

PALATABILITY AND EFFICACY OF RB SOFT BAG FORMULATED BAITS IN CONTROLLING HOUSE MOUSE AND NORWAY RAT IN MILLS AND STORAGE FACILITIES OF AGRICULTURAL PRODUCTS

PRIHVATLJIVOST I EFIKASNOST RB MEKI MAMAK FORMULACIJE U KONTROLI KUĆNOG MIŠA I SIVOG PACOVA U MLINOVIMA I SKLADIŠTIMA POLJOPRIVREDNIH PROIZVODA

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ABSTRACT

House mouse, black and grey rat are the most important pest rodents in storage facilities and cause a 5% loss of the overall world food production. Control of rodent number in agricultural storage facilities is undertaken only after its presence has been registered. Preparations used to control rodents need to meet palatability requirements, i.e. stimulate rodents to choose baits rather than food available in abundance. Experiments were conducted in Omoljica mills and Starčevo storage facilities following the standard EPPO method. Palatability and efficacy of RB formulated baits containing bromadiolone and brodifacoum as active substances were tested against the house mouse in wheat mills and flour packaging and storing buildings and the Norway rat around mills and food storage facilities. Palatability and efficacy was calculated according to Abbott's formula. The results showed that palatability and efficacy of RB soft bag formulations (96-100%) was substantially high especially of brodifacoum-based baits.

Key words: *Mus musculus*, *Rattus norvegicus*, RB soft bag formulation, palatability, efficacy, storage facilities.

REZIME

Kućni miš sa sivim i crnim pacovom spada u najvažnije štetne glodare uskladištenih proizvoda. U skladištima poljoprivrednih proizvoda oni izazivaju ozbiljna štete ne samo kroz pojedenu količinu, već i zagađivanjem i do devet puta veće količine hrane. Svojom aktivnošću dovodu do gubitka 5% hrane u svetu što je dovoljno za ishranu 130 miliona ljudi. Kontrola brojnosti glodra uglavnom tek pošto se uoči njihovo prisustvo. Preparati za suzbijanje treba da imaju što bolju prihvatljivost, tj. da navedu glodare da radije konzumiraju mamak nego hranu koja im je dostupna po izboru u skladištu. Eksperimente smo izveli u mlinu u Omoljici i skladištima u Starčevu (povrće i žitarice) po standardnoj EPPO metodi. Prihvatljivost i efikasnost RB formuliranih mamaka sa 0,005% bromadiolona i 0,005% brodifakuma kao aktivne materije su testirani za suzbijanje kućnog miša u prostoru za mlevenje, pakirnici i skladištu sa džakovima brašna u mlinu i za sivog pacova oko mlina i u skladištima sa žitom i povrćem. Kao standard koristili smo mamke u obliku peleta sa 0,005% bromadiolona i 0,005% brodifakuma. Mamci su postavljeni u specijalne kutije na rastojanju od 1-3 m, jedna kesica za miševu i 3-5 za pacove. Brojnost glodara izračunata je na osnovu najveće i najmanje količine pojedenog mamka podeljeno sa dnevnom količinom potrebne hrane i primenjen je metod cenzusa pre i posle tretmana. Prisustvo glodara praćeno je i 20 dana posle tretmana. Palatabilnost i efikasnost testirane i standardne formulacije izračunata je prema Abbott-u. Rezultati su pokazali da je postignuta visoka prihvatljivost i efikasnost RB meki mamak formulacije (96-100%), naročito za mamke na bazi brodifakuma kao aktivne materije.

Gljučne reči: *Mus musculus*, *Rattus norvegicus*, RB meki mamak formulacija, prihvatljivost, efikasnost, skladišta.

INTRODUCTION

House mouse (*Mus musculus*) is one of the commonest rodent species. It reproduces rapidly. Namely, young females can breed at 6 time per year and produce numerous litters with up to 2000 baby mice a year (Wilson and Reeder, 1992). Mice are omnivorous and may cause significant damage in both household and storehouse. According to some estimations up to 2 000 000 mice can be registered in Belgrade each year. Thereby, the amount of food they eat or contaminate is usually 8600 tons. The cost can be compared with the value of 70 apartments 50 m² in size (Kataranovski et al., 1988). Rats are also among the most distributed rodent species. In Serbia the Norway rat (*Rattus norvegicus*) is the commonest (Djukić et al., 2005). It breeds 3-4 times a year with 7-10 baby rats in the litter. An adult rat may eat 5-9 kg of cereals annually. The damage caused amounts to 500 to 5000 metric tons (Brooks and Fielder, 2006). Based on some estimations 3.3 million tons of world food (5% of the total produced) is either eaten or damaged by rodents which is sufficient for the nourishment of 130 million people (Djukić et al., 2005). Rodents have important epidemic significance as natural source and main vector of pathogens of animal and human origin or indirectly by numerous ectoparasites (Gratz, 1988, Morita, 1995, Stajković et al., 1995). It is impossible to destroy rodents and for this reason their number should regularly be kept under

control. Prior to that their number needs to be evaluated and the species present should be determined using the method of transect C-30 (WHO) (Djukić et al., 2005), i.e. census (EPPO, 1999). There are numerous ways of decreasing damages due to rodent activity. PREVENTIVE: agricultural practices, technological, manipulative, sanitary, hygienic, constructional, technical. DIRECT: mechanical, physical, biological, genetic and chemical methods. MECHANICAL: Application of different traps (baits, glues). In buildings where the use of rodenticides is undesirable, traps with glue, ultrasound apparatus or electric traps are commendable.

BIOLOGICAL: Use of parasites, prey birds or pathogenous microorganisms. However, caution is needed because accidental poisoning of man and useful organisms is not excluded (Rilnikov and Tošigin, 1990).

CHEMICAL CONTROL: Application of rodenticides and fumigants in rodent control. Fumigation is employed in order to achieve a simultaneous rodent, insect and mite control in storehouses. The rodenticides mostly used contribute to the most efficient and rapid reduction of overpopulated rodent pests. This is not always justifiable from the biological standpoint, especially acute rodenticides which provoke rapid death and hostility towards the bait offered, changes in the behaviour of the rodent, danger to non-target animals, man and the environment (Claperton, 2006, Fisher, 2006). There is no ideal rodenticide toxic to

rodents only and non-toxic to animals and man. For this reason there is a big choice of rodenticides differing with regard to chemical composition, mode of action and toxicity (Almaši, 2004, Vukša, 2008). Anticoagulant rodenticides of the first and second generation with the mode of action based on preventing the factors of blood coagulation are mostly used, and lethality is registered after a couple of days only. In the study conducted by Quy et al., (1992) a decrease in the palatability and efficacy of bromadiolone, difenacoum and brodifacoum baits was registered. Therefore, it is necessary to develop acceptable preparations meeting palatability requirements that would stimulate rodents to choose baits rather than other food available in abundance in storehouses, prevent any hostility, protect non-target organisms and the environment (soil, water).

MATERIAL AND METHOD

Localities

Experiments were conducted in Omoljica private mill "Nedeljković" (N:44°45'368" E020: 0°521'705") and Starčevo Agricultural Combine "Old Tamiš" storage facilities (sunflower, maize, wheat, potato and feed) (N:44°45'712" E020: 0°521'705"). Palatability and efficacy of rodenticide preparations were tested against the house mouse in wheat mills (50 m²), (50 m²) flour packaging and storing buildings (900 m²) with flour stored in sacks lifted up on pallets in Omoljica private mill "Nedeljković". Palatability and efficacy rodenticide preparations were tested against the Norway rat at narrow band around mills "Nedeljković" and in wheat and vegetable storage facilities at Agricultural Combine "Old Tamiš". Products were stored in sacks lifted up on pallets. Total storage area was 3600 m².

Preparations studied

Palatability and efficacy of the following preparations was studied:

- Brodifacoum-based active substance BRODY FRESH BAIT (0,005% brodifacoum) manufactured by KOLLANT, Italy, represented in Serbia by MAGAN YU, Subotica. Referent preparation applied was RATTACK-pellets (0,005 % brodifacoum) produced by DUOCHEM, Belgrade, Serbia.

Bromadiolone-based active substance: RATIBROM 2 FRESH BAIT manufactured by KOLLANT, Italy, represented in Serbia by MAGAN YU, Subotica; GARDENTOP manufactured by ZAPI, Italy, represented in Serbia by AGROMARKET, Kragujevac; RATIMOR (mehka vaba –soft bait) manufactured by UNICHEM, Slovenia, represented in Serbia by PALPROPROM, Batajnica, Serbia and BRODILON MEKI MAMAC (BRODILON SOFT BAIT) manufactured by VETERINA, Kalinovica, Croatia. All preparations had 0,005% bromadiolone as active substance. Referent preparation was pellet formulation (0,005% bromadiolone) MAMAK B-KH produced by CIKLO-NIZACIJA, Novi Sad, Serbia. All the tested preparations were formulated as RB (ready to use) soft bait paste kept in special 10 g paper bags.

Trial methods

The trial complied with the PP 1/114(2) method (OEPP/EPPO, 1999). Rodent abundance was assessed using the C-30 method (Đukić et al., 2005) or the transect method (EPPO, 1990; EPPO, 1992) at the beginning and 10 days after the beginning of the trial. Rodent abundance was evaluated based on the highest and lowest daily food consumption of baits over a 10 day trial period divided by the daily required amount of feeding. Placebo bait was laid at 10 spots in each facility over a period of 5 days.

Tested and standard baits were placed directly at the active holes, in amount of 3-5 bags (30-50 g), for Norway rat found around mills and storage facilities. At the mills and storage facilities, on places where rodent activity had been observed previously and along rodent paths (underneath pellets), baits were placed in special boxes for bait exposition at 1-3 m intervals, one bag (10 g) for mice and three to five (30-50 g) for rats. Rodent presence was monitored over the next 30 days.

The efficacy of the tested RB soft bait and standard formulations was calculated according to Abbott's formula.

RESULTS AND DISCUSSION

Palatability and efficacy of the preparation studied

Table 1. shows the overall bait consumption, evaluated abundance of house mouse and Norway rat (at the start and at the end of trial) and efficacy in rodent control of standard and tested RB soft bait preparations on the basis of bromadiolone.

Table 1. Amount of bait taken (g), rodent numbers and rodenticide efficacy in mills and agricultural storage facilities (bromadiolone)

Product (active substance bromadiolone)	Species	Bait taken (g)	Estimated number		Efficacy %
			Beginning	End	
MAMAKB-KH (stan. bait -pellets)	<i>R. norvegicus</i>	963	32	4	87.55
	<i>M. musculus</i>	75	10	1	90.00
BRODILON MEKI MAMAC (RB SOFT BAIT)	<i>R. norvegicus</i>	1728	57	4	93.00
	<i>M. musculus</i>	65	10	1	98.50
RATIBROM 2 FRESH BAIT (RB SOFT BAIT)	<i>R. norvegicus</i>	1100	36	2	94.40
	<i>M. musculus</i>	61	10	1	98.40
GARDENTOP (RB SOFT BAIT)	<i>R. norvegicus</i>	1256	41	2	95.20
	<i>M. musculus</i>	250	25	1	96.00
RATIMOR ME-HKA VABA (RB SOFT BAIT)	<i>R. norvegicus</i>	1421	47	3	93.60
	<i>M. musculus</i>	200	20	1	95.00

The results showed high palatability of all the tested RB soft bait formulated preparations for house mouse and Norway rat compared with the referent pellet formulated preparation. Our results showed very high values (93.00 do 95.20%) of all the tested RB soft bait preparations for the Norway rat control and very high efficacy (95.00 do 98,50 %) for the house mouse control. The overall bait consumption, evaluated abundance of house mouse and Norway-grey rat (at the start and at the end of trial) and efficacy in rodent control of standard and tested RB soft bait preparation on the basis of brodifacoum are shown in Table 2.

Table 2. Amount of bait taken (g), rodent numbers and rodenticide efficacy in mills and agricultural storage facilities (brodifacoum)

Product (active substance brodifacoum)	Species	Bait taken (g)	Estimated number		Efficacy %
			Beginning	End	
RATTACK (standard bait pellets)	<i>R. norvegicus</i>	1140	58	6	89.66
	<i>M. musculus</i>	95	12	1	91,67
BRODY FRESH BAIT (RB SOFT BAIT)	<i>R. norvegicus</i>	1950	49	3	93.90
	<i>M. musculus</i>	72	11	2	97.20

The results showed higher overall bait consumption of the tested Brody Fresh Bait preparation compared with the referent Rattack pellet preparation. The Brody Fresh Bait preparation showed exceptional efficacy in both house mouse and Norway-grey rat control. Our trial results showed exceptional palatability of all the RB soft bait formulated preparations based on bromadiolone and brodifacoum as active substances. The efficacy of both bromadiolone-based (93.00 against Norway rat to 98.50% against house mouse) and brodifacoum-based (93.90 % against Norway rat and 97.20% against house mouse) preparations tested was extremely high (outstanding). Based on some literature data (Parshad et al, 1987), products based on bromadiolone and brodifacoum were found to demonstrate 80.8-97% efficacy against house mouse on poultry farms. According to Rowe et al. (1978) brodifacoum efficacy against house mice on farms ranged from 92.7% to 100% (mean 98.8%). Bromadiolone efficacy against the same farm pest ranged from 92.7% to 100% (mean 92.4%) in another trial (Rowe et al., 1981). Our results in efficacy testing of products on the basis of bromadiolone and brodifacoum against house mouse and Norway rat are in accordance with those reported by other authors (Rowe, et al., ; Parshad et al., 1987; Brooks and Rowe 1987; Quy, 1992; Milić, 1999; Vukša et al., 2002; Vukša 2008).

CONCLUSION

The Norway rat and house mouse are the most important pest rodents in storage facilities. It is very important to follow their abundance during the year and maintain it at the acceptable level, avoid losses and damage of storage facilities and prevent disease transmission. To suppress rodents and maintain their number at the sustainable level is a delicate task and chemical control measures are usually required. The choice of baits should be given special attention considering rodents to be very intelligent and prudent animals but also the need to prevent environmental pollution. Baits which do not provoke fear and hostility (on the basis of anticoagulation active substances) and avoid environmental contamination should be applied.

Our investigation shows that the new RB soft bait formulation of rodenticide has exceptional palatability for both rodent species (Norway rat and house mice) of major importance in storage facilities and outstanding efficacy of their control. It is also very convenient being packed in special paper bags which do not allow spilling and food and environmental contamination.

ACKNOWLEDGMENT : This study was carried out as a part of project III 4608 «Development of integrated management system harmful organisms in plant aiming to overcome resistance and improve food quality and safety» (2011-2014) which is financially supported by Ministry of Education and Science of the Republic Serbia.

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Received: 10.12.2011.

Accepted: 26.12.2011.

