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Conference paper

THE SCOPE OF PROBLEMS RELATED TO THE CONTROL OF THE HOUSEFLY (*Musca domestica* L.) IN ANIMAL HOUSES BY MEANS OF ADULTICIDAL PREPARATIONS

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Summary

The use of adulticidal insecticides in the control of *Musca domestica* L. is presently the most frequent form of its eradication in animal houses. Their effectiveness depends, however, on several factors related to both the affected environment and the character of the active ingredients, such as the residual effect, knock-down effect, resistance of flies and the application form.

In our study we made an effort to evaluate the mentioned factors in animal houses with respect to presently used adulticides from the point of view of optimum requirements on their use in animal production.

Key words: *Musca domestica* L., adulticides, insecticidal effectiveness

Introduction

Numerous populations of flies in productive animal houses is an important factor of biological quality of the environment in relation to their noxious character and epizootiologic consequences.

M. domestica L. accounts for 98% of total interior entofauna in animal houses. An important factor with regard to the noxious effect of flies in these housings is the considerable dynamics of their numbers. In temperate climate their maximum numbers occur in the period of July - August and about 10 generations develop in one year.

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Keiding (2) stated that 50% of flies die within initial 5-6 days of their life and very few live up to 8-10 days. The reasons for this short life span of flies under practical conditions have not been explained sufficiently although it has been assumed that infection with micromycete Entomophtora muscae plays an important role.

Economically important is the overpopulation of flies in animal houses which corresponds to more than 200 flies per animal and is related to bothering of animals, sucking of blood in haematophagous species, licking the mucous secretions and skin. According to Rac (11), overpopulation of flies in pig fattening may result in 5-10% losses in meat production. Observations showed that the decrease in meat production occurs if there are 40 *M. domestica* L. or one S. cacitrans per animal.

Houseflies as a potential vector of infectious diseases transfer the infections predominantly by direct contact. Kočišová and Para (6) cultivated the following mean numbers of microorganisms from the surface of *M. domestica* L: blood agar - 13 036, Endo agar - 5 643 and Sabourad agar - 145 micromycetes. Experimental infection of the surface of *M. domestica* L. showed that the respective germs survived for 21 days.

All the mentioned reasons justify the systematic control of flies in animal houses by regular insect control measures in the summer season. At the present, the most frequent method of fly control is based on the use of chemical preparations - insecticides. Gábriš et al. (1) presented the general opinion that in relation to intensification of animal production insecticides will occupy an important place also in the future within the scope of both integrated protection of herds and biological-ecological and economical aspects.

With regard to the effect of insecticides on flies in animal houses dominant role is played by adulticides. The preparations used are based mostly on pyrethroids, carbamates and organophosphates (5,10).

It should be noted that the development of insecticides against flies is not the main objective of producers. The production of insecticides occurs typically on a small-tonne basis and economy of such production depends on the extensive use of the product which, with regard to indication and the dimensions of the sanitized area, speaks in favour of orientation on insecticides used for protection of plants. This appears a more attractive area from the point of market and economy of production.

The systematic research and development of insecticides that was initiated some 60 years ago has been focused more on the treatment of plants as a first link of the food chain. One can therefore assume that the insecticides used for

killing of flies have been developed primarily for protection of plants against insects and their use was extended to insects in animal production units provided that their effectiveness and toxicological characteristics enabled such use. The first products used were extracts from plants: rotenone, nicotine and pyrethrum. A revolutionary year in the control of arthropoda was 1939 when Swiss scientists synthesized DDT, a compound with excellent insecticidal properties. In 1940 British and French scientists synthesized HCH and numerous other complex hydrocarbons. Organophosphorous compounds related to chemical war substances found extensive use during the Second World War. Natural insecticides had no longer been able to compete with cheaper and more effective synthetic insecticides which led to considerable optimism (1).

As it has been shown later, the onset of development of resistance of target organisms to these insecticides occured at a faster rate than the development of new effective ingredients which takes in general at least 6 years.

DDT was first used in Slovakia in early fifties and immediately after several applications of this preparation for the control of *M. domestica* L., Vostál and Horváth (15) were able to observe resistance of flies in animal houses to its active ingredient.

The development of any new active insecticidal ingredient is a very complicated process which begins with organic-chemical synthesis of a compound with assumed insecticidal properties. Then, by means of biological screening tests, the biological effectiveness of the compound is determined. In general only about 5% of the compounds appear biologically effective. It means that from about 10 000 organic substances synthesized on a worldwide scale annually only several hundreds are biologically active. After determining the pesticidal effectiveness, the compound is compared with standard pesticides. In addition to that toxicological research is conducted in parallel. Its principal objective is to determine the presence of residua in individual components of the environment which frequently decide whether the respective pesticide complies with the set criteria. Only after this complicated validation process, provided that the compound fulfills all the respective criteria, it can pass to the final stage which is the formulation of the preparation (1).

An important factor, which complicates the use of adulticides in the control of *M. domestica* L., is their potential resistance.

This is extremely important in the control of flies which have relatively short developmental cycle with about 10 generations in one year. It has been

stated in general, that flies quickly develop resistance to pyrethroids and once developed it can persist for considerable time. Kočišová and Para (5) and Kočišová et al. (6) showed increased resistance of *M. domestica* L. to preparation based on deltamethrin after six applications in the interior of animal houses. The factor of resistance FR=18 increased to 61-91. Under the identical conditions the resistance to azamethiphos increased from FR=8 to 28-59. Even after 2-year withdrawal of deltamethrin the resistance to this compound remained high (FR=29). Under laboratory conditions the resistance to deltamethrin persisted up to 25th generation of flies. When using the approach of alternating insecticides dimethoate, azamethiphos and permethrin the resistance of flies remained low to moderate for 4 years. The factors of resistance ranged between 1-14 for azamethiphos, 7-15 for dimethoate and 4-16 for permethrin.

The results obtained point to the fact that the use of only one insecticide may lead to the development of resistance within one application. Although the alternate application of preparations will not prevent the resistance completely, the period of their effective use may be prolonged considerably.

From the point of suitability of adulticidal insecticides for the control of flies we should divide them to two large groups, pyrethroids and organophosphates.

Despite the fact that the List of preparations permitted by the Ministry of Agriculture and Nutrition of SR for the control of flies in animal production contains predominantly those based on pyrethroids we cannot agree with all of them completely. This concerns mainly those that are used largely for the protection of plants and have short residual effect so they protect the health of consumers in this portion of the food chain.

We can present several reasons why it is desirable to prefer organophospahtes to pyrethroids in the control of flies in animal houses, Firstly, it is the mentioned short residual effect that does not exceed 3-6 weeks while toxic activity of surfaces treated with organophosphates persists for several months. Toxic effect of ALFACRON 50 WP applied to protected surfaces in an animal house under practical condition lasted up to the following summer season. This question is related to the economy of insect control as to maintain the protection by pyrethroids for 5-6 months means that we have to apply them 3-4 times while in case of organophosphates one application usually suffices at comparable purchase costs.

The knock-down effect characteristic of most of pyrethroids is undesirable in the control of flies in animal houses. The housefly is a flying insect and prefers vertical surfaces on which it becomes intoxicated subletally with

pyrethroids, falls to the floor that is not saturated with insecticide and in a short time can become completely revitalized. The intoxication by organophospahtes is irreversible and the affected insects cannot revitalize.

The onset of resistance to organophosphates is much slower. In Slovakia preparations based on azamethiphos have been applied for several years with considerable success.

The results presented clearly demonstrate that the control of flies in animal houses cannot be managed completely only by application of adulticides. Kočišová (9) envisaged prospective solution to this problem in utilization of biorational insecticides. They are synthetic analogues of substances that occur in nature that act at very low concentrations and are poisonous, i.e. directly toxic, neither to the target nor to non-target species. They affect some essential functions, such as multiplication or behaviour of insects and, in comparison with conventional pesticides, are less dangerous to animals and humans (12,13). This large group contains substances with different mechanism of effect including inhibitors of production of chitin (diflubenzurone, cyromazin) and synthetic analogues of juvenile hormones (Methopren, Hydropren, Fenoxycarb) (5,6,9).

To contribute to resolving of the unfavourable situation in animal houses related to the polyresistant strains of flies we conducted validation experiments using diflubenzurone as an inhibitor of chitin production in fly larvae. The active ingredient was applied in the form of preparation DIMILIN 25 DP at a dose of 1g diflubenzurone per $1m^2$ concrete floor with straw bedding in a calf house and pig delivery room. The preparation was applied by means of a garden sprinkling can in two-week intervals. This all-season treatment of both houses allowed us to reach higher than 90% decrease in the number of adult flies in the interior of houses in comparison with the control (14).

Conclusion

The effective use of adulticides in the control of flies in animal houses is complicated by several factors the most important of them being the development of resistance. Observation of effectiveness of adulticidal insecticides under laboratory and practical conditions unambiguously prove that organophospahtes are more suitable than pyrethroids. Long-term use of adulticides in animal housings in SR resulted in selection of polyresistant strains of flies that cannot be controlled using the range of preparations

presently permitted for insect control measures. In this respect biorational insecticides with different mechanism of effect than conventional insecticides appear prospective.

Validation experiments carried out under practical conditions showed 90% decrease in the population of flies in animal houses that were treated with diflubenzurone, the inhibitor of chitin production in fly larvae.

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RJEŠENJE PROBLEMA VEZANIH ZA KONTROLU KUĆNE MUHE (*Musca domestica* L.) U ŽIVOTINJSKIM NASTAMBAMA PRIMJENOM ADULTICIDNIH PREPARATA

Sažetak

Upotreba adulticidnih insekticida u kontroli *M. domestica* L. trenutno je najupotrebljavanija forma za njeno iskorjenjivanje u životinjskim nastambama. Njihova djelotvornost ovisi o nekoliko faktora povezanih i s karakteristikama okoliša i aktivnih sastojaka kao što su rezidualni učinak, knock-down učinak, otpornost muha i oblik aplikacije.

U našem istraživanju pokušali smo procijeniti navedene faktore u životinjskim nastambama prema trenutno korištenim adulticidima, s obzirom na njihovu optimalnu upotrebu u animalnoj proizvodnji.

Ključne riječi: *M. domestica* L., adulticidi, djelotvornost insekticida

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