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CONTROL MEASURES FOR PESTS, SPECIES IDENTIFICATION, PREVENTION OF INFESTATION, PREVENTIVE MEASURES, AND PEST MANAGEMENT STRATEGIES IN RESTAURANTS

Abstract
This article discusses methods that can be used to prevent, detect and destroy pests in restaurants. Special attention is paid to insect pests. This is an important issue for ensuring the safety of food products and protecting the health of consumers.

Keywords: *HACCP, pests, deratization, disinsection, insects, control, prevention.*

Introduction

To ensure food safety and consumer protection (Bolton et al., 2008; Dudarev et al., 2023; Zaporozhan et al., 2022) effective pest control measures must be implemented in restaurants. Integrated pest

management (*IPM*) is a comprehensive approach to pest control that combines various methods and tools to ensure effective destruction of pests with minimal impact on the environment and human health (Kloosterman & Mager, 2014).

Monitoring pest populations is a key component of *IPM* programs. It allows you to detect pests in the early stages, when they are most susceptible to control, and helps to evaluate the effectiveness of the methods used. Continuous monitoring allows monitoring the dynamics of pest populations over time. This makes it possible to apply control measures in time when pests reach the threshold value of action, which allows to minimize their spread and damage (Mul et al., 2016).

Successful food storage depends on many factors, including environmental conditions. The presence of pests can significantly change the storage conditions, and the application of control measures can lead to further changes. Pests have certain temperature and humidity limits at which they can survive. If the temperature or humidity exceeds these limits, the pests die. However, even within these limits, different types of pests may respond differently to changes in temperature and humidity. For example, some types of pests can tolerate higher temperatures than others. This means that a lower storage temperature may be required to control these pests. Similarly, some types of pests can tolerate higher humidity than others. This means that a lower storage humidity may be required to control these pests. Therefore, for successful food storage, it is important to understand the conditions under which pests can survive. This will help to develop effective control measures that will protect food products from spoilage (Bell, 2014).

Actuality of theme

Pests are one of the most serious problems facing restaurants. They can cause significant damage to food, equipment and premises, as well as lead to a deterioration in the quality of service and the safety of consumers. In modern conditions, when requirements for food safety are constantly growing, pest control is one of the priority tasks for restaurant establishments. Implementation of an effective pest control system allows to ensure:

• Food safety (Bilousova et al., 2023; Skrynnyk & Kuzmin, 2022);

• Preservation of equipment and premises (Moskalchuk et al, 2022);
• Reduction of risks for consumers' health;
• Increasing the level of service;
• Reduction of financial costs.

The topic of the monograph "Control measures for pests, species identification, prevention of infestation, preventive measures, and pest management strategies in restaurants" is relevant, as it meets the modern needs of restaurants and allows solving a number of important tasks.

Materials and Methods

In the course of the research, international regulatory documents implemented into Ukrainian legislation were used, which regulate the requirements for food safety and pest control.

Results and Discussions

General requirements. The responsible cook must regularly check raw materials and semi-finished products stored in refrigerators and freezers, which are further sold, because flies, cockroaches and rodents feed on waste, they can transfer food poisoning pathogens, intestinal infections, and helminth eggs to food products and ready-made food.

Visitors, for example, inspectors of control (supervisory) bodies, clients (customers), personnel who carry out technical maintenance of equipment, must have limited access to food processing areas (areas). These visitors must use protective overalls and comply with food safety requirements established for the public catering sector (National standards body of Ukraine DSTU ISO/TS 22002-2:2019, 2019).

Therefore, in restaurants, great attention is paid to the fight against these pests, which is carried out by disinsection (destroying flies, cockroaches and other insects) and deratization (destroying rodents) by concluding a contract with the company.

Premises must be designed to protect against pests and prevent contamination of products, drinking water, equipment, premises or roads within the premises (Codex Alimentarius CAC/RCP 39-1993, 1993).

Food waste is collected in containers (tanks, buckets, containers) that are tightly closed. All food waste should be removed daily, after which the walls and bottom of the container should be cleaned, washed and disinfected.

Sewage and garbage disposal. Businesses must have an effective system for the disposal of sewage and garbage contained in order and in good condition. All waste pipes (including sewers) must be designed to prevent contamination of drinking water. All waste pipes must be installed properly and lead to a water discharge pipe (Codex Alimentarius CAC/RCP 39-1993, 1993).

Internal pest control measures. Restaurant establishments constantly struggle with rodents and insects. These pests can cause significant damage to food, equipment and premises, as well as lead to poor service quality and consumer safety (Smithers, 2022).

To ensure food safety and consumer protection, effective pest control measures must be implemented in restaurants. Preventive measures in the fight against cockroaches and flies are the protection of food products from possible hatchlings and egg deposits. All products must be protected with nets, caps, and stored in closed cabinets. For this, partitions and walls of cabinets, shelves must be without gaps. In order to reduce insects, the establishment installs an electric insect killer and turns on a bactericidal lamp for half an hour after the closing of the food industry enterprise.

If necessary, the market operators introduce the following control measures: procedures for incoming water control with an indication of the frequency and method of water sample selection, types of analyzes and methods of conducting them. The periodicity and type of analyzes are based on risk assessment (Ministry of Agrarian Policy and Food of Ukraine, Order No. 590, 2012).

Pest control measures, including treatment with mechanical, biological means or chemical reagents approved by the competent authorities for use for this purpose, must be implemented in the catering establishment by personnel with appropriate qualifications and training. Appropriate records of the pesticides used must be kept (National standards body of Ukraine DSTU ISO/TS 22002-2:2019, 2019).

Electric insect killers are recommended to be placed in places where insects are likely to enter and avoid placing them over

exposed food. All pest control measures should be aimed at preventing their entry into premises where technological or auxiliary processes are carried out. Remains of crumbs, food on tables, shelves, in boxes can lead to the appearance of cockroaches. Various chemical compounds are also used to combat them.

Measures to prevent pests from entering the territory:

• availability of a fence and arrangement of the territory, sealing of doors, ventilation openings, equipment of windows with protective nets against insects;

• installation of electric insect killers, they should not be placed over open food products (Ministry of Agrarian Policy and Food of Ukraine, Order No. 590, 2012);

• installation of means of prevention and control of pests on the external perimeter and in the premises. All pest control measures must be carried out in such a way that there is no threat to the safety of food products due to cross-contamination.

To avoid cross-contamination, the use of poison baits should be avoided in areas where food (unprocessed, partially processed or processed), food processing aids, articles and materials in contact with food are handled.

Sanitary measures are aimed at constant maintenance of cleanliness at the production site and its immediate surroundings, in the adjacent territories.

In the kitchen and food preparation areas, waste must be collected in disposable waterproof bags or labeled reusable containers. The latter must be sealed or closed, removed from the production premises as they fill or after each shift, and placed (in the case of single-use bags) or emptied (in the case of reusable containers) into closable waste bins that are never brought into the kitchen.

Reusable containers must be cleaned and disinfected before reuse in the kitchen. Trash cans should be kept in separate closed rooms used only for this purpose and separated from the rooms for storing products. In these rooms, the minimum possible temperature should be maintained, they should be well ventilated, protected from insects and rodents, and convenient for washing and disinfection.

Litter boxes must be disinfected after each use. Cardboard boxes and wrappers must be disposed of immediately after emptying, under the same conditions as other waste. Garbage compactor equipment

should be located away from any food handling areas. If a garbage disposal is used, it is mandatory to use disposable garbage bags for offal and other waste. The waste chute opening must be washed and disinfected daily (Codex Alimentarius CAC/RCP 39-1993, 1993).

All food waste should be collected in garbage bags (the pedal bucket can be up to 60 % full) for daily removal from the facility.

Containers with food waste must be placed at least 25 meters from production on asphalted areas measuring 9-10 m^2.

Sanitary – technical measures are applied in order to block off (if possible completely) the access of pests to the premises of the enterprise.

Sanitary and technical measures to ensure the impenetrability of rodents in the building are provided for capital or current repairs.

Ventilation and all other openings, located low above the ground (20 cm and below), must be closed with a wire mesh with loops, 10-20 mm in diameter. It is necessary to constantly identify holes through which rats and mice can penetrate from the outside of the building (inside it) and cover up all discovered holes.

For preventive purposes, when fighting insects, you should systematically check the presence of cracks and close all cracks in the lower parts of walls, in floors, behind baseboards, in furniture, near heating and cooling equipment, racks and warehouses, protect window openings and ventilation openings with nets.

Staff training is an integral part of preventive measures in the fight against pests.

It is necessary for everyone to know that for preventive purposes it is important:

- close the door tightly;
- keep the premises clean;
- systematically remove garbage from the tanks (the tank can be filled to a maximum of 60 %);
- carefully collect and remove food residues and waste from production premises;
- do not leave crumbs and leftovers in the dining room and changing rooms;
- keep closets with personal belongings clean.

It should be taken into account that not only the usual rodents targeted for deratization, insects targeted for disinsection, but also

representatives of other vertebrates should be controlled: birds, cats, dogs, raccoons, foxes, shrews, etc.

The initial measure is a visual or instrumental survey, during which it is necessary to establish the type of pest, the width of its distribution, the threat of its appearance. At the same time, possible channels of entry and movement of the pest, places of residence, nutrition and reproduction should be identified.

The second measure is the preparation of special recommendations for the given territory and facilities of the enterprise on the implementation of pest protection measures, specifying the scope and terms of implementation.

The third stage is the organization of accounting, maintenance of a network of means of detection in constant readiness and assessment of indicators of the number of pests, the ecological phase of its development and movements, as well as monitoring of the pest in the places of its entry and possible residence with special means of detection.

It is necessary to appoint a responsible person and personnel who will take an active part in the constant maintenance of protective measures in working, effective condition. Designated personnel must monitor the number and placement of pest species, improving and developing measures for the prevention and destruction of pests.

The main preventive and control measures are carried out in accordance with the current regulatory and legal norms.

The equipment must be designed and maintained in such a way as to exclude the entry of birds, rodents and other animals.

The arrangement of traps for pests is presented in Figures 4.1-4.2. The names of the restaurant premises are listed in Table 4.1.

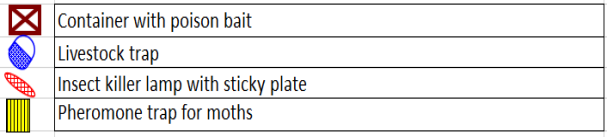

Figure 4.1 Notations on the scheme of traps in the restaurant

Practical pest control measures. They include such methods of control as: deratization and disinsection, which are aimed at combating pests that have already penetrated the enterprise.

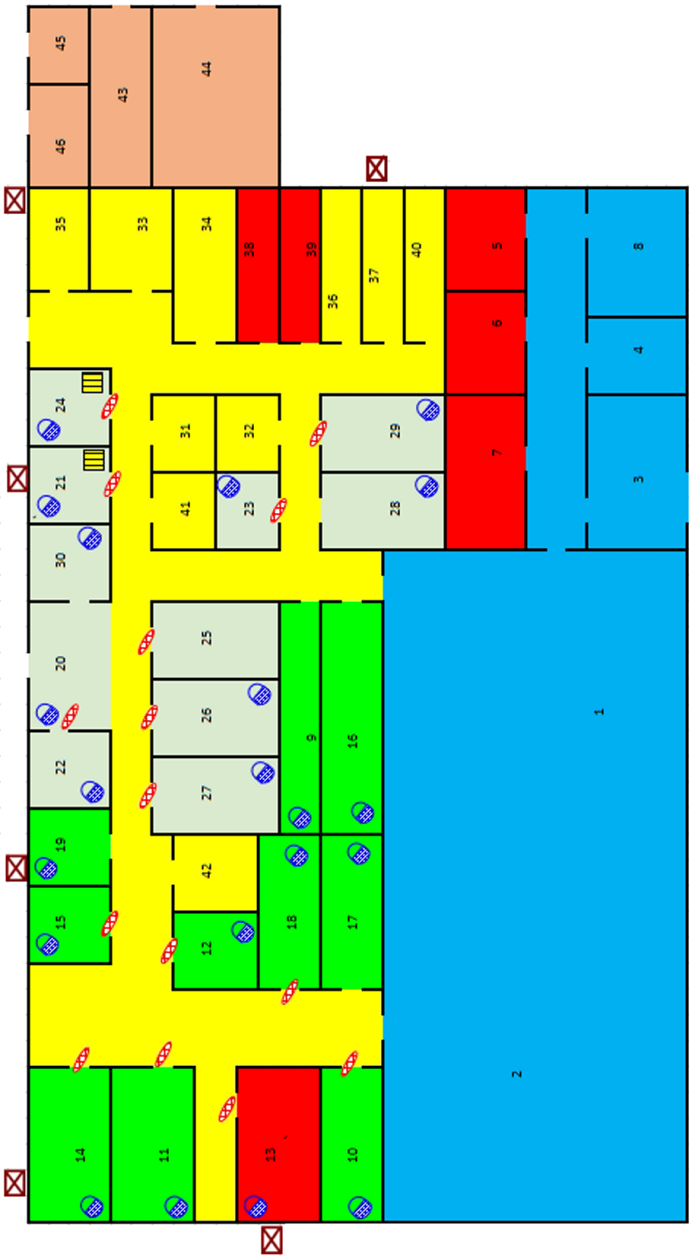

Figure 4.2 Scheme of traps in the restaurant

Table 4.1

The names of the restaurant premises

No.	Name		No.	Name
	Premises for visitors			**Service premises**
1	Dining room		31	Director's office
2	Zone of musical atoms, audio and video reproducing, etc.		32	Accounting
3	Lobby		33	Waiters and bartenders' quarters
4	Wardrobe		34	Staff quarters
5	Women's toilet (restroom)		35	Staff wardrobe
6	Men's toilet (restroom)		36	Showers for women
7	Toilet (restroom) for people with limited mobility		37	Showers for men
8	Smoking room		38	Women's toilet (restroom)
	Production premises		39	Men's toilet (restroom)
9	Buffet		40	Storekeeper's room
10	Hot shop		41	Cleaning equipment storage room
11	Cold shop		42	Linen storage room
12	Bread cutting room			**Technical premises**
13	Meat and fish workshop		43	Electrical panel room
14	Vegetable shop		44	Heating point room
15	Production Manager's Office		45	Room for fresh air ventilation
16	Room for washing tableware		46	Exhaust ventilation room
17	Room for storing and dispensing dishes			
18	Room for washing kitchen utensils			
19	Egg processing room			
	Warehouses			
20	Loading room			
21	Dry food pantry			
22	Pantry of vegetables and pickles			
23	Wine and vodka pantry			
24	Grocery Pantry			
25	Cooling chamber for meat and fish			
26	Cooling chamber for dairy and fat products and gastronomy			
27	Cooling chamber for fruits, herbs, vegetables and drinks			
28	Pantry for daily supply of raw materials			
29	Logistics storeroom			
30	Pantry for washing containers and household packaging goods			

To exterminate insects, the company uses an Electric Insect Killer. This is the most practical, hygienic and effective method using ultraviolet light. An electric insect killer is installed in the production room and in the dining hall where the cooking department is located.

During disinfestation with insecticides (poisonous substances from various chemical compounds), all foodstuffs, utensils, and equipment are removed from the premises. Disinsection is carried out on a sanitary day and with the appearance of biological pests.

The following methods of rodent extermination and deterrence are used in rodent control practice: mechanical, chemical, biological, and electronic.

The destruction of rodents, which can be carriers of pathogens of food and intestinal diseases, is carried out by deratization. Since rodents reproduce quickly, they also cause significant economic damage.

In the event of the appearance of rodents, mechanical methods of their destruction (using traps) are used. Rodents are also destroyed with poisonous chemicals that are added to baits. Since these substances are also poisonous to humans, only specialists – exterminators can use chemicals and means to destroy rodents.

Staff training. Heads of structural divisions conduct briefings for production personnel:

• initial briefing – after putting the document into effect;

• periodical instruction – once a year;

• out-of-hours briefing – when making changes to documents and when cases of non-compliance by employees with the requirements of this program are detected.

The personnel of the facility must possess proportional knowledge of the HACCP system in accordance with their job duties (Ministry of Agrarian Policy and Food of Ukraine, Order No. 590, 2012).

Prerequisites Program Verification: If necessary, system verification should include a comparison of the number of final products with the number of ingredients to verify performance.

Verification activities should confirm that:

a) the prerequisites program is implemented and effective;

b) the hazard management plan is implemented and effective;

c) hazard levels are within acceptable levels;

d) input data for hazard analysis are updated;

The organization shall ensure that verification activities are not performed by the person responsible for monitoring these activities. The results of the verification must be kept in the form of documented information and must be communicated.

If the verification is based on tests of samples of the final product or direct sampling from the process, and the tests reveal non-compliance of the samples with an acceptable level of food hazard, then the organization should treat the questionable part (batch) of the product as potentially dangerous and take corrective actions (National standards body of Ukraine, DSTU ISO 22000:2019, 2019).

Conclusions

So, pests are one of the most serious problems facing restaurants. They can cause significant damage to food, equipment and premises, as well as lead to a deterioration in the quality of service and the safety of consumers (Yurchenko et al., 2022).

To ensure food safety and consumer protection, effective pest control measures must be implemented in restaurants.

These measures should include preventive measures aimed at preventing pests from entering the territory and premises of the enterprise, as well as practical measures to combat pests that have already entered the enterprise.

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