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## Association of keratinophilic non-dermatophytic fungi with skin diseases of ruminants

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Keratinophilic non-dermatophytic fungi have increasingly been reported from various pathological conditions of man and animals. In the present study, a large number of keratinophilic non dermatophytes was recovered culturally from ruminants (cattle, buffalo, sheep and goat) having skin disorders. The isolated fungi included *Alternaria* sp. (37.25%), *Aspergillus* sp. (2.94%), *Beauveria bassiana* (4.90%), *Chrysosporium keratinophilum* (0.98%), *Chrysosporium indicum* (0.98%), *Curvularia* sp. (2.94%), *Paecilomyces lilacinous* (1.96%), *Penicillium* sp. (2.94%) and *Pseudarachiniotus flavoluteus* (1.96%).

KERATINOPHILIC non-dermatophytic fungi have increasingly been reported in the recent past from man, animals and soil<sup>1</sup>. These fungi are often designated as opportunistic and their occurrences in nature have been greatly influenced by ecological factors. Some keratinophilic fungi by way of their property to break down the soil debris have become potentially pathogenic for man and animals. In the past, their role as etiopathogen was ignored but now they are given more importance for their involvement with various pathological conditions. Since no comprehensive information is available from India and, particularly from Uttar Pradesh, on the prevalence of keratinophilic non dermatophytes associated with skin disorders in ruminants, the present study was undertaken.

A population of 4534 animals comprising 1062 cattles, 768 buffaloes, 1049 sheeps and 1655 goats were screened at different parts of Uttar Pradesh, India

during 1987-88, out of which skin scrapings were collected from 102 animals having skin disorders. Collected specimens were subjected to direct microscopic examination under 10% KOH mount. Sabouraud dextrose agar was used for primary isolation of fungi. The recovered fungi were identified according to Campbell and Stewart<sup>2</sup>.

The overall occurrences of clinical cases irrespective of species were 2.25%. Of the four species, sheep (4.19%) was found mostly susceptible to dermatomycoses followed by cattle (1.98%), goat (1.69%) and buffalo (1.17%) (Table 1).

Microscopic examination of the specimens revealed muriform conidia of *Alternaria* sp. in 26.47% specimens except in cattle, *Curvularia* sp. in 7.84% cases except in cattle and buffalo samples.

Culture of specimens on Sabouraud dextrose agar, however, yielded large number of keratinophilic non dermatophytes from the specimens. The isolated fungi included *Alternaria* sp. (37.25%), *Aspergillus* sp. (2.94%), *Beauveria bassiana* (4.90%), *Chrysosporium keratinophilum* (0.98%), *Chrysosporium indicum* (0.98%), *Curvularia* sp. (2.94%), *Paecilomyces lilacinous* (1.96%), *Penicillium* sp. (2.94%) and *Pseudarachiniotus flavoluteus* (1.96%). Of the four species, sheep and goat showed higher fungal loads on their body surfaces as culturally more isolates could be detected from these species of animals. The details of the fungi isolated species-wise are given in Table 2.

Isolation of various keratinophilic non dermatophytes indicates the extent of fungal load on the body surfaces of the animals and vulnerability of their skin surfaces. Reports of cutaneous alternariosis are not so far available in these species of animals but *Alternaria* sp. has been reported from skin disease of dog<sup>3</sup> and skin lesions of man<sup>4</sup>. The isolation of *Aspergillus* sp. from the skin surfaces goes with the observation of Sinha<sup>5</sup> from cattle and Nooruddin *et al.*<sup>3</sup> (*loc. cit.*) from goats. But report regarding sheep is so far silent. *B. bassiana* is so far not reported from animals but isolation was made from mycoses in tortoises<sup>6</sup>. Isolation of *C. keratinophilum* from cattle is supported by Takatori *et al.*<sup>7</sup> and Bagy<sup>8</sup> who also noted skin infection due to this fungus. Reports regarding the *P. lilacinous* from sheep and goats are not available but this fungus has been

Table 1. Overall occurrence of clinical cases versus culturally positive cases

Animals	No. of animals	Clinically positive cases	Positive cases under KOH mount	Culturally positive cases
Cattle	1062	21 (1.98)	0.0	10 (47.62)
Buffalo	768	9 (1.17)	2 (22.22)	3 (33.33)
Sheep	1049	44 (4.19)	21 (47.72)	28 (63.64)
Goat	1655	28 (1.69)	12 (42.86)	17 (68.71)

Figures in parentheses indicate percentage.

Table 2. Keratinophilic fungi isolated from different species of animals

Fungi	Cattle	Buffalo	Sheep	Goat	Total
<i>Alternaria</i> sp.	6 (28.57)	2 (22.22)	18 (40.91)	12 (42.86)	38 (37.25)
<i>Aspergillus</i> sp.	1 (4.76)	—	1 (2.27)	1 (3.57)	3 (2.94)
<i>Beauveria bassiana</i> *	1 (4.76)	—	3 (6.81)	1 (3.57)	5 (4.90)
<i>Chrysosporium indicum</i> **	—	—	—	1 (3.57)	1 (0.98)
<i>Chrysosporium keratinophilum</i> **	1 (4.76)	—	—	—	1 (0.98)
<i>Paecilomyces lilacinous</i> *	—	—	1 (2.27)	1 (3.57)	2 (1.96)
<i>Curvularia</i> sp.	—	—	3 (6.81)	—	3 (2.94)
<i>Penicillium</i> sp.	1 (4.76)	1 (11.11)	1 (2.27)	—	3 (2.94)
<i>Pseudarachniotus flavoluteus</i> **	—	—	1 (2.27)	1 (3.57)	2 (2.92)

\* Isolates confirmed by CAB International Mycological Institute, UK.

\*\* Isolates confirmed by Calcutta School of Tropical Medicine, Calcutta, India.

reported from skin surfaces of cattle<sup>5</sup>. Similarly cutaneous penicilliosis although not reported in cattle, buffaloes and sheep as observed in the present study, species of *Penicillium* have been found to be associated with pathological condition in man<sup>9</sup>, camel<sup>10</sup> and birds<sup>11</sup>. *P. flavoluteus* which could be recovered under the present study from sheep and goats thus far appears to be reported from camel<sup>10</sup>, hair of rodents<sup>12</sup> and soil<sup>1</sup>. The isolation of these fungi from skin disorder cases in various species of animals suggests their association with the disease processes but its pathogenicity is required to be established experimentally.

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## Transfer of genes for resistance against stem, leaf and stripe rusts from *Triticum timopheevi* Zhuk to bread wheat

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*Triticum timopheevi* Zhuk is well known to have resistance against a number of important wheat diseases (stem rust, leaf rust, powdery mildew, bunt, loose smut, etc.). Here we report on *timopheevi* derivatives in bread wheat background resistant to stem, leaf and stripe rusts in adult plant stage as well as seedling stage against a number of virulent races of these diseases. Some of them have shown differential reaction than that caused by earlier known genes from *timopheevi* (*Sr36*, *Sr37* and *Lr18*), thereby indicating that these *timopheevi* derivatives may possess different genes.

*TRITICUM TIMOPHEEVI* Zhuk is well known to have resistance against a number of wheat diseases (stem rust, leaf rust, powdery mildew, bunt, loose smut, etc.) than any other *Triticum* species<sup>1,2</sup>. In spite of its being a valuable source of resistance against these diseases, it is less exploited. *Sr36* and *Sr37* for stem rust<sup>1,3</sup> *Lr18* for leaf rust<sup>4</sup> and *PM6* for powdery mildew<sup>5,6</sup> are the only known genes from *T. timopheevi*. McIntosh<sup>4</sup> suggested that *Lr18* may not be the only gene for leaf rust resistance in the source line(s) of *T. timopheevi*. Further attempts using high temperature to suppress the action of *Lr18*, or virulent cultures where available, should aid the transfer of such genes. There is so far hardly any