COUNCIL ON ANIMAL AFFAIRS

THE EMERGING INSECT INDUSTRY

SUMMARY

The purpose and activities of the Council

The Council on Animal Affairs (Raad voor Dierenaangelegenheden, RDA) is an independent council of experts, which advises the Minister for Agriculture, Nature and Food quality of the Netherlands. This advice is submitted on request and by the Council's own initiative regarding complex, multidisciplinary issues relating to animal health and welfare. The RDA currently comprises some forty experts with a wide range of back grounds and expertise, who serve on the Council in a personal capacity, independently and without any outside influence.

The Council on Animal Affairs considers issues across the entire spectrum of animal policy: on captive ("domesticated") and non-captive ("wild") animals, smallholding, or hobby farm animals, companion animals (pets), commercially raised animals and laboratory animals.

The Council records the conclusions of its deliberations in opinions. These documents provide an overview of the scientific and societal background to various issues, and include recommendations on policy options and avenues for resolving potential problems. Consensus is not a requirement for the inclusion of opinions; an opinion may contain views held by a minority of Council members.

Foreword

Worldwide interest in the use of insects as a source of food for humans and production animals has clearly risen in recent years, with some species showing clear potential as a promising alternative source of high-quality protein. This development raises questions, such as: how safe is the consumption of insects? What about greenhouse gas emissions and ammonia? How dangerous are escaped insects, and should we take insect welfare into consideration?

In light of this, the Dutch Council on Animal Affairs (RDA) deemed it necessary to issue an advisory report on the most relevant social and ethical issues surrounding the large-scale production of insects and other land-dwelling invertebrates.

Our aim is to create an overview of the interests of humans, animals and the environment within this fast-growing sector, and thus reveal any gaps in policy, legislation or research requiring attention. The Council has recorded the results in an advisory report, and condensed them into this citizens' summary in the hope of reaching a wider audience.

The complete report is available for download on the RDA website: https://english.rda.nl/.

The Hague, The Netherlands,
June 2018

Jan Staman, Chair

Marc Schakenraad, First Secretary

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RAAD VOOR DIERENAANGELEGENHEDEN

The emerging insect industry
Independent advisory report

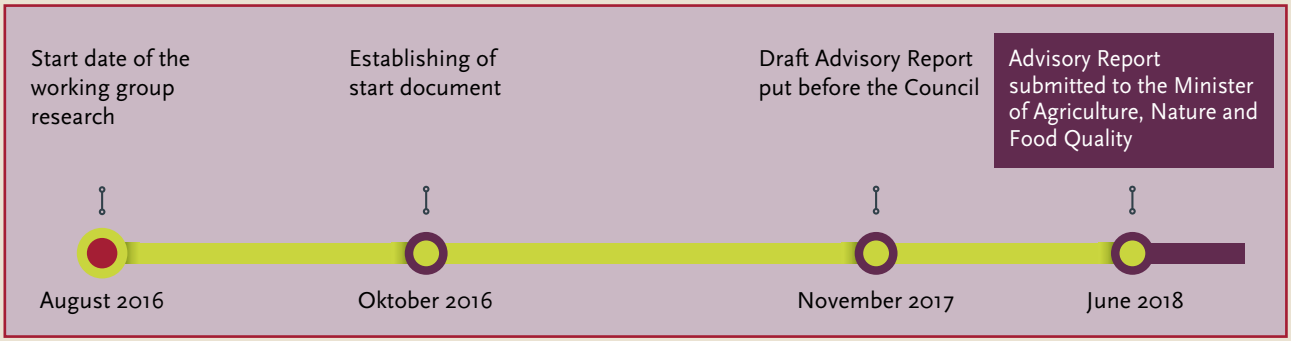
Question: what are the key questions raised by the rapid growth and anticipated expansion of insect production? How can they be answered, and can the RDA assist?

Background: "Insects are occupying an increasingly prominent position on the social agenda as a food source for both livestock and humans," says Prof. Arnold van Huis, member of the RDA and emeritus professor of Tropical Entomology at Wageningen University & Research. There is a lot of interest in production, and numerous parties are getting involved, according to the chair of the investigating working group. "There are now 220 producers worldwide, and the Netherlands already has two major companies preparing large-scale commercial production projects." Insects are also a popular research topic: "The year 2017 saw the same number of articles on the subject as in the entire decade from 2006-2015. It is a promising sector, but also a new one with much uncharted territory. The anticipated growth necessitates answers to questions regarding the relevant interests of humans, animals and the environment."

Considerations: there will be challenges with regard to insect welfare, Van Huis explains. "In the western world, insects have long been regarded as lesser creatures. The motto has always been 'a good bug is a dead bug', and Insect welfare has never been a concern. There are around five-and-a-half million insect species, only a million of which have been documented. Moreover, they display incredible variety. We now know that there are at least some insect species that can (or do) experience sensation, so we cannot simply assume that welfare is not an issue. Cockroaches have been shown to possess over one million neurons, which – in combination with their complex neurobiological organisation – fulfil the


Photo: René Verleg

Working group chair Arnold van Huis



preconditions for sentience. The journal *Science* published a study in which bumblebees displayed a certain emotional capacity; another article demonstrated the plausibility of subjective experience in insects. We therefore cannot ignore that some insects may be considered 'sentient beings'."

Another key consideration of potential large-scale production is food safety. Van Huis mentions potential contamination via pathogens or heavy metals, which can occur when insects are fed on residue and waste – in itself an attractive prospect from a sustainability perspective. "The government has precious few answers to these questions," he says. "Currently, for example, chickens can be fed on live insects – like the black soldier fly currently being fed to the chickens laying eggs for the recently launched brand *Oerei*– but not dead insects. And it was primarily due to the lobbying efforts of a platform of European insect-growers that the use of insects in fish farming became legal in July last year." The sector is therefore still in a state of flux amidst a dearth of government regulation.

Recommendations: the advisory report contains a series of recommendations based on the sixteen social values formulated previously by the RDA in the advisory report "One Health: A Policy Assessment Framework". One major recommendation is to respect the intrinsic value of insects, and to treat insects in captivity as sentient beings. Van Huis also believes that a centralised institute should be created that brings all stakeholders together to fill gaps in legislation, identify bottlenecks and help determine where the dividing line should be between government and sector responsibilities. The Council also recommends introducing a monitoring system to keep track of food and insect flows and enable prompt action in the event of any undesirable developments from a public health perspective. "If producers start using antibiotics, for example, we would want to know what happens to the waste products. Where do they go, what are they used for? Monitoring these things is important."

Brief summary of the report

More and more parties, from investors to consumers, are becoming involved in the large-scale production of insects, which raises a number of social questions regarding this new livestock industry. Often, however, there proves to be too little practical or scientific information available to provide any conclusive answers. It is for this reason that the Council on Animal Affairs (RDA) has investigated the issues most important to society and presented the results in this advisory report. Our aim is to create an overview of the implications for humans, animals and the environment within this fast-growing sector, and thus reveal any gaps in policy, legislation or research that require attention. To do so, the sixteen social values were applied from the advisory report "One Health: A Policy Assessment Framework" (RDA, 2015).

Since the turn of the century, there has been a clear rise in interest in the cultivation of insects and other invertebrates for various purposes. The feed and food industries are showing particular interest, due in part to the rising need for the high-quality animal proteins needed to feed a growing and increasingly prosperous world population. The production of insect protein is a potentially promising addition to protein from meat, dairy and eggs, and to livestock feeds such as soy and fishmeal. The environmental impact of insect production seems to be relatively low compared to alternative protein sources such as legumes, algae or laboratory meat, and presents a particularly environmentally-friendly option if insects can be fed using low-quality waste streams from the agriculture and food sector. The main factors affecting the viability of insect production in the circular economy are a competitive cost price and potential public health risks.

Large volumes and a consistent quality of insect meal will be necessary for application in the livestock and fish farming industry. The lack of practical experience with large-scale insect cultivation means research on new technologies is necessary to ensure the cost-efficient production of these volumes. The Netherlands is a leader in these types of innovations, due to its advanced agricultural technologies and the associated knowledge infrastructure.

Large-scale insect cultivation should therefore be viewed as a new agricultural sector. At this stage of growth in particular, it is important to monitor the risks of new production processes in order to provide prompt guidance (as necessary) in the form of supplementary policy. The RDA believes that the sector has a leading role to play in this respect, for example by creating and maintaining transparency of production. Ultimately, the social significance of this sector will depend to a large extent on the sixteen factors from the previous One Health policy framework (RDA, 2015), which are addressed below.

Intrinsic Value (1) and Welfare (2): the Dutch Animals Act (*Wet dieren*) acknowledges the intrinsic value of animals, with due consideration of their capacity for sentient experience. Some ambiguity can arise regarding the intrinsic value of invertebrates, which have not conclusively been shown to be sentient beings capable of experiencing well-being and pain. Other societal issues, too, have revealed that the moral value we assign to invertebrates is ambiguous and sometimes inconsistent. The large-scale use of insects requires further reflection on the concept of intrinsic value and the moral status of invertebrates. There are already sufficient arguments,

Black Soldier Fly larvae

An adult Black Soldier Fly, whose larvae are used for protein production.

however, to ask the relevant parties to attach moral value to invertebrates and act accordingly. In the Council's view, this means due observance of welfare considerations in the treatment of these animals. Although there is no scientific evidence to date that invertebrates are capable of suffering, there is no evidence to the contrary either. There are indications, however, that certain invertebrate families (such as octopuses and bees) can experience states resembling emotions. It is for this reason that the RDA recommends treating invertebrates as sentient beings. The possibility of future research showing that some species are indeed sentient must also be taken into consideration. Such may lead to exceptions for these species, as is already the case for octopuses under animal testing legislation. Investments in the welfare of invertebrates would also seem to be in the producers' own interests, as adapting farms to suit the needs and developmental stages of certain species as much as possible not only increases production, but is also important for the social acceptance of the insect industry. More research on species-specific behaviour and well-being is therefore

necessary, to serve as a basis for husbandry requirements or welfare protocols. Public exchange of best practices is important in this respect.

Instrumental (3) and Economic value (4): the increasing investments in the development of large-scale insect production are a sign of economic confidence in the sector. Whereas production originally focused on insect meal intended for people and animals, by-products such as oil, fats and chitin have also emerged as promising nutritional and pharmaceutical possibilities. There is also commercial interest in potential applications for sustainable and circular agriculture, such as the bioconversion of waste streams and even manure, and in biological pest management and pollination. Economic significance is expected to increase in the short term, due to insects recently being approved for use in the EU as feed for farmed fish and their potential future use as feed for chickens and pigs. The above may also provide an incentive to use invertebrates for other applications. Whether insect production develops into a fully-fledged agricultural sector of its own will depend strongly on factors such as successful upscaling, international food market trends, the development of other alternative sources of protein and the options for incorporating insects into the circular economy.

Public Health (5) and the Health of the Animal Population (6): one of the key issues concerning the increasing use of invertebrate species concerns the potential health risks for both humans and animals. Much is still unknown regarding the health risks for various types of farms, substrates and processes. Currently, as far as we know, the microbiological risks do not differ significantly from (and are sometimes even smaller than) the risks associated with foods of common production animals. In principle, this means that insect production should be subject to similar safety protocols. However, risks such as the accumulation of heavy metals in insects require special attention. The rapid developments and wide-ranging production and processing methods per species mean that much is still unknown, so monitoring remains necessary. There is also an urgent need for additional research, particularly in the field of chemical risks, human and animal allergies and the possible applications of insect manure. Sustainable methods for preventing health problems within and between farmed invertebrate populations and stopping transmission to other animal species also require investigation. Vigilance regarding health issues is not only the government's responsibility – it is also in the sector's own interests.

Contamination (7) and Biodiversity (8): compared to traditional livestock farming and other alternative sources of protein, the insect sector would seem to perform relatively well in terms of the environment and biodiversity. Here, too, it is important to investigate the environmental impact of all species and production methods. Much is dependent on the substrate type used to farm the animals. Research is also required into the circular-agriculture opportunities offered by insect farming. The search is aimed at finding the best possible low-grade waste streams that are available in sufficient quantities, that pose the fewest health risks (which excludes manure and kitchen waste for the present) and produce the best insect growth. There is also room to include new agricultural crops and crop applications. One critical point to consider in insect farming is the impact that escaped animals may have on native biodiversity. Although such effects are accounted for in the admissions procedure for all production species, continued monitoring is still recommended.

Landscape architecture (9): insect farming offers new opportunities in agricultural areas where the space for traditional livestock farming is becoming scarce. It is for this reason that Dutch regions such as East Brabant and North Limburg are encouraging the development of a local insect sector, often as a collaboration among farmers, local government authorities, chain suppliers/purchasers, knowledge institutions and investors. The farms form the linchpin of this chain, and themselves consist of a department that produces fertilised eggs and a rearing unit that produces fully-grown larvae. There are advanced plans for a model that outsources the rearing to participating regional businesses, or perhaps even internationally in future. Depending on how successfully the insect-farming business can be scaled up, the entire chain (from substrate production to the transport of end products and waste) will impact landscape architecture. Farms may be situated in areas zoned for agriculture, but also in industrial parks. In such cases, it is advisable to ensure adequate spacing in order to limit environmental or disease-related risks as much as possible. Since insect farms often fall outside the definitions in regional legislation, local farming policy will vary. We therefore recommend greater attention to invertebrate farming in local legislation, and to making regional regulations as uniform as possible.

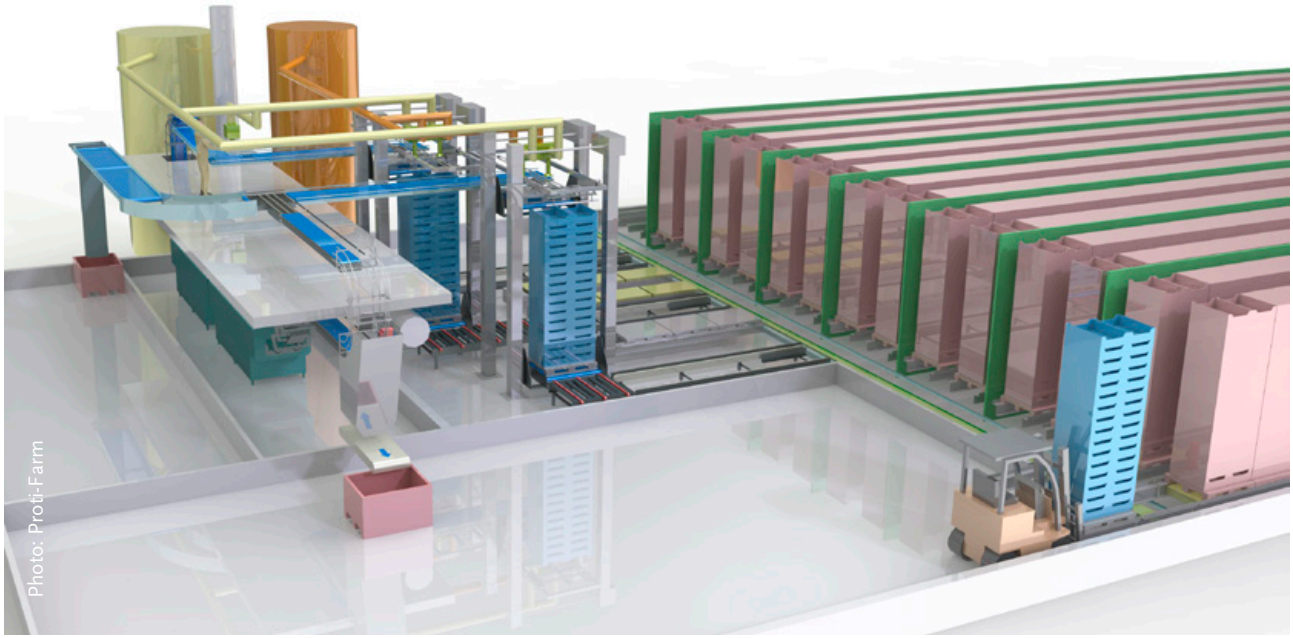
Photo: Hans Smid WUR

The common mealworm, a popular source of protein

Legal Framework (10): laws and legislation at European and national level have both proven to cater poorly for the use of invertebrates as production animals. Existing legislation is not always conducive to insect farming conditions, and may therefore require adjustment. Nor is legislation always consistent. This is the case for the production of insects for various purposes, and for local bylaws potentially applicable to setting up an invertebrate farm. There is a pressing need for increased collaboration between the sector and national, provincial and municipal authorities, in order to create an overview of the diverse range of regulations present in various laws. This will help the sector to develop in an efficient and transparent manner, and aid governments in adapting legislation to suit changing circumstances.

Cultural Value (11), Inherent Dignity (12), Autonomy (13), Relational Value (14), Public Opinion (15) and Social Impact (16): traditionally, western culture has viewed insects predominantly as unclean, disease-spreading pests, rather than as useful, valuable organisms. Hence, many people will need to overcome their aversion before using and consuming insects. In addition to this "yuck factor", certain personal convictions, such as religion and vegetarianism, will influence the social acceptance of using and producing invertebrates. Due to the promising opportunities on offer, many are cautiously optimistic about large-scale insect production. Consumers are expected to adopt a pragmatic stance: food products containing insect ingredients are likely to be accepted, provided they taste good and are not too expensive. There also seems to be some interest in niche-market products with clear benefits, such as health (special proteins for athletes) or

flavour (delicacies). Everybody – either as consumer, citizen or professional – may be impacted by insect farming, necessitating choices in areas such as consumption, economics, ethics and health. However, any negative incidents (in areas such as animal welfare, the environment or health) could easily undo positive public opinion on insect production due to the ever-dormant "yuck factor". Because of the wide array of public interests, it is important for the government to monitor developments in the insect sector, to continue to promote relevant research and to ensure early and transparent knowledge exchange. The primary responsibility lies with the sector itself, which acknowledges the importance of a positive image for public acceptance, and ultimately the success of the sector.



Sketch of advanced mechanised insect production

Appendix

This advisory report is a product of the full Council on Animal Affairs (RDA). It was prepared by a working group composed of RDA members prof.dr.ir. A. van Huis (chair), prof.dr. J.J.M. van Alphen, dr.ir. G.B.C. Backus, A.L. ten Have-Mellema, Ir. M. de Jong-Timmerman, and dr. F.L.B. Meijboom. Ir. M.H.W. Schakenraad and dr. B.B. Houx acted as secretaries of the working group.

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