

### 3. Streszczenie w języku angielskim (summary)

Fungal skin, hair, and nail infections in humans and animals are one of the most commonly diagnosed communicable diseases worldwide. The monitoring and control of these conditions are associated with a high economic burden. Dermatophytes are the etiological factors of most of these infections. The prevalence of dermatophytoses has increased in recent decades to such a high level that now they affect over 20-25% of the world population. The high incidence of dermatophytic infections is supported by their easy transmission to species other than the original host, and humans are particularly predisposed to these mycoses. As indicated by scientific reports, symptomatic dermatophytoses may develop in humans when the same etiological factor occurs even asymptotically in a carrier animal. Hence, monitoring of the presence of dermatophytes in animal herds, assessment of their virulence, and determination of their drug sensitivity should be performed routinely. The aim of study was to provide a comprehensive presentation of methods for diagnosis of dermatophytoses, identification of pathogen species, and epidemiological analysis and to assess the virulence and *in vitro* antifungal activity of antimycotic agents against *Trichophyton mentagrophytes* and *Trichophyton verrucosum* isolates collected in various European countries from animals and zoonosis cases.

The current trend in mycological diagnostics consists in the use of molecular tests for identification of dermatophytes, based primarily on the analysis of Internal Transcribed Spacer (ITS) sequences preceded by meticulous morphological examinations, culturing, and assessment of fungal macro- and micromorphology. The studies showed that the qPCR method with group-specific primers facilitated detection of dermatophytes in samples with 10.84% (45% vs. 34.17%) higher efficiency than the direct light microscopy analysis. Moreover, the agreement of the positive qPCR result with that provided by culturing was 10.98% (50% vs. 39.02%) higher than in the case of the microscopic examination.

Another issue related to dermatophytes is their virulence, which largely depends on their enzyme production ability. The study revealed that the enzymatic activity varied depending on the host and the type of infection. Higher elastase activity and more pronounced hemolysis were determined in the human cases. In turn, the activity of keratinases was lower in strains derived from the carrier animals. There is a probable relationship between the enzymatic activity and the affinity of dermatophytes for species-

specific keratinocytes. Moreover, the increase in the keratinase concentration in the culture was not positively correlated with the intensity of natural keratin degradation. This is confirmed by the fact that the key role in the virulence is played by the predisposition of enzymes associated with the adaptation of the fungus to the natural host. Serine proteases (subtilisins) are one of the most important enzymes involved in the degradation of keratin. Seven genes coding for these enzymes (*SUB1-SUB7*) have been described in the literature. The multiplex PCR analysis showed that the pathogenicity of the dermatophytes is not related to the presence of specific subtilisin genes in the genome but to their accumulation and synergistic action of their products. Furthermore, the human isolates had the widest subtilisin gene profile with a statistically significantly higher percentage of *SUB3*, *SUB4*, and *SUB7* gene amplicons.

*In vitro* determination of the drug susceptibility of clinical dermatophyte strains is one of the most important challenges for the mycological community. Studies conducted on a large pool of *T. mentagrophytes* strains isolated from infected humans and animals as well as asymptomatic vectors have demonstrated a high terbinafine resistance rate of approximately 14%. Interesting was the resistance in strains isolated from asymptomatic animals. This may suggest that terbinafine resistance is not acquired via drug exposure but is intrinsic. It was also shown that the resistant strains had missense mutations in the squalene epoxidase gene corresponding to the same Leu393Phe amino acid substitution in the enzyme.

In summary, dermatophytoses have long been considered nuisance diseases in animals and humans. The diagnostic difficulties, ambiguous epidemiology, increasing virulence, and drug resistance of these fungal pathogens are the current challenges for mycologists and physicians. Undoubtedly, correct diagnosis and selection of therapy are key elements in the elimination of the sources of infection, i.e. potential dermatophytosis foci. In this respect, the cooperation between laboratory diagnosticians, dermatologists, and veterinarians seems indispensable.