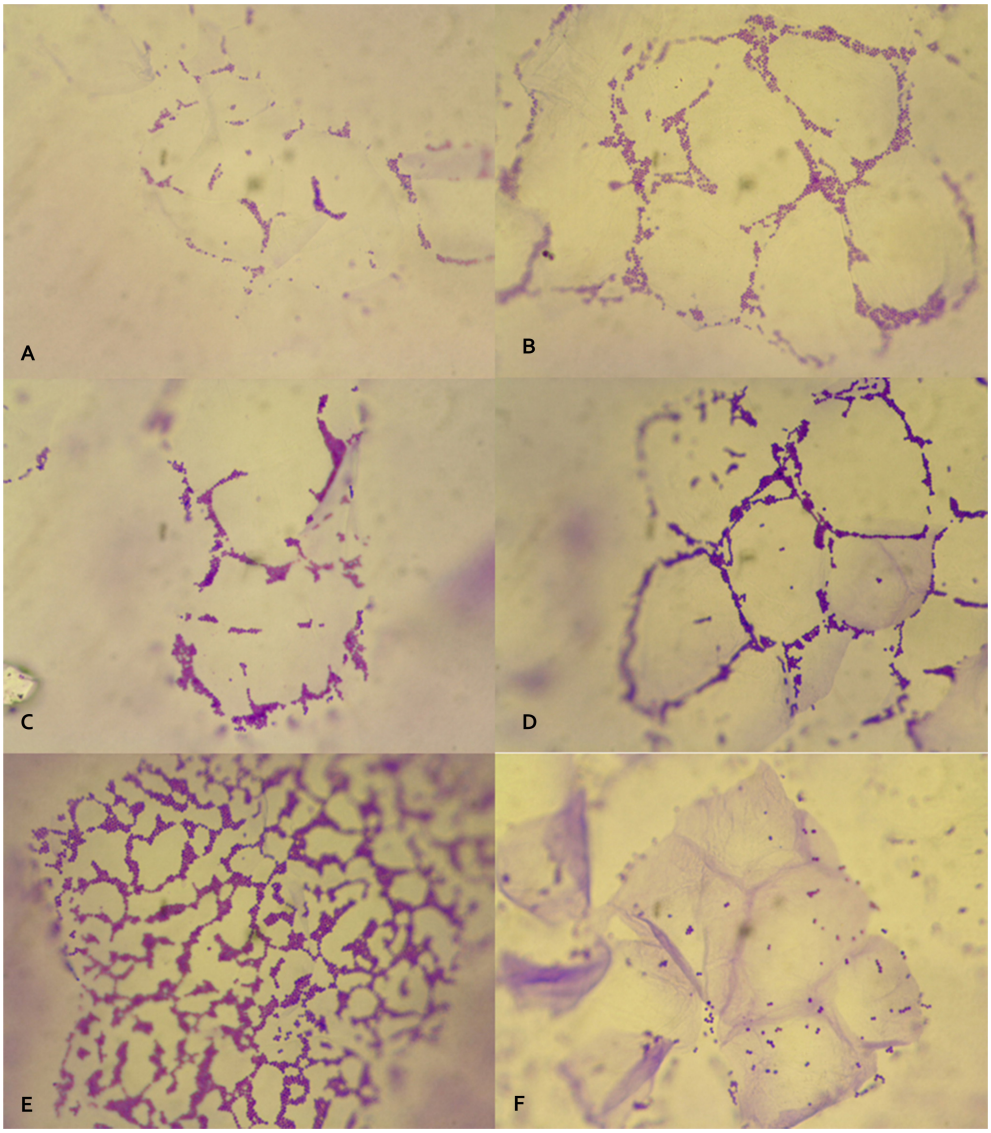

Fig 1. Representative photomicrographs show the adherence of *Staphylococcus aureus* and *Staphylococcus schleiferi* coagulans, *Staphylococcus intermedius* to human and canine corneocytes. A. *S. aureus* adherent to canine corneocytes; B. *S. aureus* adherent to human corneocytes; C. *S.schleiferi* coagulans adherent to canine corneocytes; D. *S. schleiferi* coagulans adherent to human corneocytes; E. *S. pseudintermedius* adherent to canine corneocytes; F. *S. pseudintermedius* adherent to human corneocytes. Crystal violet stain × 1000 original magnification.

Generally, *S. schleiferi* adhered to canine corneocytes in smaller amounts than *S. pseudintermedius* and *S. aureus*. The mean adherence index for each of the 10 images, according to the gray scale level is illustrated in Fig 1. Statistics between the two hosts of the three isolates showed significant differences ($p < 0.01$). *S. schleiferi* showed significantly more adhesion to human corneocytes than *S. pseudintermedius* ($p < 0.01$), but there was no significant difference when compared to *S. aureus* ($p = 0.523$). In addition, the mean adherence index of *S. schleiferi* to canine corneocytes was a little less than *S. aureus* ($p = 0.088$) but significantly greater than *S. pseudintermedius* ($p < 0.01$).

From this study, it was determined that *S. schleiferi* adhered to human corneocytes much more than *S. pseudintermedius* does, this indicated that *S. schleiferi coagulans* may have zoonotic potential, albeit limited to transmission from dogs to humans. We also additionally discovered the differences in adherence patterns to corneocytes among the three isolates; whereas *S. pseudintermedius* adhered to the entire surface of both human and canine corneocytes. *S. aureus* and *S. schleiferi* adhered only to the periphery of the corneocytes.

In conclusion, *S. schleiferi* showed some adherence to both human and canine corneocytes, but it was more adhesive to the former than to the latter. As a result, *S. schleiferi* may have zoonotic potential that is higher than *S. pseudintermedius*. When dogs with bacterial pyoderma arrive at an animal hospital, the clinician must distinguish between *S. schleiferi* and *S. pseudintermedius* as the causal strain for pyoderma. After identification of *S. schleiferi* as the causal strain, the clinician needs to be aware of the possibility of a contagious infection from the dog to the pet owner.

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