In recent years, the infection with chicken mite is a major problem in poultry farming in the European Union and in the poultry farms of Ukraine. In view of this, there is a constant need for alternative control measures to maintain a satisfactory physiological state of poultry for different containment technologies. The chicken mite *Dermanyssus gallinae* (De Geer, 1778) is an dangerous ectoparasite-hematophagous (eats at night time) on farms with cage and floor keeping poultry in many countries around the world [1, 2]. During the light period of the day, the adult and larval stages of the mite are hiding in the cracks and gaps of the poultry house [3]. The study of the environmental properties of *D. gallinae* has shown that such abiotic factors as temperature above 21°C, high humidity and illumination in the poultry house is optimal for rapid multiplication mite, also under these conditions the life cycle can be completed within the week [4].

Infection chicken mite has a direct and indirect impact on the poultry. It is known that ectoparasites feed on poultry blood, which can cause anxiety, irritation, anemia, and even death, and the emergence of severe infections in chickens that results in significant economic losses of poultry holdings [5]. In addition, the mite can be a carrier of dangerous pathogens such as *Salmonella*, bird spirochaetosis, chicken pox virus, Newcastle virus, bird typhus, bird cholera, etc [6]. Bites of the mite cause a man’s dermatitis, which causes a significant problem for the staff of the poultry [7]. The prevalence of *D. gallinae* in the bird’s nests varies from 20–90% depending on the conditions of detention and production technology [8].

Control of parasites with acaricides is a rather complex and lengthy process that causes the resistance to this pest. Also, the use of synthetic drugs has a negative impact on the environment, since substances that are part of the preparations can be stored for a long time in the products of life of poultry and litter, and a significant accumulation of these components can lead to mutagenic, teratogenic and carcinogenic actions. To avoid these negative effects, it is proposed to use organic herbal preparations. Plant essential oils can be an alternative source of products for the treatment of infec-
ted mite, because they are a powerful source of biologically active chemicals. The research confirms the authenticity of the effects of the use of plant extracts, which makes it possible to abandon pesticides harmful to the environment [9]. Currently, the ecological direction of the fight against parasitic pests of poultry farms is relevant and requires further research on the expansion of a number of plant species, which include phytoncides.

The purpose of the work is to investigate the acaricidal effect of nine essential oils on D. gallinae in vitro.

MATERIALS AND METHODS OF RESEARCH

In the laboratory, it was investigated effect of nine essential oils of such plant species as Sweet basil (Ocimum basilicum), Coriander (Coriandrum sativum), Peppermint (Méntha piperíta), Garlic (Allium satívum), Laurel (Laurus nobilis), Cinnamon (Cinnamomum verum), Carnation (Syzygium aromaticum), Lime (Citrus aurantiifolia), Thyme (Thymus) on life activity of populations of species of parasitic mites D. gallinae, collected on the farm (Chernihiv reg.) from cages which contain poultry. The mites were collected using a brush and placed in plastic containers and used for experiments within 2 days of collection; kept at temperatures 24°C with a photoperiod of 16:8 hours (light:darkness). Essential oils were tested at concentrations of 0.2, 0.4 and 0.6 mg/ml [10] with a triple repetition. The strips of filter paper size 10/100 mm were impregnated with a suspension of essential oils in a volume of 10 mg/ml and placed in a Petri dish. The control served as a strip, moistened with distilled water. The experiment lasted 72 hours, after which the average mortality rate of individuals was calculated.

RESULTS AND THEIR DISCUSSION

The research results indicate acaricidal effect of essential oils of investigated plants in all proposed concentrations. Investigated suspensions can be divided into three groups:

Group I — plants whose essential oils have an average acaricidal action beginning at the third hour of the experiment;

Group II — plants whose essential oils have a low acaricidal effect, where mites die within 72 hours of the experiment.

Compared to the control conditions, which caused the mites to die only for 48 hours of experiment (18%), the acaricidal action of the suspensions Ocimum basilicum and Coriandrum sativum (Group I) was observed from the 2nd hour of the experiment, and for the last 24 hours the entire study group D. gallinae died. At a concentration of suspensions of 0.2 mg/ml, the proportion of dead individuals was 7 and 9%, respectively, with increasing concentrations of D. gallinae mortality increased by almost 2–3 times (fig. 1).

Study of group II of essential oil suspensions showed that the most effective acaricidal effect is Cinnamomum verum at a concentration of 0.2 mg/ml, as a result of which the fraction of dead specimens of mites was 21%, while at the same concentration of essential oils Laurus nobilis and Allium sativum — 18 and 19%, which is also a very positive indicator. During 24 hours, 100% death of D. gallinae was recorded (fig. 2).

The group III essential oils are four suspension — in the first two (Méntha piperíta and Thymus) acaricidal effect was observed from the 3rd hour of the experiment. It should be noted that the mortality rate of D. gallinae for the use of peppermint suspension in a concentration of 0.2 mg/ml was 11%, thyme at a concentration of 0.4 mg/ml — 13%. As for the other two suspensions (Syzygium aromaticum and Citrus aurantiifolia), they had a low indicator of acaricidal properties. At a minimum concentration of lime suspension, the mortality rate of individuals of D. gallinae only at 6 hours of the experiment reached 31%, but with an increase in concentrations up to 0.4 and 0.6 mg/ml — 35 and 36% respectively. Note that acaricidal action of essential oil of cloves was the lowest and began only at 24 hours of experiment (fig. 3).

Consequently, essential oils of plants are an alternative to synthetic drugs, because
Fig. 1. Acaricidal action *Ocimum basilicum* and *Coriandrum sativum* suspensions depending on the concentration and exposure period.

Fig. 2. Acaricidal action *Allium sativum*, *Laurus nobilis* and *Cinnamomum verum* suspensions depending on the concentration and exposure period.

Fig. 3. Acaricidal action *Méntha piperita*, *Thymus*, *Syzygium aromaticum* and *Citrus aurantiifolia* suspensions depending on the concentration and exposure period.
they contain only natural ingredients — phytoncides. They have a detrimental effect not only on the population of mites, but also have a bactericidal effect and can interfere with the development of harmful microbiocenosis in poultry farms and have insecticidal properties.

**CONCLUSIONS**

It has been established acaricidal effect of investigated nine essential oils on *D. gallinae* populations *in vitro* by direct contact. Suspensions of essential oils *Ocimum basilicum* L. and *Coriandrum sativum* L. have the highest acaricidal effect on the mites and cause their death within 2 hours of direct contact with the substance at a minimum concentration of 0.2 mg/ml.

It has been demonstrated that essential oils are one of the environmentally friendly means of struggle to combat parasitic mites species *D. gallinae*, especially in poultry farms with long-term floor and cage keeping poultry.

**REFERENCES**

Сучасне сільськогосподарське виробництво, і садівництво насамперед, базується на високотехнологічних індустріальних технологіях, які значною мірою перенасичені реалізаційними елементами; до того ж не завжди і не зовсім адекватно береться до уваги біологічний і природний потенціал різноманіття видів, що зумовлює зростання невиправданних енергетичних зтрат, неконтрольованого забруднення біосфери і, як наслідок, руйнування біоценозу та домінування згубних незворотних процесів. Такі технології не забезпечують і не формують раціонального і гуманного ставлення до природи, а питання одержання екологічної продукції за цих умов вважаються поза обговоренням. Для його вирішення, з максимальною користю для природи і людини, слід радикально змінювати концепцію садівництва на основі нових наукових досягнень, з мінімальними "фізичними" і технологічними впливаючими навантаженнями на продукуючі об’єкти, спрямовуючи функціонування дерева (його ріст і розвиток) у властивий йому природі і людині.

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