

# OVICIDAL ACTION OF INSECTOACARICIDE DRUGS SENTRY HOME, NEOSTOMAZAN 1:200 MANUFACTURED BY CEVA, NEOSTOMAZAN 1:200 MANUFACTURED BY PRODUCT AND EXTRAZOL M ON FLEAS CTENOCEPHALIDES SPP. EGGS

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## Abstract

**The aim of the research.** To compare the ovicidal efficiency of insectoacaricides of different composition and manufacturers on flea eggs (*Ctenocephalides spp.*) for treatment of the premises where animals live.

**Materials and methods of the research.** The study was conducted on the basis of the clinic of veterinary medicine «Vet-service» Sumy, laboratory «Veterinary Pharmacy» and «Innovative technologies and safety and quality of livestock products» of Sumy National Agrarian University. The ovicidal effect of insectoacaricides on flea eggs of *Ctenocephalides spp.* was studied. *Ctenocephalides spp.* eggs were selected from the pet bedding on which the animal spent most of its time, namely the cats. The studied material was selected with a cosmetic brush. *Ctenocephalides spp.* eggs were placed into a Petri dish of 10 eggs per each dish. The test material was introduced with a dental probe. There were 4 test dishes, which were treated with insectoacaricides (each test dish was treated with a separate drug) and 1 control dish with no treatment. Microscopy was conducted under a light microscope with magnification X8 of each egg, with following treatment of each egg with insectoacaricides. Monitoring was conducted in 24, 48 and 72 hours after treatment.

**Results.** Research has shown that drugs which demonstrated 100 % ovicidal effectiveness were *Sentry Home* (pyriproxyfen – 0.02 %, permethrin – 0.2 %, n-Octyl Bicyclohepten – 1.0 %) in 24 hours and *Neostomazan (CEVA)* (transmix – 5.0 g, tetramethrin – 0.5 g) in 72 hours.

**Conclusions.** Insectoacaricide drug *Sentry Home* (pyriproxyfen – 0.02 %, permethrin – 0.2 %, n-Octyl Bicyclohepten – 1.0 %), used for the treatment of the premises where the animals live, showed the most pronounced ovicidal effect in 24 hours.

**Keywords:** Ovicidal action, insectoacaricide drug, *Ctenocephalides spp.*, effectiveness of ovicidal action.

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## 1. Introduction

The main object of the study was the ovicidal effect of the insectoacaricide drugs *Sentry Home*, *Neostomazan 1:200*, manufactured by CEVA, *Neostomazan 1:200*, manufactured by PRODUCT, *Extrazol M* on flea eggs (*Stenocephalides spp.*), namely the number of living eggs after treatment with insectoacaricides, to determine the effectiveness of the treatment of the premises when using insectoacaricides in practice.

Fleas are temporary parasites. The development of insects occurs with a complete transformation. The life cycle of fleas is a complete transformation, lasting from 14 to 140 days, depending on temperature and humidity. They live in animal fur or nests. Females after fertilization lay up to 450–2500 eggs in the cracks of buildings, trees, land, debris and sometimes on animal skin, where they fall into places of sleep or rest of the animal.

Eggs are small, oval with blunt poles, slightly transparent, milky white or pearl color, size 0.5×0.3 mm, can be larger than 0.5–1 mm. Eggs are not sticky, so they roll from the animal into the environment. White larvae develop from eggs on the 2<sup>nd</sup>–14<sup>th</sup> day, but the development of larvae from eggs can take up to 60 days and it depends on the ambient temperature. The larvae are worm-like, 4 mm long, similar in appearance to the larvae of flies, the body segments have sparse but long hairs. They have a rodent-type mouthparts. Flea larvae have a fairly large head and 13 joints. The smallest larvae that have just hatched from an egg have a small egg tooth on the tip – a hard

growth that helps them break through the egg shell. The tooth falls off along with the chitinous shell during the first moult. Flea larvae can starve long enough – up to 3–4 weeks. At the same time they do not develop and do not grow, but do not fall into anabiosis. The larvae have a so-called phototaxis – wherever they are, they try to get into the least illuminated place. Although the eyes of flea larvae are almost undeveloped, they feel light well and try to hide from a lighted place. Indoors, flea larvae survive at the base of carpets, cracks in wooden floors. The development of cat fleas depends on temperature and humidity. In the southern regions, the flea development cycle lasts up to 3 weeks, in the central and northern, with a cool climate – up to 2 years. Fleas live 1–4 years. Still, there are data on the life of fleas up to 5 years [1, 2].

Fleas are common everywhere. These insects cause the most damage to dogs and cats. They also attack people. Distributed in places where animals are kept in unsanitary conditions, in large groups. Places for favorable development in the room are pet bedding, thick carpets, baseboards and dirty floors. Potentially favorable places for development outside buildings are moist soil and shade. At very high temperatures, flea larvae dry out – at low humidity it occurs at 34–36 °C. At high humidity (up to 90 %) larvae survive this temperature well. Excess water has a detrimental effect on the larvae. Under optimal conditions – at a temperature of about 23 °C and a humidity of 60 % flea larvae develop in about three weeks. A significant number of fleas are observed in summer and autumn. Cat fleas cannot survive for long periods of time at low temperatures. The flea population is rare in pets in the winter months, but reinvasion usually occurs in spring and summer. They can be mechanical and biological vectors of pathogens. Flea saliva is toxic to animals and humans and causes allergic dermatitis [3, 4].

Parasitizing on many animals (rats, gophers, marmots), fleas are carriers of many zoono-anthropotic diseases (plague, tularemia, myxomatosis, typhus) [5, 6].

Fleas parasite on the bodies of small pets. It is the second most common cause of dermatological diseases. Up to 80 % of all allergic dermatitis in animals is due to fleas [7, 8].

The general population of fleas in different sources is different. Iatusevych A. I. points out that about 1,000 species of fleas have been registered, 30 of which parasitize humans and domestic animals, rodents [9, 10]. Zakhvatkin Iu. A. also counts about 1,000 species of fleas, of which 250 species are located at the territory of CIS [11, 12]. According to Dykyi I. L., there are up to 1,400 species of fleas from the order *Siphonaptera* in the world fauna. Of these, 500 species belonging to 50 genera were found in the CIS [13, 14]. Vashchenok V. S. accounts more than 1800 species [15, 16], while Balashov Iu. S. and Pavlovych S. A. – 2000 fleas species, a quarter of which lives in the CIS territory [17, 18]. Kuliieva Kh. F. and Donato Traversa indicate that more than 2,500 species and subspecies of fleas are known, of which 500 are registered in the CIS countries [19, 20].

Ierokhina O. M., Iatusevych A. I., Akbaiev M. Sh., Galat V. F., Abuladze K. I., Vodanov A. A., Lutsuk S. N., Tolokonnikov V. P. distinguish 3 genera of fleas that have veterinary significance: *Ctenocephalides canis* (in dogs), *Ctenocephalides felis* (in cats), *Pulex irritans* (in human) which belongs to *Siphonaptera* order [1, 4].

The disease caused by fleas of the *Ctenocephalides* genus has several names. First variant is according to the name of the order *Siphonaptera* – siphonapterosis [6]. The second one is Aphaniptera – aphanipterosis [11], which are synonymous names. There is also the name of the disease by the genus *Ctenocephalides* – ctenocephalidosis [1].

Data on the ovicidal efficacy of insectoacaricide drugs have been insufficiently studied. The aim was to investigate and compare the ovicidal efficacy of insectoacaricides: SENTRY HOME (pyriproxyfen – 0.02 %, permethrin – 0.2 %, n-Octyl Bicyclohepten – 1.0 %), manufactured in the USA; Neostomazan 1:200 (transmix – 5.0 g, tetramethrin – 0.5 g), manufactured by CEVA, France; Neostomazan 1:200 (transmix – 5.0 g, tetramethrin – 0.5 g), manufactured by PRODUCT, Ukraine; Extrazol M (esbiothrin – 0.17 %, tetramethrin – 0.038 %, deltamethrin – 0.02 %), manufactured in Ukraine for the complex destruction of parasites since the first stage of their development [5, 17].

## 2. Materials and methods of the research

The study was carried out on the basis of the veterinary clinic «Vetservis» in Sumy from 1.03.2020 to 6.03.2020. The analyzed material was taken in an apartment where two cats lived.

It was taken from a bedding of 100x120 cm in size used for cats' sleeping. Approximately 150 eggs of *Ctenocephalides spp.* were collected. The selected material was divided into 6 Petri dishes and represented by 5 study groups and 1 control group.

The study was performed at a temperature of 21 °C and a humidity of 85 %. Temperature and humidity were measured with a psychrometric hygrometer VIT-1. The dishes were not covered. Humidity and temperature in the room were natural. There were created the same conditions that would have been in the treatment of the room in practice (the most natural conditions for the development of *Ctenocephalides spp.* eggs).

The studied drugs were divided into groups according to the active substances (**Table 1**).

Ten *Ctenocephalides spp.* eggs were placed in every dish.

Petri 1 – Sentry Home (pyriproxyfen – 0.02 %, permethrin – 0.2 %, n-Octyl Bicyclohepten – 1.0 %), manufactured in the USA.

Petri 2 – Neostomazan 1:200 (transmix – 5.0 g, tetramethrin – 0.5 g), manufactured by CEVA, France.

Petri 3 – Neostomazan 1:200 (transmix – 5.0 g, tetramethrin – 0.5 g), manufactured by PRODUCT, Ukraine.

Petri 4 – Extrazol M (esbiothrin – 0.17 %, tetramethrin – 0.038 %, deltamethrin – 0.02 %), manufactured in Ukraine.

Petri 5 – The control group (flea eggs of *Ctenocephalides spp.* were placed in a control dish which was not processed by anything).

Flea eggs (*Ctenocephalides spp.*) were introduced into Petri dishes using a dental probe, after circling the wells with a laboratory pencil in a Petri dish. There were 10 wells in each dish. The experiment lasted 5 days.

The following changes in the processed material were evaluated:

1. The shell condition.
  - 1.1. Deformation.
    - 1.1.1. Complete.
    - 1.1.2. Almost complete.
    - 1.1.3. Average.
    - 1.1.4. Partially.
    - 1.1.5. No deformation observed.
2. Visualization of the larva.
3. Motor activity of the larva.
4. Hatched larvae.
5. Motor activity of hatched larvae.

The condition of the shell, namely the deformation, was assessed by the correct shape of the egg (eggs were small, oval with obtuse poles, slightly transparent, milky white or pearl color, size 0.5x0.3 mm, could be larger than 0.5–1 mm ). That is why the deformation of the shell was evaluated for it (the wall is smooth, without depressions – no deformation; there are depressions on the wall of the egg more than 10–20 % – partial, 30–50 % – medium, 60–70 % – almost complete, more 80 % – full deformation). The image of the oval divided into 10 parts was superimposed on the image for this purpose.

The larva in the egg was visualized under a light microscope at magnification X4 or X8 and detected the presence of the larva under the egg shell and its motor activity.

The effectiveness of ovicidal action of drugs was determined by the difference between the number of viable eggs of *Ctenocephalides Felis* in the control and experimental group (the motor activity of the larva in the egg shell and the motor activity of the hatched larva were found) attributed to their number in the control and expressed as a percentage:

$$EOA = \frac{Ec - Ee}{Ec} \cdot 100,$$

where *EOA* – effectiveness of ovicidal action; *Ec* – the number of live eggs in the control group; *Ee* – the number of live eggs in the experimental group.

### 3. Results

#### 3. 1. The results of ovicidal action of the insectoacaricide drug Sentry Home (pyriproxyfen – 0.02 %, permethrin – 0.2 %, n-Octyl Bicyclohepten – 1.0 %) manufactured in the USA

*Before treatment:* The complete deformation was not found in any egg. There was a slightly deformed lower pole in two eggs. This is due to the fact that such a condition of an egg occurs before hatching from the larva. This fact was proved during the study of the biology of *Ctenocephalides spp.* egg development and which was found in no literary source. All eight eggs had a smooth surface and were oval in shape. Eight eggs had a transparent shell, and two eggs, which were in the hatching stage, had a slightly compacted shell. The larva was visualized in all ten eggs and motor activity of the larva was also observed in all eggs of fleas *Ctenocephalides spp.*

Twenty-four hours after treatment with insectoacaricide drug Sentry Home the following results were obtained. The complete deformation of the shell was found in 24 hours after treatment with insectoacaricide Sentry Home in 100 % of the test material. It was also determined that the transparency of the shell in 100 % of the test material was reduced, the larva was visualized in all eggs as well as the motor activity of the larva was absent in 100 % and the shape of all eggs was completely changed in 100 %. Hatched larvae are absent. The result of ovicidal action after 24 hours:

$$EOA = \frac{10 - 0}{0} \cdot 100 = 100 \%.$$

#### 3. 2. The results of ovicidal action of the insectoacaricide drug Neostomazan 1:200 (transmix – 5.0 g, tetramethrin – 0.5 g) manufactured by CEVA, France

*Before treatment:* complete deformation was not found in any egg. The lower pole was slightly deformed in two eggs. This is due to the fact that this condition of the egg occurs before hatching from the larva, which we proved during the study of the biology of egg development *Ctenocephalides spp.* and which was found in no literary source. All eight eggs had a smooth surface and were oval in shape. All studied eggs of fleas *Ctenocephalides Felis* had a transparent shell. The larva was visualized in all ten eggs and motor activity of the larva was also observed in all flea eggs.

*In 24 and 48 hours after treatment with insectoacaricide drug Neostomazan (CEVA) 1:200:* complete deformation of the shell was in 40 % of the treated material, average deformation of the shell – in 20 %, partial – in 40 %. The shell transparency was partially changed in 90 % of the studied material; in 10 % it remained unchanged. The larva was visualized in 100 % of the studied material. The motor activity of the larva was recorded in 50 % of the studied eggs and in 50 % it was absent. The shape of *Ctenocephalides spp* eggs remained unchanged in 20 %, in 40 % it was partially changed and in 40 % it was completely changed. Hatched larvae were absent.

$$EOA = \frac{10 - 5}{10} \cdot 100 = 50 \%.$$

*In 72 hours after treatment with insectoacaricide drug Neostomazan (CEVA) 1:200:* Complete deformation of the egg shell was in 80 % of the studied eggs, average – in 10 % and partial also in 10 %. The transparency of the shell was changed in 100 % of the test material. The larva was visualized in 100 % of the examined eggs. The motor activity of the larva was absent in 100 % of the studied objects. The shape of *Ctenocephalides Felis* eggs remained unchanged in 10 % of processed eggs, partially changed – in 30 %, completely changed – in 60 %. Hatched larvae were absent.

$$EOA = \frac{10 - 0}{10} \cdot 100 = 100 \%.$$

#### 3. 3. The results of ovicidal action of the insectoacaricide drug Neostomazan 1:200 (transmix – 5.0 g, tetramethrin – 0.5 g), manufactured by PRODUCT, Ukraine

*Before treatment:* complete deformation was not found in any egg. All ten eggs had a smooth surface and were oval in shape. 60 % of the examined *Ctenocephalides spp.* eggs had a transparent shell, 40 % had a darker color, which can be explained by the stage of egg development. The larva was visualized in all ten eggs and motor activity of the larva was also observed in all eggs of *Ctenocephalides spp.*

*In 24 and 48 hours after treatment with insectoacaricide drug Neostomazan (PRODUCT) 1:200:* Complete deformation of the egg shell was observed in 40 % of the treated material, average deformation of the shell – in 20 %, partial – in 40 %. The transparency of the shell was completely preserved in 20 % of the studied material, in 80 % there was a partial change in the transparency of the shell. The larva was visualized in 100 % of the studied material. The motor activity of the larva was preserved in 60 % of processed eggs and in 40 % it was absent. The shape of the eggs remained unchanged in 30 % of the studied material, was partially changed in 30 %, completely changed – in 40 %. Hatched larvae were absent.

$$EOA = \frac{10-6}{10} \cdot 100 = 40 \ %.$$

*In 72 hours after treatment with insectoacaricide drug Neostomazan (PRODUCT) 1:200:* complete deformation of the egg shell was observed in 60 % of the treated material, average deformation of the shell – in 20 % and partial – in 20 % of the studied material. The transparency of the shell was partially changed in 100 % of the treated material. The larva was visualized in 100 % of the processed material. The motor activity of the larva was preserved in 40 % of eggs and was absent in 60 %. The shape of the eggs remained unchanged in 20 %, partially changed in 20 %, and completely changed in 60 % of the processed material. Hatched larvae were absent.

$$EOA = \frac{10-4}{10} \cdot 100 = 60 \ %.$$

### **3.4. The results of ovicidal action of the insectoacaricide drug Extrazol M (esbiothrin – 0.17 %, tetramethrin – 0.038 %, deltamethrin – 0.02 %), manufactured in Ukraine**

*Before treatment:* complete deformation was not found in any egg. All ten eggs had a smooth surface and were oval in shape. 50 % of the examined *Ctenocephalides spp.* eggs had a transparent shell, 50 % had a darker color, which can be explained by the stage of egg development. The larva was visualized in all ten eggs and motor activity of the larva was also observed in all eggs of fleas *Ctenocephalides spp.*

*In 24 hours after treatment with insectoacaricide drug Extrazol M:* complete deformation of the egg shell was in 20 % of processed eggs, almost complete deformation of the shell – in 10 %, average deformation of the shell – in 20 %, partial – in 10 %. The shell deformation was absent in 40 % of the studied material. The transparency of the shell was partially changed in 100 % of processed eggs. Visualization of the larva in the egg shell was observed in 100 % of the test material. Motor activity of the larva was observed in 60 % of treated eggs. It was absent in 40 % of the treated eggs. The shape of the eggs was partially changed in 10 % of the studied material, completely the shape of the eggs changed in 40 %, remained unchanged in 50 % of the processed eggs. Hatched larvae were absent.

$$EOA = \frac{10-6}{10} \cdot 100 = 40 \ %.$$

*In 48 hours after treatment with insectoacaricide drug Extrazol M:* The shell was destroyed in 20 % of processed eggs. Complete shell deformation was noticed in 40 % of the studied material, partial shell deformation – in 30 % and no shell deformation – in 10 % of eggs. 20 % of the processed eggs hatched, the same ones in which the shell was destroyed, but the larvae were dead. There were 8 eggs left (80 % of the test material). The transparency of the shell was partially changed in 80 % of the studied material. The larva was visualized in the egg shell in 80 % of the test material. Motor activity of the larva was observed in 20 % of treated eggs, in 80 % it was absent. The shape of the eggs was partially changed in 20 %, completely changed – in 40 %, remained unchanged – in 20 %.

$$EOA = \frac{10-2}{10} \cdot 100 = 80 \ %.$$

*In 72 hours after treatment with insectoacaricide drug Extrazol M:* The destroyed shell was observed in 30 % of the processed material. Complete deformation was noticed in 30 % of treated



eggs, almost complete – in 10 %, average deformation of the shell – in 20 %, partial deformation – in 10 %. Another larva hatched, but it was dead and the total number of hatched larvae was 3 (30 % dead) within 72 hours after treatment. 70 % of the tested eggs remained. The transparency of the shell was partially changed in 70 % of the test material. The larva was visualized in 70 % of the studied material. The motor activity of the larva was in 10 % of processed eggs and in 60 % it was absent. The shape of the eggs was partially changed in 20 %, unchanged – in 10 %, completely changed – in 40 % of the studied material.

$$EOA = \frac{10 - 9}{10} \cdot 100 = 90 \%$$

### 3. 5. Discussion of research results

As a result of the study of the ovicidal efficacy of insectoacaricide drugs revealed ovicidal efficacy of insectoacaricide drugs based on pyrethroids and synergists of insectoacaricidal action of pyrethroids, pyrethrins and carbamates. The study makes it possible to choose the most effective insectoacaricide drug for the treatment of the premises in which the animals live (**Table 1**).

**Table 1**

Ovicidal effectiveness of insect acaricides

The drug name	24 hours	48 hours	72 hours
<i>Sentry Home</i> (pyriproxyfen – 0.02 %, permethrin – 0.2 %, n-Octyl Bicyclohepten – 1.0 %)	100 %		
<i>Neostomazan (CEVA)</i> (transmix – 5.0 g, tetramethrin – 0.5 g)	50 %	50 %	100 %
<i>Neostomazan (PRODUCT)</i> (transmix – 5.0 g, tetramethrin – 0.5 g)	40 %	40 %	60 %
<i>Extrazol M</i> (deltamethrin – 0.02 %, esbiothrin – 0.17 %, tetramethrin – 0.038 %)	40 %	80 %	90 %

Research has shown that drugs which demonstrated 100 % ovicidal effectiveness were *Sentry Home* (pyriproxyfen – 0.02 %, permethrin – 0.2 %, n-Octyl Bicyclohepten – 1.0 %) in 24 hours and *Neostomazan (CEVA)* (transmix – 5.0 g, tetramethrin – 0.5 g) in 72 hours (**Table 2**).

It is possible to make a conclusion that ovicidal efficiency of two identical combinations of *Neostomazan (CEVA)*, manufactured in France (transmix – 5.0 g, tetramethrin – 0.5 g) and *Neostomazan (PRODUCT)*, manufactured in Ukraine (transmix – 5.0 g, tetramethrin – 0.5 g) was compared. According to the results of the research, the place of synthesis of the molecule and the drug production are of great importance for its effectiveness.

### 4. Discussion

Fleas are common everywhere. These insects cause the most damage to dogs and cats. Places for favorable development in the room are pet bedding, thick carpets, baseboards and dirty floors. Under optimal conditions at a temperature of about 23 °C and humidity of 60 % larvae develop in about three weeks [3, 4].

The conducted experiment makes it possible to destroy fleas effectively at the first stage of their development (at the egg stage).

It has been experimentally determined that the insecticide *Sentry Home* kills not only the adult representatives of *Ctenocephalides spp.* (as indicated in the instructions for use of the drug), but also 100 % of eggs of parasites within 24 hours after just one treatment. Insectoacaricide drug *Neostomazan* (manufactured by CEVA, France) showed 10 % better ovicidal efficiency than *Neostomazan* (manufactured by PRODUCT, Ukraine). It is needed to treat the room with both of these drugs at least 2 times. Therefore, the insectoacaricide drug *Sentry Home* can be recommended for effective treatment of the premises in order to destroy fleas in the first stage of their development (at the egg stage).

**Research limitations.** Limitation of the research was that the study was conducted under the laboratory conditions. The owners may not comply with all processing conditions during the treatment of the premises where the animals live. This, in turn, may cause poor treatment quality of the premises.

**Prospects for further research.** It is planned to conduct industrial research of insecticides *Sentry Home*, *Neostomazan (CEVA)*, *Neostomazan (PRODUCT)* in the conditions of real living of animals: homes, booths.

## 5. Conclusions

The study showed the maximum ovicidal efficacy of the insecticide *Sentry Home* (pyriproxyfen – 0.02 %, permethrin – 0.2 %, n-Octyl Bicyclohepten – 1.0 %) which gives 100 % ovicidal efficacy after 24 hours.

Studies have shown that the insecticide *Neostomazan (CEVA)*, manufactured in France) has a 10 % better ovicidal efficacy than the insecticide *Neostomazan (PRODUCT)*, manufactured in Ukraine).

## Conflicts of interest

The authors declare that they have no conflicts of interest.

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