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

P. ZEMAN, V. ŠTIKA*, B. SKALKA**, M. BÁRTÍK***, F. DUBÁBEK
and M. LÁVIČKOVÁ*)

Institute of Parasitology, Czechoslovak Academy of Sciences, Prague, * Central State Veterinary
Institute, Prague, ** Veterinary University, Brno, and *** District Veterinary Station, Havlíčkův
Brod

Abstract. Salmonella gallinarum was repeatedly isolated from mites Dermatophysus 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 Dermatophysus 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 (Reshet-
and epizootiological importance of D. gallinae in general was dealt with by Zemskaya
(1973).

The impetus of the present study was long-term 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 dissection of the breeding hails.
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to improve the sanitary conditions (Vysloužil and Skalka, unpublished results).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. gallinarum
in the transfer and maintenance of pullurosis-typus in poultry farmings.

MATERIAL AND METHODS

The mites for isolation experiments were collected in the farm halls where pullurosis-typus 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 formamide 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 cm 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 sterile broth and incubated at 38°C, placing 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

| Mites without surface disinfection | + | + | + | + |
| Mites after peracetic acid disinfection | + | + | + | + |
| 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 Arpax persicus Oken ete. The possible transmission of the agent of avian pullorum-typus 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 imagos 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 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 Gadowiev (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 dissection in poultry breeding farms for a successful liquidation of pullorum-typus.

Acknowledgements. Our thanks are due to Academician B. Rosický for his kind support and guidance and Dr. Vysouzlí and Dr. Pejovská for valuable information.

ВОЗМОЖНАЯ РОЛЬ DERMINAYSSS GALLINAE DE GEER, 1778 В ПЕРВОВЫХ ПОДВОДНОМУ ПУЛЛРОУЗА У КУРИЦ

P. Земп, В. Штака, Б. Скляя, М. Бартек, Ф. Дубакн и М. Завичков

Резюме. Из клещей Dermatophagoides gallinae повторно выделили Salmonella gallinarum и определили локализацию в тела клещей. Сальмонеллы сохраняются в телях клещей по крайней мере 6 месяцев.

REFERENCES


This role of ticks in the distribution of avian
paratyphus. Veterinariya (Moskva) 49:49 to 50, 1972. (In Russian.)


P. Z. Parasitologicky ustav ČSAV,
Na skálech 702,
370 05 České Budíšovice
ČSSR