



*Review*

## VETERINARY LEGISLATION AND GENERAL REQUIREMENTS TARGETING INSECTS AS FOOD

L. Angelova\*, K. Koev, B. Slavcheva

Faculty of Veterinary Medicine, Trakia University, Stara Zagora, Bulgaria

### ABSTRACT

The European Commission's decision to approve the use of insects and their parts for human consumption caused a wave of public discussion and media interest in our country. However, the veterinary perspective on the matter seems to have remained in the shadow of the predominantly discussed ethical and moral considerations on the subject and the opinions of specialists from other fields such as technologists, nutritionists, and control authorities. This led us to consider the issue of the usage of insects as food ingredients for human consumption from the veterinarian's perspective. As a starting point, we use the knowledge about insects, normatively regulated as part of the education process during the study of veterinary medicine and acquired by veterinarians nowadays. In the course of reasoning, we compare that knowledge with the questions, which have arisen in front of the veterinary guild in connection to the input of insects into the composition of foods, and as ingredients of human nutrition, which the European bodies have officially accepted and permitted. We explored normative documents and literary sources, which could answer the question: "Does the veterinary medical profession have a place in this type of husbandry and food production in the future?".

**Key words:** novel food, veterinary competencies, veterinary legislation, green innovation, animal husbandry

### INTRODUCTION

More than 2,000 species of edible insects are an essential dietary component in the menu of specific communities in Africa, Asia, Oceania, and South America, and according to the United Nations, they are part of the diet of 2.5 billion people in over 80 countries around the world (1; 2). In the European region, the idea of using insects as a food protein source for human consumption is not new, appearing in a 1975 publication by Meyer-Rochow (according to Zuk-Golashevska et al, 2022) (1). But it has been practically applicable in the last few years, as the main prerequisite for this is the available legal provisions that regulate public relations for the establishment of such a sector.

The shortage of protein sources for the growing world population can be compensated by

alternative protein sources obtained from insects. Entomophagy (eating insects) appeared as a new component in food systems in the European Union. Edible insects are accepted as farm animals and are raised for human food and animal feed. The nutritional value of insects is variable. It is determined by the species of insects, the method of production and the feed used to grow them. The selection of farmed insect species must comply with legal regulations regarding food safety requirements, which poses significant technological, social and economic challenges. Safe food production requires the application of specific management systems, including good breeding practices, good hygiene practices and a "Hazard Analysis and Critical Control Point" system (HACCP) (1). The placing of Novel Food on the EU market is regulated by Regulation (EU) 2015/2283 (3). Insects are Novel Food and they can be released within the EU only if they are previously authorized and included in the Union list of Novel Food (4) as such or included in food or used on food. The Regulation describes

\*Correspondence to: *Laska Angelova, Trakia University, Faculty of Veterinary Medicine, Department of „Food Quality and Safety and Veterinary Legislation”,  
e-mail: lkostadinova.vet@gmail.com*

the procedure for assessing the safety of new foods, including insects for human consumption. In different parts of the world, the legal interpretation of insects as food is variable. For example: in Canada, insects are defined as "novel foods" and the Canadian Food Safety Agency allows up to 4 insect components in every 225g of cheese but in the USA, edible insects are food additives and the law allows up to 30 insect fragments per 100 grams of peanut butter (5). In the EU, insects are considered as food or as additives inside foods or used on foods. (3, 4).

The review of the scientific literature discussing various issues arising from the use of insects as food for animals and humans shows that, based on the adopted legal regulations, in the last decade the idea of Meyer-Rochow (1975) has grown into a sector. According to data from Global Market Insights in 2019, the business with insects formed a market worth more than 50 million US dollars with tendencies to increase permanently (according to GMInsights published report) (5). The expectations are that the World Edible Insect Market will grow by 43.5% between 2020 and 2026 to around 710 billion US dollars in 2026 (5, 6).

## MATERIAL AND METHODS

The present study discovers the place of veterinary science and competencies in the insect farming sector according to the existing legal base from one side, and the possibilities for the development of the above-mentioned sector from another. It analyses the current issues in front of the research community in the aspect of putting insects into food for animals and humans, reflected in the scientific literature and legal documents. This would allow us to assess the need for veterinary competencies in the sector, and to compare it with the traditional training in the speciality in our country in the form of a regulated amount of knowledge and skills formed by veterinarians regarding insects. The analysis visualizes the question that we believe every veterinarian is asking, namely: "Does our profession have a place in this type of husbandry and this type of food production in the future?".

For the purpose of the analysis, literature sources from open-access scientific databases were reviewed (Google Scholar; Wageningen Academic Publishers; MDPI; Springer; European Commission; European Food Safety Authority; Center for Risk Assessment in the

Food Chain, etc.) and regulations. The analysis was prepared according to the methodology of the traditional humanities documentary method, methods of comparison and analogy, and content analysis. Conclusions on the outlook for veterinary services in the insect farming sector for food application are formulated based on identified key events, trends and authorizations for the market niche establishments in Europe.

## RESULTS AND DISCUSSION

### 1. Current issues of the use of insects as food.

Literary sources almost unequivocally define the insect farming business as promising, highlighting edible insects as recognized as an innovation in the food sector (1), enabling the future satisfaction of the population's growing needs for protein as a source (7, 8). The insects are also seen as a means of reducing livestock and household waste, in sync with the basic concept of the circular economy, given the behavioural characteristics of some waste-eating insects (9). The insect business shows trends of a global increase in the number of producers, but also in the number of consumers (5, 6). Edible insects are increasingly seen as an attractive source of protein. That, in our opinion, fits well with the concepts of building sustainable food systems, the transition to ecological agriculture, the circular economy, reducing the hydrogen footprint and food security. Insects are rich in protein (dry matter), fibre and beneficial fatty acids. They are good sources of trace elements such as iron, zinc, magnesium, manganese, phosphorus, selenium and zinc. The vitamin content of edible insects includes riboflavin, pantothenic acid, biotin and, in some cases, folic acid. Factors such as the quality of the insect-rearing substrates, the developmental stage of harvesting and environmental factors influence the nutrient content of edible insects. Factors such as the quality of insect-rearing substrates, the stage of harvest development and environmental factors affect the nutrient content of edible insects, causing variations in their nutritional composition (10).

In countries whose traditional menu includes insects, the so-called "mini-cattle" (Cited by Ayieko, M., H. Ogola, I. Ayieko, 2016) (9) is hunted (wild stock) or farmed, used for personal consumption or marketed. While personal consumption is not subject to official control, the supply of food products of any origin to the commercial network must be regulated and controlled. For European producers and

consumers, the wild stock of edible insects is doubtfully applicable due to the lack of consumer traditions, the peculiarities of the climate, and the weaker distribution of insects, which is predominantly seasonal. In this aspect, a significant part of the publications constitutes an analysis of the market of edible insects in Europe and worldwide, its current state and prospects (6, 11-13). In this group of publications, the authors (Mancini et al., 2021; Macombe et al., 2019; Derrien & Boccuni., 2018; Pippinato et al., 2020) established that the existing regulatory framework has a deficit of rules that could create consumer safety entomophagy procedures analogous to the traditional animal food market in national legislation. Derrien & Boccuni (2018) discussed the minimalistic requirements of the EU in the procedure for the inclusion of different insect species as "novel foods"(12). Some sources (Mancini et al., 2022) include concerns about the production, processing and consumption of insects and the need for risk management in this field (6).

In this regard, the benefits of this developing sector must be weighed against the challenges of food safety from insects. Like any food, insect-based foods are associated with certain hazards that must be controlled. Foods produced by insects may present consumer safety risks based on different types of hazards, such as biological, chemical and physical. Control over the risks is possible by following safety procedures, such as good hygiene practices during the cultivation, harvesting, handling, storage and transport of the insects. Insect-based foods can also pose a potential allergenic risk to consumers. People allergic to crustaceans may be more vulnerable to allergic reactions to insect-based foods. Insects collected from the wild and eaten raw may pose higher food safety risks than those that are grown and processed under controlled hygienic conditions. Insect microbiota may contain foodborne pathogens, such as *Bacillus cereus*, *Salmonella* sp. and *Campylobacter* sp. The quality and safety of the substrates used in the rearing of insects need to be controlled because of the biological and chemical contaminants they may contain. Agricultural pesticides and antimicrobial residues can also be found in insects if manure is used as a substrate for their cultivation. The accumulation of heavy metals (cadmium, lead, arsenic, etc.) in edible insects depends on factors such as environmental

pollution, insect species, as well as the substrates used for rearing the insects (14).

Analysts of the risks of the industrialization of the production and processing of insects for food purposes discuss issues of possible allergenic constituents and properties of insects (15) and their ability to accumulate heavy metals, mycotoxins and pesticides (16), various technological and ecological aspects of insect farming such as methods of immobilization, processing (17), and "cooking" (18) and their effect on the final product (1, 17, 18), the study "other" components of insects – vitamins (19), enzymes, antioxidants (20) and other bioactive substances (19-21).

Insect chitin and chitosan from edible insects are the subjects of enormous research interest considered a health risk product for consumers when consumed directly, but also in the light of an undeveloped reliable alternative (22) to its extraction from insects for industrial purposes such as agricultural needs, biomedicine, bioplastics in place of or in addition to its traditional extraction from arthropods and crustaceans (22, 23).

Discussions on the industrialization of insect farming in the Old Continent close to the veterinary profession discuss issues of food safety (15, 24-26), insect quality and factors affecting it (27), biosecurity of insect farms (1, 28), animal welfare (1, 29), security in the logistics and distribution of edible insects (1, 30), requirements for means of transport, buildings, equipment, personnel (1, 24, 31), certification of the cultivation of edible insects (8, 29, 32), insect breeding technologies, insect feed (33, 34), etc. Regarding the need to define health rules analogous to those existing for waste management - animal by-products, the future insect industry is interpreted not only in the aspect of its application as food but also as a feed ingredient (1).

Some of the publications are devoted to the pathogenic profile of edible insects. The insects can be the reason for an epidemiological problem- insect-processed animal protein (IPAP) can be contaminated by *Clostridium* spp. (Grenda et al., 2021) (35). They can be a reservoir of harmful substances: heavy metals like arsenic, cadmium, chrome, mercury, nickel, and lead (Purshke et al., 2017) (16); mycotoxins like aflatoxins inside human foods permitted honeybees (Evans & Chao, 2022)

(20); pesticides (16). Insects can be a source of biological threat but also a part of the mechanism of various parasitosis. Galecki & Sokol (2019) share the view that edible insects are often infected by pathogens and parasites that not only cause significant production losses but also pose an indirect threat to humans, livestock and exotic animals (36; 37). Some of the most popular edible insects can include parasites like Gregarine spp. (in mealworms, house crickets, and migratory locusts), *Hymenolepis diminuta* (in mealworms), mites of the family Acaridae (in mealworm), *Nosema* spp. (in house crickets), *Steinernema* spp. (in house crickets), *Nosema* spp. (in migratory locust) (36). Doi, Galecki & Mulia (2021) studied insects in relation to their ability to transmit infection with COVID-19, but with particular emphasis on the minimal risk of COVID-19- disease transmission from entomophagy (38).

In summary, we could conclude that edible insects represent a huge research interest with diverse goals and methods of analysis, and authors mainly recognize the perspective of the branch and consider its permanent growth, which they find limited by two main negative factors:

- 1) consumer attitudes of reticence and/or entomophobia;
- 2) the lack of applicable regulations.

## **2. Applicable legislative basis as a basic prerequisite for the development of the sector.**

Legal provisions are the main prerequisite for the existence, functioning and management of public relations in all aspects, including food production. In the field of food, they are of great importance to ensure the health and safety of consumers in modern society. According to Baker (1998) (39), Redmond & Griffith (2004) (40) and Patil, Cates & Morales (2005) (41) from a consumer's point of view, food safety is the most important consideration. In sync with this "rule" the European consumer safety system "from the farm to the table" is built and works. Consumer safety in the EU is ensured by the system components including the European Food Safety Authority; national food safety authorities; pan-European notification of risks originating from food and feed; the specialized border control of live animals, plants, products for human and non-human consumption, materials in contact with food, etc. For the most part, the responsibilities for

ensuring the consumer's health are delegated to the veterinary authorities, for the implementation of which there is an extensive legislative framework - at the international, European and national levels.

According to Regulation (EU) 2017/893 (42), certain insect species (*H. illucens*, *M. domestica*, *T. molitor*, *A. diaperinus*, *G. sigillatus*, *A. domesticus*, *G. assimilissa*) are legalized as adequate and applicable to feed requirements. They are classified as novel foods in the EU based on an EFSA opinion and national risk assessments from 2015 (43).

With the entry into force of Regulation (EU) 2015/2283 on novel foods (3), the procedure for adding novel foods to the Union's list of novel foods has been regulated (4). Since the Regulation (EU) 2015/2283 (3) on novel foods entry into force (01 of January 2008) to date, in the list of insects approved for consumption in the EU are several species. The list of that species can be found in the Annex of the Regulation for Implementation (EU) 2017/2470 (4) establishing the Union list of Novel Foods by Regulation (EU) 2015/2283 of the European Parliament and European Council on Novel Foods. By 2020 under the procedure of the European Food Safety Authority some forms of insects have already received approval for insertion into some foods for human consumption as an ingredient of different food products in variable forms (Table 1).

However, a legal-regulatory framework relevant to the entire production chain is missing. Currently, the leading position in Regulation (EU) 2015/2283 (3) applicable to edible insects is that they should not have been used for human consumption to a significant extent in the Union before the date of entry into force of that Regulation, namely 15 May 1997 (12). The list of novel foods permitted to be placed on the EU market in Implementing Regulation (EU) 2017/2470 (4) is drawn up and updated by the European Commission. The Regulation specifies all permitted novel foods, the conditions under which they can be used, the category of food in which they can be used and the corresponding maximum level of use. The list also specifies additional specific requirements regarding the labelling of food products containing the relevant new food. As part of the procedure for the authorization of novel foods, the Commission can ask the European Food Safety Authority (EFSA) to

carry out a scientific assessment of the safety of the novel food for consumers. The authority determines whether the new food is safe for consumers and poses a risk to human health. If

the safety assessment is positive, the EC approves the entry of the relevant new food into the Union list.

**Table 1.** *Approved for human consumption insects and their parts (4; 44).*

| Edible insect                         | Latin name             | Approved for human consumption      |
|---------------------------------------|------------------------|-------------------------------------|
| Crickets of the house cricket species | Acheta domesticus      | in pulver; whole and ground         |
| Crickets from other species           | Gryllodes sigillatus   | dried whole insects                 |
| Flour Beetle                          | Alphitobius diaperinus | whole and ground larvae             |
| Honey Bee                             | Apis mellifera         | unfertilized eggs (male bee larvae) |
| Migratory locust                      | Locusta migratoria     | Whole and ground insects            |
| Black soldier fly                     | Hermetia illucens      | protein meal from larvae            |
| Mealworm                              | Tenebrio molitor       | in pulver; dried; whole and ground  |

The option of producing food resources from insects for human consumption will naturally lead to public pressure on the legislature to establish rules and controls ensuring consumer safety, achievable by developing a legislative framework for all stages of the production process in the cultivation and processing of edible insects, analogous to those found in traditional livestock sectors (note: edible insects are classified as livestock) (1):

- Requirements for primary production capacities - growing conditions, requirements for buildings, technical means, capacities, facilities, technologies, personnel, biosecurity and farm security, disease monitoring, nutritional regime - diet, pest control in insect farms and so on;
- Requirements for storage and processing, packaging, and labelling of raw materials for the specific type of livestock; control of residual amounts of harmful substances and substances in them;
- Requirements for transport and means of transport for live insects and their products and raw materials;
- Rules for the control of waste from the production of insects and insect products;
- Requirements for enterprises and facilities for the production of insecticidal raw materials for the food industry for human consumption -

Hazard Analysis and Critical Control Point system, monitoring of production processes;  
 - Measures to ensure the health of "mini livestock" and zoonophylaxis.

Ensuring safety for the consumer's health is the prerequisite for overcoming negative attitudes among consumers, to which the quality of food products containing insects would also contribute.

During the study of public attitudes regarding foods containing insects Lensvelt & Steenbekkers (2014) concluded that people tend to try such foods out of curiosity, and after trying them, they mostly either do not distinguish which foods have insects in them, or they approve of the taste qualities of said food (45). Because of their study, Lensvelt & Steenbekkers (2014) also conclude that there is a possibility for gradual change in attitudes towards entomophagy (45).

A part of the legislation regulating productive animal husbandry activities is essentially animal welfare requirements. As professionals, we must also consider this issue in the light of intensive insect farming. The existing rules for animal welfare concern only vertebrates and industrial fish. Given the chronology of the emergence of the concept of animal welfare, it is logical to expect that the increase in the exploitation of insects would lead to the need to

create rules and requirements for their welfare on farms. Such a need may not arise given the specific nervous system of insects and their different mechanism of pain perception. However, if this happens, it will lead to the creation of a whole new field of animal welfare, which falls almost entirely within veterinary competence and control.

### **3. Insects through the veterinary point of view, based on specific knowledge and skills of veterinary medicine.**

As veterinary medical specialists, we think that there are serious reasons to expect the emergence of public needs from the specific competencies and responsibilities of the profession towards the "mini livestock" - edible insects. Veterinary medicine, however, currently studies, considers and treats insects mainly as pests, objects of disinsection, vectors of parasitosis and infectious diseases in animals. The regulated competencies of veterinary medical specialists, acquired in the cycle of their training in the speciality, are adapted to study the insect organism in aspects of combating insects and limiting the population and their spread for the prevention and protection of animal and human health. Today, protecting the health of insects is popular for specimens kept as pets or as wild animals in captivity, and in a mass aspect - to specific types of insects with long -established beneficial qualities- honeybees and silkworms. We can note that the zoo prophylactic measures and control veterinary medical measures to protect the health of insects with mandatory character exist only for bees and silkworms.

### **CONCLUSION**

The available theoretical statements and practical-applied studies confirm the potential of insects as an alternative food source in case of worldwide food shortage and protein starvation. In an industrial aspect, edible insects are identified as the alternative solution for obtaining quality food protein, reduction of arable land, reduction of carbon footprint and greenhouse gases, fast reproductive cycle, waste reduction tools, and sustainable production.

The negative aspects of the industrialization of edible insects are mainly socio-psychological factors and phenomena (according to a 2020 report by the European Consumer Organization, only 10% of Europeans are willing to swap meat for insects), modification of the environment,

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the allergenicity of insects in regular consumption or in daily contact with them, and ethical problems in the breeding of insects.

Despite the considerable amount of literature, insect farming is still not well researched, but "*edible insect farming can become a viable business sector if strict food safety standards are introduced*" (Cited by Zuk-Golaszewska et al., 2022) (1). The development of a national-level legal framework for insect farming is essential to control and ensure the safety of insect-based foods. Ensuring food safety is an integral part of veterinary health and safety guarantees necessary for establishing consumer confidence.

As a consequence of the present analysis, we could draw the conclusion that the future of the "edible insects" sector is closely linked to the need for adequate veterinary medical care in all its stages, as veterinary medical competencies in the field will not only arise but would also be defined as a necessary prerequisite for the development of the sector.

As a consequence of the above conclusion, we can logically infer the need for the development of veterinary science and practice in the field of edible insects, which has already begun as a process at the experimental and research level but is yet to be introduced in the form of acquired narrow-specific knowledge and skills in the training of veterinary specialists.

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