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Species Characteristics of the Causative Agents of Mycosis of Horseflies

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Annotation: The article discusses the etiological agents of horsefly mycoses, identified as fungus from horseflies belonging to the groups Zygomycetes and Deuteromycetes. The first group consists of 2, whereas the second ranges from 8 genera. This paper provides a detailed description of the method by which fungi affect the bodies of larvae and imago of horseflies. Equipped with a formidable piercing-sucking mechanism, horseflies, as bloodsuckers, pose a significant threat when they assault animals. When they ingest blood, they are able to detect, and then retain and transfer viruses including highly hazardous illnesses. Hence, a thorough investigation of the fauna and ecology of horseflies is necessary to safeguard human health and avoid the infestation of farm animals by these blood-sucking insects.

Keywords: Horseflies, mycoses, horsefly larvae, herbivorous horsefly fungus, technique of biological control.

Introduction. Due to the universal attention to the problems of protecting the biosphere, the interest of specialists in biological control methods has increased [1], which are based on the use

of natural regulators of the number of populations of harmful species [2]. The problem of environmentally safe control of blood-sucking diptera insects is of great economic importance all over the world [3,4]. Horseflies, as bloodsuckers, have a powerful piercing-sucking apparatus and cause great concern when attacking animals [5].

Entomopathogenic fungi usually cause infection when spores come into contact with an arthropod host [6]. Under ideal conditions of moderate temperature and high relative humidity, fungal spores germinate and penetrate the insect cuticle through enzymatic degradation and mechanical pressure to enter the insect's body [7,8]. Once in the body, fungi multiply, invade insect tissues [9], exit the dead insect and produce more spores [10].

The purpose and objectives of the study. The purpose of this study was to detect and study the fungi of entomopathogens of horseflies in various regions of Uzbekistan.

Materials and methods: Horsefly larvae were collected by taking samples of moss and silt at the breeding sites. In the vicinity of settlements, biotopes of various typologies were examined - characteristic breeding sites for horseflies. The captured larvae were kept in laboratory conditions in a hospital in glass jars with a capacity of 200-250 ml. A substrate (soil, moss) taken from the larval habitats was placed at the bottom of the jars. When signs of disease or death of larvae were detected, they were used to prepare smears of hemolymph and internal organs on slides and crops on nutrient media (MPA, Saburo,). The preparation of smears, methanol fixation, and Romanovsky-Giemsa staining were carried out according to generally accepted methods. Microorganisms grown on nutrient media were separated into pure cultures for subsequent determination.

Results and discussions.

There are three categorised groups of entomopathogenic fungus that induce sickness and mortality in horsefly pupae:

1. Obligate parasites are specialised to exclusively emerge in live horseflies, specifically targeting Tabanomyces and other entomophthora fungus.

Typically forming in live insects, facultative saprophytes are also capable of performing saprophytism (Beauveria, Metarrhizium, Paecilomyces, etc.).

3. Facultative parasites refer to saprophytes or plant pathogens that, in exceptional instances, infect living insects such as Fusarium or Fspergillus.

The first group of mycosis infections is distinguished by their persistent representation in the population of insect hosts. They frequently induce epizootics.

The fungi belonging to the second group typically induce local epizootic syndromes.

Fungal members of the third category exhibit pathogenic characteristics in relation to weaker insects in the presence of favourable environmental conditions.

Fungal pathogens primarily infiltrate the host body via the integument, with oral entry considered relatively uncommon. Several fungal species produce chitinase and other enzymes capable of degradation of the cuticle. The antimicrobial activity of parasites is juxtaposed with the defensive roles of insect integuments, owing to their mechanical composition and the characteristics of saturated fatty acids present in the wax layer of the epicuticle, which impede fungal growth. The protective characteristics of insect integuments are linked to overall physiological parameters and the age of the chitinous layer of the cuticle coating. Particularly significant among the variables influencing the physiological status of insects are dietary conditions, hydrothermal conditions, and the length of individual phases and stages of the species under study.

Adverse environmental conditions exert its influence by inducing alterations in metabolism. Contributing to the intensity of metabolism, environmental variables disrupt the equilibrium of energy metabolism by increasing energy consumption to accommodate the rise in body weight.

This, in conjunction with the extension of the life cycle, diminishes the physiological resistance of the body to infections. Impairment of insect living conditions also enhances the aggressiveness of infection, which is frequently dormant in the insect body. Permeability of insect integuments compromised by parasites or infectious disorders is much greater than that of the cuticle in healthy, regularly developing organisms.

We identified two types of mycoses pathogens isolated from horseflies: Zygomycetes and Deuteromycetes. The first category features 2 genera, while the second category consists of 8 genera (Table 1).

Table. 1. An analysis of the fungal species composition found in horseflies throughout different regions of Uzbekistan.

.Types of mushrooms	The genus of host insects	Landscape zones			Season	
		plains	foothills	mountains	Spring	Autumn
Mukor cylindrosporus Ling. Mukor cylindrosporus Ling.	Chrysops	+	+	+	+	+
Mukor cylindrosporus Ling.	Tabanus	+	+	+	+	+
Mukor cylindrosporus Ling.	Haematopota	+	+	+	+	+
Tabanomycetes are dairy	Chrysops	+	+	+	+	+
Tabanomycetes are dairy	Tabanus	+	+	+	+	+
Tabanomycetes are dairy	Haematopota	+	+	+	+	+
Aspergillus fumigatus Fres..	Chrysops	+	+	-	+	+
Aspergillus fumigatus Fres.	Tabanus	+	+	-	+	+
A.niger Van Tiegh.	Tabanus	+	+	-	+	+
A.flavus Link.	Chrysops	+	+	+	+	+
A.flavus Link.	Tabanus	+	+	+	+	+
A.flavus Link.	Haematopota	+	+	+	+	+
Beauveria bassiana Vuill.	Tabanus	+	-	-	-	+
Cephalosporium lecanii Zimm.	Tabanus	+	+	-	+	-
Metarrhizium anisopliae Sor.	Tabanus	+	+	+	+	+
Metarrhizium anisopliae Sor.	Haematopota	+	+	+	+	+
Paecilomyces varioti Bain	Tabanus	-	+	-	-	+
Penicillium thomii Moire.	Tabanus	+	-	-	-	+
Penicillium thomii	Haematopota	+	-	-	-	+

Moire.						
P. lanossum Westi.	Tabanus	-	-	+	+	+
Sporotrichum lanatum Petch.	Tabanus	+	-	-	+	-
S. densum Fres.	Tabanus	+	-	-	+	-
Fusarium oxisporium	Tabanus	+	-	+	+	+
Fusarium oxisporium	Haematopota	+	-	+	+	+
F. javanicum Cord.	Tabanus	+	+	-	-	+
Total types:		13	9	6	11	11

Conclusions

The research results indicated that the primary causative agent of illnesses is the highly specialised entomotrophic fungus Tabanomyces milkoi, which is exclusive to horseflies and absent in other insect species.

Tabanomyces milkoi possesses several advantageous characteristics that make it a highly promising organism for the biological control of horseflies. These include a 100% lethal outcome for infected individuals owing to the exceptional pathogenicity of this parasite, the potential for a severe and widespread lesion, and the ability to maintain the viability of spores of the fungus for up to 5 years in natural environments.

The fungal species Metarrhizium anisopliae, Penicillium lanossum, Cephalosporium lecanii, and others also show potential for biomethods.

The acquired data on the extensive species diversity of entomopathogenic fungus from horseflies not only enhances our knowledge of the distribution of these species in Uzbekistan, but also enables the identification of potential centres of fungal epizootics and the acquisition of novel active strains."

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