

Electron microscopic examination of the influence of Cumbasil® Mite on the extremities of the red chicken mite (*Dermanyssus gallinae*)

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Introduction

At the Department of Agriculture of the South Westphalia University of Applied Sciences (SWUAS), a series of investigations were carried out on the effect of a product made of rock flour (Cumbasil® Mite, Fa. Witel, Germany) on the red chicken mite.

The first studies focused on the investigation of an initial suspicion of a biocidal effect. Light microscopic analyses of untreated bird mites and those treated with Cumbasil® Mite showed that the product is only found on the surface of the chicken mites. No particles were found that penetrated the exoskeleton of the mites (GARMEISTER et al. 2019). The studies on the movement behaviour of the untreated and Cumbasil® Mite treated chicken mites showed a clearly less and slower progress of the mites. No mite was able to climb over a bird feather pollinated with Cumbasil® Mite, not even the untreated mites (GARMEISTER & Boelhauve 2019a).

Additional raster electronic images were taken to investigate the influence of the Cumbasil® Mite product on the extremities and the resulting movement. First, the extremities and the head were examined for damage to the cuticle and blocked joints.

Material & Methods

The tested mites originated from a laying hen farm ("Bioland", NRW, Germany), which were collected by nocturnal, non-invasive mite traps and further tested on the same day. Subsequently, the red chicken mite was determined with the corresponding stages of development. To investigate the influence of Cumbasil® Mite, mites were artificially sprinkled with the preparation in a Petri dish and absorbed with a piece of filter paper after they had digged free. The running behaviour of the mites in the control and experimental groups was recorded. Afterwards the mites of the Cumbasil group were sprinkled with water and after drying in the air for two hours the movement behaviour in comparison to the control group was observed again. For the electron microscopic examination, a sample of the Cumbasil® Mite specimen was recorded 100-fold, 500-fold and 2000-fold in the magnifications (sputter coater model S 150 B, Edwards; scanning electron microscope for SEM, model VEGA

SBH, Tescan) after determining a sufficient intrinsic conductivity in the SEM mode (secondary electron microscopy). Both mites with Cumbasil® Mite as well as control mites from the dorsal and ventral view were initially vaporized with gold in the sputter and recorded in various magnifications up to 2,000 fold. The surfaces of the animals were also examined for changes and peculiarities.

Results

In a series of images it was shown that isolated particles remained in the joint gaps and could not be washed out without mechanical action (Fig. 1).

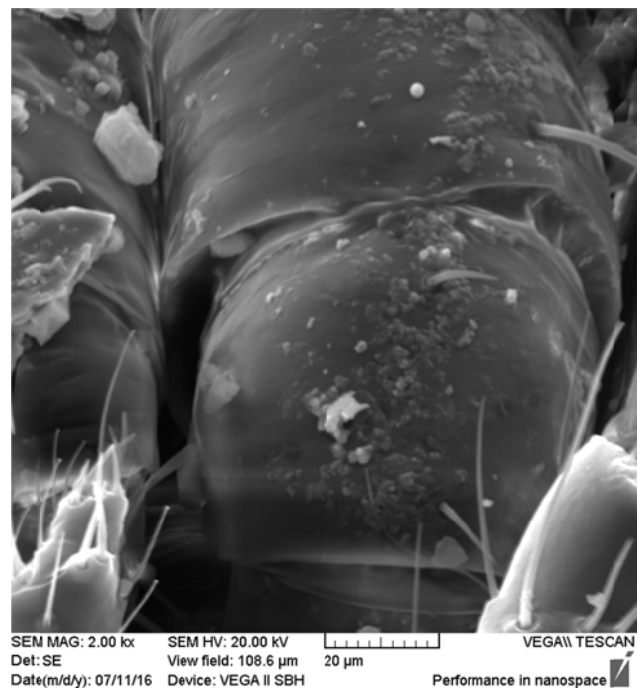


Fig. 1: Electron microscope image of the left anterior extremity after simplified washing of Cumbasil® Mite and subsequent drying. 2,000x magnification, section enlarged. Particles are visible in the joint.

The head views of a treated mite from the underside (Fig. 2) showed no damage to the anterior paired mouth parts (pedipalps), but the mouth opening (suction pharynx) showed a number of adhering particles compared to the untreated mite in this experiment (Fig. 3).

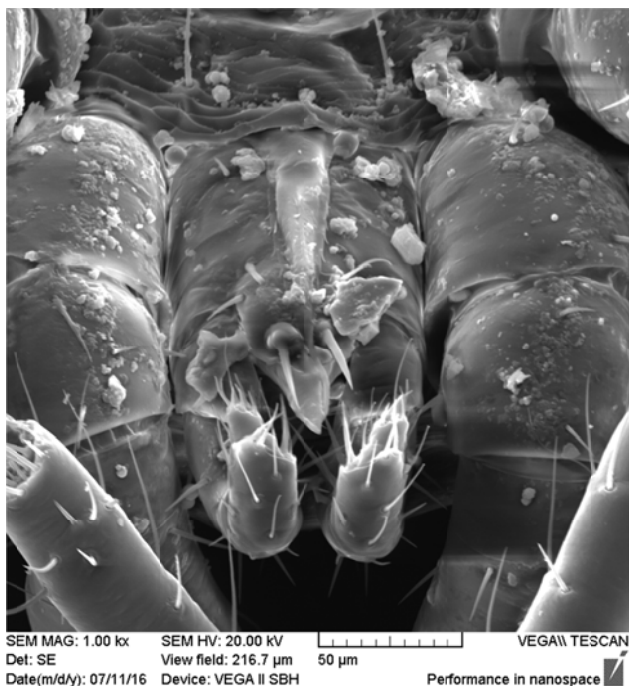


Fig. 2: Electron microscopic view of the two anterior extremities of a mite with Cumbasil® Mite treatment. There is a dense stocking at the head area and partially particles in joint gaps (1,000 times magnification).



Fig. 3: Electron microscope image of the two anterior extremities of a mite without Cumbasil® Mite treatment at 1,000x magnification. No particles are visible in the joints, extremities or mouthparts.

Discussion

A blockade of the joints by Cumbasil® Mite as well as an injury of the cuticle of the extremities could not be detected by light microscopy (cf. GARMEISTER & BOELHAUVE 2019b). Electron microscopy, on the other hand, reveals particles in mites treated with Cumbasil® Mite. These particles were also detectable on the mites after the simple cleaning step, but were only on the surface.

The reduced walking activity of the Cumbasil-treated mites may be caused not only by the poorer adhesion to the feathers (cf. GARMEISTER & BOELHAUVE 2019b), but also by direct mechanical impairments of the joints. Injuries caused by the treatment of mites with Cumbasil® Mite were also not detectable by electron microscopy in this study (cf. GARMEISTER et al. 2019).

The area around the mouth parts also showed no damage. However, particles were found in the entrance area of the suction pharynx, which could interfere with the unrestricted function. The fact that the act of sucking is made more difficult, especially in dust-bathed chickens, must be discussed as a possible cause of a weakening of the parasite pressure.

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References

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