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POTENTIAL ROLE OF DERMANYSSUS GALLINAE DE GEER, 1778 IN THE CIRCULATION OF THE AGENT OF PULLUROSIS-TYPHUS IN HENS

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Abstract. *Salmonella gallinarum* was repeatedly isolated from mites *Dermanyssus gallinae* and its localization in the mite body was verified. The mites can carry *S. gallinarum* in their bodies for at least 4 months.

The role of *Dermanyssus gallinae* as a vector of many significant diseases has been emphasized many times (Smith et al. 1944, Sulkin et al. 1955, Kraminskaya et al. 1962 and others). From the economical point of view important are its relations to poultry pathogens as *Treponema*, *Yersinia*, agent of chicken pox and Newcastle disease (Reshetnikov 1967, Petrov 1975, Shirinov et al. 1972, Zemskaya 1971). The epidemiological and epizootological importance of *D. gallinae* in general was dealt with by Zemskaya (1973).

The impetus of the present study was long-termed chronic infection of hens with *Salmonella gallinarum* in a great breeding farm. The morbidity of the reproduction stock of ROSS-hybrid hens kept there was constantly high in spite of culling elimination of sick individuals and following disinfection and disinsection of the breeding halls. *Salmonella gallinarum* has been found among the mites collected there during the trials to improve the sanitary conditions (Vysloužil and Skalka, unpublished results). The aim of the present paper was to contribute to the evaluation of the role of *D. gallinae* in the transfer and maintenance of pullurosis-typhus in poultry farmings.

MATERIAL AND METHODS

The mites for isolation experiments were collected in the farm halls where pullurosis-typhus occurred. A massive occurrence of mites was recorded in the fissures in laying nests, metal equipment of halls and, to a lesser extent, also in mineral isolation felt in the hall walls. To prepare samples for bacteriological examinations, the dust containing mites was collected from these places and put in plastic bags. After several hours, the mites aggregated in an upper corner of the bag, then they were sucked off by a water vacuum pump into tubes and kept in a refrigerator at the temperature of about 4 °C.

For a better handling, the mites were narcotized with carbon dioxide prior to bacteriological examination. For the determination of localization of isolated *Salmonella* organisms in the mite bodies, a part of mite samples were washed with disinfecting solutions with surface effect. In our experiments, ether-alcohol (1 : 1), 4 % water solution of formaldehyde and 1 % water solution of peracetic acid were used. The following criteria were considered while choosing the disinfectants:

a) high effect on the isolated strain during the short time of treatment limited by the narcosis of mites,

b) surface effect depending on the ability of the substance not to penetrate through the mite cuticle,

c) ability not to leave residues which might influence further cultivation.

The required properties of the substance were verified in separate experiments. Ether-alcohol was omitted due to the low efficacy on the isolated strain. In order to increase the wetting ability of mites' cuticle, Triton X 100 was added to formaldehyde. The time of disinfectant treatment was stated experimentally to produce the highest effect on *Salmonella* organisms without killing the mites. It was 7 min for 4 % formaldehyde and 10 min for 1 % peracetic acid.

The samples for isolation experiments consisted of about 0.5 ccm of mite bodies (approximately 1,000 specimens) which were stirred in a sterile mortar. Samples of dust collected together with mites were examined simultaneously as controls. The bacterial agent in the examined samples was inoculated in selenite broth and incubated at 38 °C, plating two times after 18 and 42 hours. The ratio between the material and medium was about 1 : 10. The 5 % sheep blood agar, desoxycholate-citrate agar and Endo agar were used as solid media for plating. Isolated *Salmonella* organisms were determined according to their biochemical properties and antigenic structure.

A total of 7 sample series (5 collections) were examined. Each series comprised dust, disinfected mites and non-disinfected mites.

RESULTS AND DISCUSSION

The examined mites from all of the five collections from breeding halls were positive for *Salmonella gallinarum*.

It was further assessed whether the isolated *Salmonella* organisms came from a surface contamination of mites or whether they were localized in their inner organs or in dust. Mites narcotized with carbon dioxide were treated with surface disinfectants to eliminate the effect of surface contamination. A similar procedure was used by Bottger et al. (1978) who applied sodium hypochlorite for this purpose. However, the use of sodium hypochlorite requires a thorough washing which could not be made in our case due to the limited time of mite narcosis. For this reason we used the formaldehyde and peracetic acid which practically do not leave any residues if dried in vacuum. Also the alcohol-ether mixture was found to be unsuitable. The isolated *Salmonella* strain survived its action for 30 min, as it was verified experimentally.

The results of parallel cultivations of samples of surface disinfected mites, non-disinfected mites and dust are summarized in Table 1. It is evident that in no case *Salmonella gallinarum* was detected in dust samples. On the other hand, it was found in mite samples including those treated with surface disinfectants. The cases when

Table 1. Isolation of *Salmonella gallinarum* from *D. gallinae* and from dust in breeding halls with occurrence of pullurosis-typhus from 4 sample series, 3 collections

Mites without surface disinfection	+	+	— +
Mites after surface disinfection	+[1])	+[2])	— +[3])
Dust	—	—	— —

Disinfectants used: [1]) 4% formaldehyde, [2]) 4% formaldehyde, + 1% Triton X 100, [3]) 1% peracetic acid + positive isolation

S. gallinarum were not isolated, e.g. after application of peracetic acid, will be discussed further. The presence of *S. gallinarum* in samples of mites previously treated with disinfectants excludes the mechanical transfer and suggests their localization inside the mite bodies.

The transmission of *Salmonella* organisms by arthropods is not an unknown phenomenon. Varela and Olarte (1946) and Eskey et al. (1949) recorded the transmission of *S. enteritidis* by some species of fleas, Parker and Steinhaus (1943) described an experimental transmission of the same agent by ticks *Dermacentor andersoni* Stiles, Glukhov (1972) demonstrated the transmission of *S. typhi-murium* by ticks *Argas persicus* Oken etc. The possible transmission of the agent of avian pullurosis-typhus by mites has also been mentioned in the literature. Glukhov (1970) experimentally transferred this agent from infected chickens to healthy ones by *A. persicus*. Clinical symptoms in chickens were induced when nymphs or imagoes of the ticks sucked on the chickens or after the ticks had been swallowed by them. The same author observed a transmission of *Salmonella* organisms between different developmental stages in a tick population.

The *Salmonella* organisms seem to be able to survive in the mites for a long time. In our isolation experiments, carried out at the intervals of about two weeks, *Salmonella gallinarum* survived in the mite bodies even for 4 months after the contact of mites with infected hosts. Most probably this time is not maximum, as the isolations after a longer time period were not carried out. Glukhov (1970, 1972) demonstrated a persistence of *Salmonella gallinarum* in *A. persicus* for 183 days and of *S. typhi-murium* in the same species for as much as 10 months.

In some cases, *S. gallinarum* could not be detected in mites even in samples without surface disinfections. It was found not only in experiments with peracetic acid (Table 1), but also in some samples in verification experiments with ether-alcohol (not given in the table). The fact that some of the *D. gallinae* samples were negative for *S. gallinarum* indicates that in the mite population only a percent of them are infected and they need not always be detected. This may explain the results of Gadzhiev (1970) who failed to demonstrate the transmission of infection by a vector in breeds infected with "fowl typhus".

It can be concluded that the demonstration of a spontaneous infection of *D. gallinae* population with *Salmonella gallinarum* shows the importance of effective disinsection in poultry breeding farms for a successful liquidation of pullurosis-typhus.

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ВОЗМОЖНАЯ РОЛЬ *DERMANYSSUS GALLINAE* DE GEER, 1778 В ЦИРКУЛЯЦИИ ВОЗБУДИТЕЛЯ ПУЛЛУРОЗА У КУРИЦ

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Резюме. Из клещей *Dermanyssus gallinae* повторно выделяли *Salmonella gallinarum* и определяли локализацию возбудителя в телах клещей. Сальмонеллы сохраняются в телах клещей по крайней мере 4 месяца.

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