

# Coletânea Nacional sobre Entomologia

Mônica Jasper  
(Organizadora)



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## APRESENTAÇÃO

Com muito orgulho apresentamos a “Coletânea Nacional sobre Entomologia”. São doze capítulos que abordam trabalhos, pesquisas e revisões de forma ampla acerca deste conhecimento. A obra reúne trabalhos de diferentes regiões do país, analisando a área da Entomologia sob diferentes abordagens, que incluem levantamentos populacionais de insetos benéficos e de insetos pragas, e também manejo integrado de pragas na agricultura. É necessário conhecer esses temas sob diversas visões de pesquisadores, a fim de aprimorar conceitos de coexistência, relações interespecíficas e desenvolver estratégias de manejo de insetos com o menor dano ambiental e social. O esforço contínuo de pesquisadores e instituições de pesquisa tem permitido grandes avanços nessa área. Assim, apresentamos neste trabalho uma importante compilação de esforços de pesquisadores, acadêmicos, professores e também da Editora Atena para produzir e disponibilizar conhecimento no vasto contexto da Entomologia. Desejamos com essa publicação disseminar informações extremamente relevantes e ampliar os horizontes da Entomologia.

Mônica Jasper

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## INSECTS FOR HUMAN CONSUMPTION: CONSUMERS' PERCEPTION ON THE IDEA OF EATING INSECTS

**Eraldo Medeiros Costa Neto**

Universidade Estadual de Feira de Santana –  
UEFS

Feira de Santana – Bahia

**Thelma Lucchese Cheung**

Universidade Federal de Mato Grosso do Sul –  
UFMS

Campo Grande – Mato Grosso do Sul

**ABSTRACT:** There are many reasons by which humans consume or reject insects as food. On one hand, the cultural issue explains the acceptance of such consumption, but on the other hand there is strong rejection from those who claim that insects cannot be considered food. Wide consumption and production are encouraged in order to promote food safety, as well as more environmentally efficient animal farming. Although the consumption of insects is recognized by consumers in urban centers as a consumption of Indigenous or traditional peoples, this practice is part of the Brazilian food history. Aiming to know the perception about insect as a food item in Brazil, a group of 130 people which live in an urban large city on center-west were interviewed since they are recognized as the largest consumers of fat meat in the country. The similarity analysis showed that the highest organizer expressions of the mental representations related to the were “no”

and “disgust”. The consumers’ perception had a structuring role in the way they reacted to the stimuli presented at the questionnaire. It is possible to affirm that marketing strategies will be compromised if they do not take into account the symbolic aspects of food.

**KEYWORDS:** innovation, consumer behavior; edible insects; Iramuteq.

**RESUMO:** Existem muitas razões pelas quais os seres humanos consomem ou rejeitam insetos como alimento. Por um lado, a questão cultural explica a aceitação de tal consumo, mas, por outro, há uma forte rejeição daqueles que afirmam que os insetos não podem ser considerados alimentos. O consumo e a produção em larga escala são encorajados para promover a segurança alimentar, bem como a criação de animais com maior eficiência ambiental. Embora a ingestão de insetos seja reconhecida pelos consumidores nos centros urbanos como um consumo de povos tradicionais, essa prática faz parte da história da alimentação brasileira. Com o objetivo de registrar a percepção sobre insetos como alimento no Brasil, um grupo de 130 pessoas que vive em uma grande cidade urbana no Centro-Oeste foi entrevistado por serem reconhecidos como os maiores consumidores de carne gorda do país. A análise de similaridade dos dados mostrou que as expressões organizadoras

mais altas das representações mentais relacionadas com os insetos eram “não” e “repugnância”. A percepção dos consumidores teve um papel estruturante na forma como reagiram aos estímulos presentes no questionário. É possível afirmar que as estratégias de marketing estarão comprometidas se não levarem em conta os aspectos simbólicos do alimento.

**PALAVRAS-CHAVE:** inovação, comportamento do consumidor, insetos comestíveis, Iramuteq

## 1 | INTRODUCTION

The regular eating of insects is known as entomophagy. These organisms are part of the ordinary feeding habits of a great variety of animals, including some species of insects themselves. Humans, as primates, have also developed a very deep interaction with insects as food resource throughout history of mankind (COSTA NETO, 2014; RAMOS-ELORDUY et al., 2009). Approximately, three thousand ethnic groups from 120 countries have been recorded as making use of many species of edible insects and their products, such as honey (COSTA NETO, 2014). The use of insects as food by human societies remains a tradition in different socioeconomic systems not only in Latin America but also in other continents, mainly in Africa and Asia (COSTA NETO, 2015).

According to the **Food and Agriculture Organization** of the **United Nations** (FAO, 2015), two billion people in the world are insect consumers. Although FAO estimates that 1.900 insect species are edible, it is recognized that their potential as food is underexplored in the world. Nonetheless, the nutritional, environmental and social aspects of the insect production justify an incentive to entomophagy. Insects are a good source of protein, healthy fat and a diversity of minerals of which iron, magnesium, potassium, and zinc gain prominence in importance (RAMOS-ELORDUY et al., 2006). Therefore, insect production can be an alternative to small farmers since it does not need large areas or massive investment in technology. Through a document prepared by researchers at the Dutch University of Wageningen, FAO (2015) regards the production of insects as way to mitigate food insecurity.

However, the same document issued by FAO (2015) recognizes that the consumption of insects is interpreted as food taboo, especially at western societies. Despite being a food source for humans, the intake of insect “meat” causes disgust and is usually regarded as a primitive feeding practice (COSTA NETO, 2014). The decline in insect consumption in many societies in the modern era, and more recently in contemporary times, explains the change in judgment and the claims that the practice is seen as a food habit of primitive peoples. Although many edible species are considered a delicacy, even a gourmet food in some cases, Costa Neto (2014) recalls that in many cultures that have been insect eaters in the past, they currently marginalize the choice of insects to the detriment of other consumption options, and limit the inclusion of these

organisms in their current choices.

According to some studies (VERBEKE, 2015; DEROY et al., 2015; TAN et al., 2015; SCHOUTETEN et al., 2016; BALZAN et al., 2016) consumer acceptance is the biggest obstacle to insect intake as a safe source of protein. Even in insect-consuming societies, this intake has decreased due to the “westernization” of food as a consequence of the entry of cheaper and processed foods.

Considering the wide range of cultural and symbolic meanings of the different food choices and focusing on the case of insects for human consumption, the main purpose of this article is to present information declared by individuals living in the Midwest region of Brazil about their perceptions of these animals and of their intake as a potential food, both determined by and because of their culture, which is based largely on the intake of fatty meat. In order to reflect upon the interviewees’ perceptions, we used some food sociology and anthropology approaches which explain food choices from social, affective, behavioral, cultural, and environmental dimensions.

## **2 | FOOD PERCEPTION WAYS AS OBJECT OF STUDY**

In order to understand how social and domestic consumption are organized, how people classify foods into edible and inedible, and which practices are internalized in certain social groups eating habits, one should consider food choices as ways of communication between individuals and their social groups. Humans are omnivorous beings who feed on meat, vegetables and their symbols (FISCHLER, 1995; RAUDE; FISCHLER, 2014). The feeding act communicates social identities (POULAIN, 2004). Thus, if we want to understand why a kind of food can be easily accepted or bravely rejected, even among individuals of the same society, it is necessary to consider that food choices can be determined by biological, physiological and, especially, cultural aspects (the symbolic meaning of food is shared socially). As it is consumed, food must trespass the barrier of the body ensuring that such aspects are thought about as well as incorporated (POULAIN, 2004).

Thus, returning to the core issue of this article, considering insects as food source available in nature, with proven nutritional value, we wonder why these animals do not have food status for many consumers.

The rules or guidelines of what should be ingested do not follow a practical order and can even vary within the same society. Many of the food consumption habits in daily meals are customary, ordinary or even equal. However, considering the act of feeding as trivial (due to its repetitive character) implies in neglecting complex decisions determined by social factors that have nothing to do with compliance or unreflective repetitions. Moreover, throughout the selection process, you can find hierarchies established by consumers concerning those foods with higher or lower potential to reflect the self-image of individuals in their social environment (RICK; MARSHALL,

2003; CHUNYAN; BAGOZZI, 2013; BIRCH; LAWLEY, 2014).

As stated above, while we recognize the influence of a set of material restrictions on food choices, a complex system of social and symbolic functions influences consumer behavior. Thus, it is interesting to consider the interactions between social representations, food patterns and the behavior of individuals as they make their consumption decisions. Food models consist of a set of accumulated knowledge passed on from generation to generation, which influences product selection, preparation modes, food types, and consumption rituals (RAUDE; FISCHLER, 2014). Furthermore, each model must be understood as a set of symbolic codes that reveal different value systems from groups of individuals in a given social group (social representations) and, for that reason, these models may, for example, represent a health, pleasure and aesthetics tool (POULAIN, 2004; AURIER; SIRIEIX, 2009; CHUNYAN; BAGOZZI, 2013; BIRCH; LAWLEY, 2014; RAUDE; FISCHLER, 2014).

As mentioned by Lévi-Strauss (2004), in order to be categorized as edible, a food item should be good for eating and as well as being thought of as such. In the feeding domain, the determination of what can be ingested, or what can really be considered as food, does not depend on nutritional aspects. According to Maciel (2013), man “eats all kinds of things, but does not eat all things”. The rating system of what is permitted and forbidden has to do with the local culture, that is, to what is culturally defined as edible. This classification, which connects individuals in the groups to which they belong, is able to establish different relationships and build walls and bridges (DOUGLAS, 1976).

Cultural values, norms and food taboos are shared and become meaningful for individuals through socialization (LANGDON; WIJK, 2010). Culture is the element which sets the classification system, defines the schedules, techniques and environments where food can be found and consumed. For instance, the concept of good, strong, weak and light food may represent a way to classify, organize and value the various types of food (WOORTMANN, 2009).

In a context of world population growth, many challenges are imposed on food sector actors as to what will be offered and on forms of agricultural production for food purposes. Specifically for the production of animal protein, the increase in the number of animals raised and slaughtered is criticized for its environmental cost, such as the deforestation to increase productive area, and due to the volume of water ingested by livestock. Taken as a trail of innovation, edible insects appear as an alternative source of animal protein to humans. However, as mentioned above, mainly for Westerners, two important barriers are imposed: the prejudice to consume these creepy crawler creatures, and the lack of legislation for the production, processing and distribution of insects to humans. But effectively, what will motivate people to find a substitute for animal protein? The lack in the market (we will have less supply of the proteins now consumed), moral problems (no longer want to consume animals for mercy), sustainability (problems related to intensive production), or equity (products from different production models, and fairer)?

To answer these questions, some results of a research conducted by Gallen, Pantin-Sohier and Peyrat-Guillard (2018) are presented. The work was carried out in France, aiming to know the cognitive mechanisms of French consumers in relation to the acceptance of a discontinuous food innovation, the case of edible insects. According to these authors, insects are treated as innovation of discontinuity because they are new to the French people because they are not part of their food culture. In France these animals are classified in the category of “not consumed by my culture” (CORBEAU; POULAIN, 2002). To think about the intake of insects is to provoke a rupture with the mental representations of these individuals and to encourage new behaviors in an alimentary model. Gallen and his colleagues explain that knowing the cognitive mechanisms of individuals allows us to understand their difficulty in analyzing a product proposal that, according to their existing mental category, is not related to the experiences already experienced. To do this, one has to make them think about how much the acceptance of innovation may represent changes in their consumption behavior and how much of this will be interpreted as a benefit or not.

Food culture determines the cognitive mechanism of individuals, as well as the food classification as edible and inedible, explaining the difficulty of introducing new unfamiliar foods into the food repertoire. According to Rozin and Fallon (1980), in western culture there are three main motivations that guide the decisions of rejection of the individuals in relation to what they judge as inedible, being: some sensorial properties (for example, bitter taste, greenish color for meat); the ability to anticipate the consequences of ingestion of something they think will harm them (rejection can lead to nausea, allergies and illness); and the judgment of what they consider as ideal to be consumed (rejection of moral order, of what they believe is not good to be ingested). In this way, it is easier to understand why in many studies carried out with consumers on the acceptance of innovative foods the great potential for rejection is often justified by judgments regarding taste, texture, unpleasant odor or a disgusting texture (PLINER et al., 1993).

Rozin and Fallon (1980) still explain that this aversion is, in general, an innate response of human beings to the novelties furthest from what is familiar to them. This is a mechanism of survival, preventing the consequences of food intake that can be harmful. The anticipation of consequences is linked to the principle of incorporation, according to which “we become what we eat” (FISCHLER, 1990).

Human beings are omnivorous. Because they must vary their diet for not being able to extract everything necessary to be well nourished from a single type of food, such as the herbivores, they live in a constant paradox. The need to vary their food sources to survive causes anxiety and fear of new, unknown and potentially dangerous food, creating what Fischler (1995) calls food neophobia. Therefore, innovations in the food sector are more accepted when individuals recognize something familiar in the new product. This fear of the new and the anxiety when tasting unfamiliar food can vary from culture to culture and between groups of individuals in the same society.

It is interesting to know that the more an innovative food goes through transformations that bring it closer to others more common to consumers, the more judgments will be made based on sensory descriptors (e.g. taste, smell and texture). When insects are presented whole or poorly processed, and are initially considered to be “inedible by my culture”, the adoption of some familiar tastes may induce more favorable attitudes and a positive intention to consume the product. Working with consumers on the affective components of the attitude, using marketing actions (sensory information about the product, images, consumer experiences in marketing channels) are also important procedures that help the acceptance of a discontinued food innovation (GALLEN et al., 2018).

In the context of the present study, it was interesting to record the perception of a group of Brazilians about innovative food. Thus, when insects are suggested as an alternative source of animal protein in a context where the consumption of beef prevails, what profile of people would be apt to consume them, and under what conditions and product presentations?

### 3 | METHODOLOGY

Based on the evaluation of individuals in a specific population group, this exploratory and qualitative study conducted data collection about the different ways of perceiving insects as food through structured interviews (MATTAR, 2008).

In a non-probability sample, 130 residents of Campo Grande, a capital city in the Brazilian savannah, were interviewed. They are all connected to the same professional environment, allowing researchers to observe their social relations in similar contexts. In order to choose the participants of the study, stratification was carried out based on gender and educational level. It should also be stated that the average age was 25 years, as young adults are less neophobic and better accept innovations according to Tuorila et al. (2001) and Verbeke (2015). The survey was submitted to be approved at the National Commission for Research Ethics in Brazil – CONEP (process number: 2.437.712). It is a committee of the National Health Council (CNS) which was created through Resolution 196/96. Such committee aims to implement norms and guidelines for regulating research that involves human beings. Interviewed people were informed about the goal, method, funding sources, researchers’ institutional affiliations, and about the benefits of the study. It is important to state that the participation was voluntary, and interviewees should give their consent to participate.

It is known that the consumption of insects is unfamiliar to the surveyed population. Therefore, it was necessary to make these individuals aware of the concept of this innovative food product. This made it possible to perform analysis and comparisons on their attitudes and perceptions regarding insect consumption, and thereby identify more or less neophobic manifestations.

Regarding the research tools, a 46 (open-ended and multiple choice) questionnaire

was applied individually. We opted for carrying out a survey which investigated the sample's behaviors, attitudes, perceptions, motivations, as well as their demographic characteristics and lifestyle (MALHOTRA, 2001). The survey questions aimed to obtain information about: what the respondents thought about consuming insects; the acceptance in trying an edible insect (body part, animal texture, cooking mode); and the words that best represented what they thought when they imagined themselves eating insects.

This article only shows results obtained with the treatment of the open-ended questions. The statistical analysis chosen in this study was the similarity analysis. Performing similarity analysis occurs when a data matrix crosses words that have been reduced to their roots in rows and columns. The matrix will show the number of times that one word is associated with another in a same text segment. Thus it was possible to identify the frequency of the words mentioned, the quoting order and the connection between the most representative words of their beliefs and social norms. All the treatment through this analysis was carried out by the free software IRAMUTEQ (CAMARGO; JUSTO, 2013).

The figures presenting the cross-examining results will show the connection between a group of statements that was mentioned more often than the average of other statements. The words, verbs or adjectives that may appear more prominently (larger in size or in bolder type) in the figures will indicate that a statistically significant number of respondents used the same expression to represent their perception concerning the proposed questions. As mentioned by Rozin et al. (2002) regarding researches on the semantic organization of long-term memory, and according to the spreading activation model (ANDERSON; BOWER, 1973; COLLINS; LOFTUS, 1975; ANDERSON, 1976), memories and meanings are assumed to be arrayed in associative networks, such that activation of any particular word or concept, represented at a particular node in the network, activates neighboring nodes, and so on. Rozin et al. (2002) state that “both semantic similarity and frequency of activation determine the strength of node links and hence these two factors should be principal determinants of free associations”. Thus, the central words, which represent the knots, show how the social representations of the studied food are organized. The other expressions derived from the central knots will present the connections with the established categories (WACHELKE, 2007). Independent variables, such as socio-demographic and economic ones, were chosen to characterize a text.

#### **4 | RESULTS AND DISCUSSION**

When asked what the 130 respondents thought about the act of consuming insects, it was possible to realize that the organizing element of the mental representation was the word “no”, that is, the rejection or attitude of disgust. The illustrative graphs of the relations that were formed around the main element of the representation allow us to

make some reflections. The word “no” is associated with different ways of perceiving the consumption of insects. Analyzing the similarity relation between the word “no” and the lower part of the tree, important links are observed between the attitude of denial and the reflections on the act of eating the insect, as well as the difficulty in thinking about this intake.

Another link which is less representative than the ones mentioned is the denial of consumption in Brazil. Many participants stated that insect consumption is not widespread in Brazil and that the benefits of this intake must be proven. Analyzing the top of the tree, one can see a similarity relation between the word “no” axis with the elements “protein consumption, being nutritious, interesting and yet again, being culturally accepted”. Terms referring to cultural issues seem to explain the negative attitude towards the consumption. The fact that they can be “nutritious” or a “healthy protein” seems strange to them, even though they think this consumption is justifiable in other cultures. There is a negative attitude concerning the possibility of an insect being an alternative for consumption in the future.

As far as educational level is concerned, this first tree (Figure 1) shows that the participants claimed to have higher education (1), post-graduation courses (2), master’s degree (3), and PhD (4). On the gender coding, female is 1 and male is 2. When colors are represented on the trees, it should be understood that they will indicate an amount of answers for a certain educational level or gender which is significantly more frequent than all the other answers.

Some studies show that there is a negative correlation between the neophobia degree and the educational level (FRANK; KLAAUW, 1994; MEISELMAN et al., 2010). Also, according to Lambert et al. (2005), the willingness to accept innovative or totally unknown food by consumers who declared to have a university degree increased. In our study, it was found that individuals who reported having a university degree tended to associate the act of consuming insects with the verb “prefer” linked to meat, whereas insects were linked with the words “strange” and “nutrients”. The participants with higher educational levels had a less negative perception, although the word “disgusting” came up in their statements along with “think”, “consider”, “nutritious”, “choice”, and “hunger”.



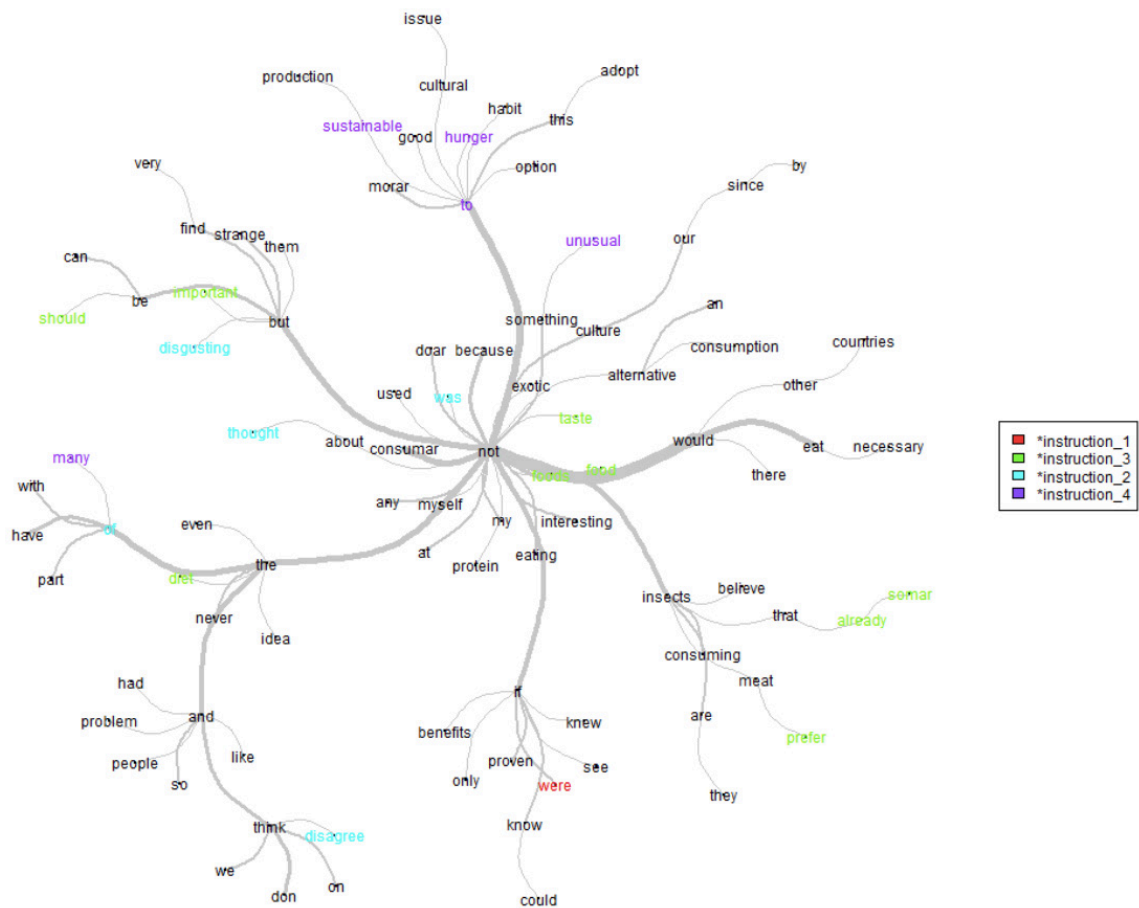


Figure 1 - Similarity tree corresponding to the question “What do you think about consuming insects?”. Level of education as an independent variable.

When the gender variable is chosen for the analysis of statements on the respondents’ opinion about the act of consuming insects, Figure 2 shows that their representation organizing axis is the word “culture”, which was repeated more often by females. There were no significant expressions for males. The vast majority of women who answered the question “what do you think about the consumption of edible insects?” stated that the culture explains the food consumption behavior. The meaning of culture for them could be better understood by observing the words that are attached to the central element (Figure 2). Culture is associated to “belief”, “need” and “hunger”. In this case, it was considered as an interesting protein for people from a particular culture.

Indeed, results of some empirical research conducted in different Western cultures showed that there is no consensus between gender differences concerning the most neophobic trend (FRANK; KLAAUW, 1994; MOONEY; WALBOURN, 2001, NORDIN, 2004; MEISELMAN et al., 2010). However, Yamamoto and Lopes (2006), Sanjuán-López, Philippidis and Resanoezcary (2011) and Goulart and Lucchese-Cheung (2014) found that women tend to try more innovative food which reduces their time in the kitchen, ensures good nutrients for family consumption and brings aesthetic benefits for their body. On the other hand, these authors noted that Western men generally prefer traditional food, known brands, giving priority to food hedonism.

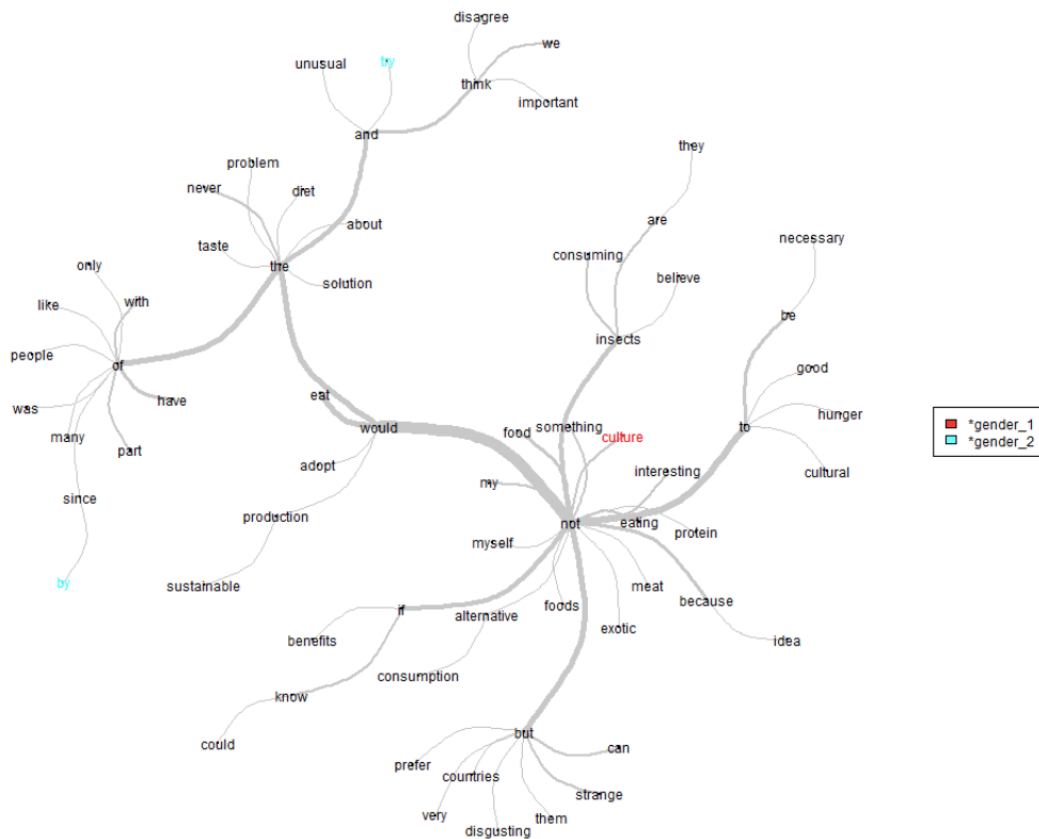


Figure 2 - Similarity tree corresponding to the question “What do you think about consuming insects?”. Gender as an independent variable.

Considering the hypothesis that they would accept eating insects, at least as an experience, they were encouraged to think about ways of consumption and animal preparation, in addition to parts of the body that they would accept eating. The elements responsible for the organization of representations (rules, ways of thinking about the body parts that could be eaten, cooking modes, and animal preparation) are better represented in Figure 3, by another organizing element. The word “no” still plays an important role in insect representation as food. This aversion attitude is connected with the impossibility of thinking about the animal body parts, texture and preparation. On the other hand, the word “fried” appears to be quite relevant in the representation arrangement. When the respondents made statements about the body parts and modes of preparation, it was noted that the previous aversion attitude did not occur in this question. Most of them repeated quite often that if the animal were presented to them “fried”, its consumption might occur. Regarding body parts, elements such as “head”, “legs” and the “body” itself appear connected to the “fried” organizing element. Respondents refer to these parts as being difficult to incorporate. If the texture is “soft” the preference is for them to be “mixed with food”. As for the modes of preparation, the most representative words were “powder”, “roasted”, “crunchy”, and “dry”. These results corroborate the studies of Deroy et al. (2015), Tan et al. (2015) and Balzan et al. (2016).

Analyzing Figure 4, it was observed that, compared to males, females showed a



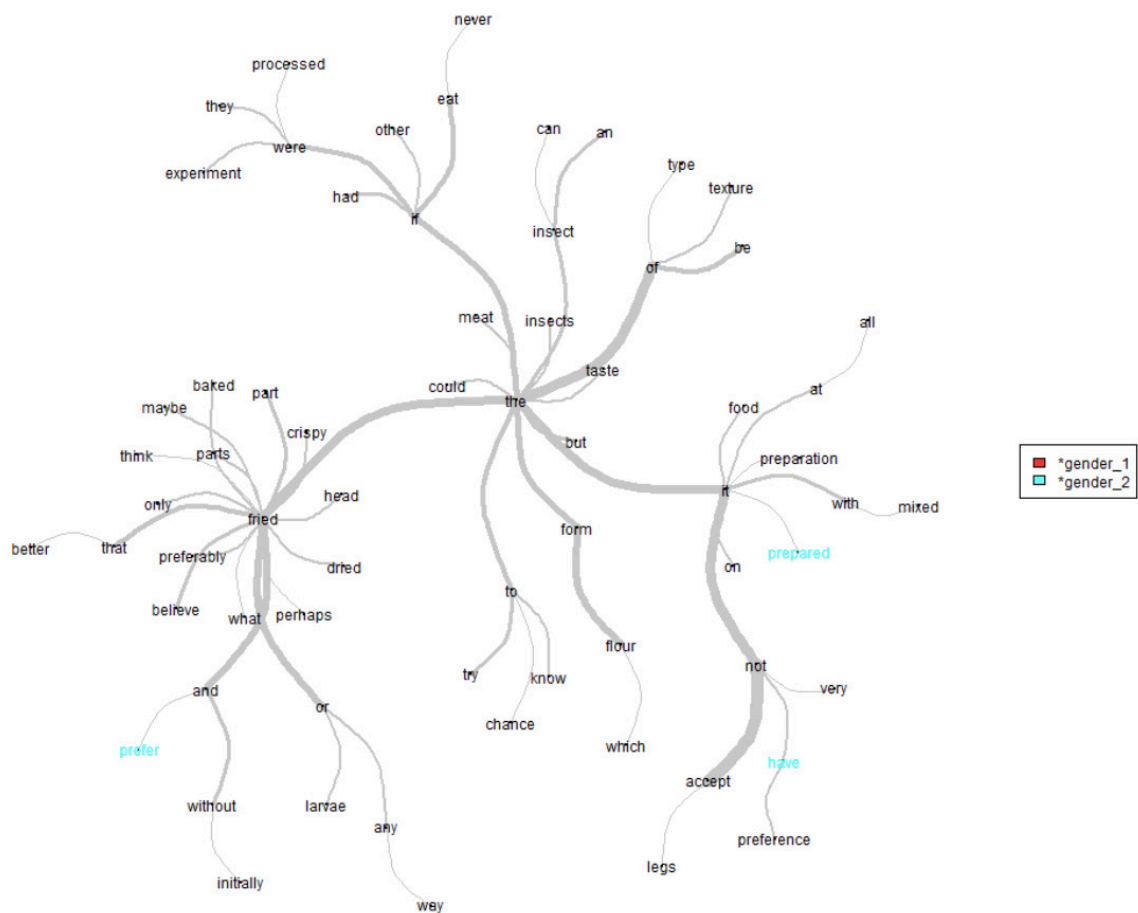


Figure 4 - Similarity tree corresponding to the question “How would you accept trying an insect? Which parts of the body? Which preparation? Which cooking modes?”, with gender as the independent variable.

The axis of the emotion representation was organized around the word “disgust”. And it is possible to see significant links as “vomit”, “repulsion”, “strange”, “disgusting” and “fear” connected to this axis. This corroborates Fischler’s (1995) explanation on the need and difficulty of omnivores to innovate their food. Less representative links in bold can illustrate the author’s speech on the omnivore’s paradox, which generates food anxiety, through the expressions “challenge”, “desperation” and “anxiety”. However, according to this author, there are different levels of neophobia generated by the need for food variation. Thus, the group which represents highest level of education repeated expressions that could indicate a less intense neophobia level, but which are not representative of the sample, when the words “curiosity”, “novelty” and “interesting” appear. The individuals who reported having intermediate levels of education showed the highest level of food neophobia through the words “horror”, “hunger”, “need”, and “sickness”.

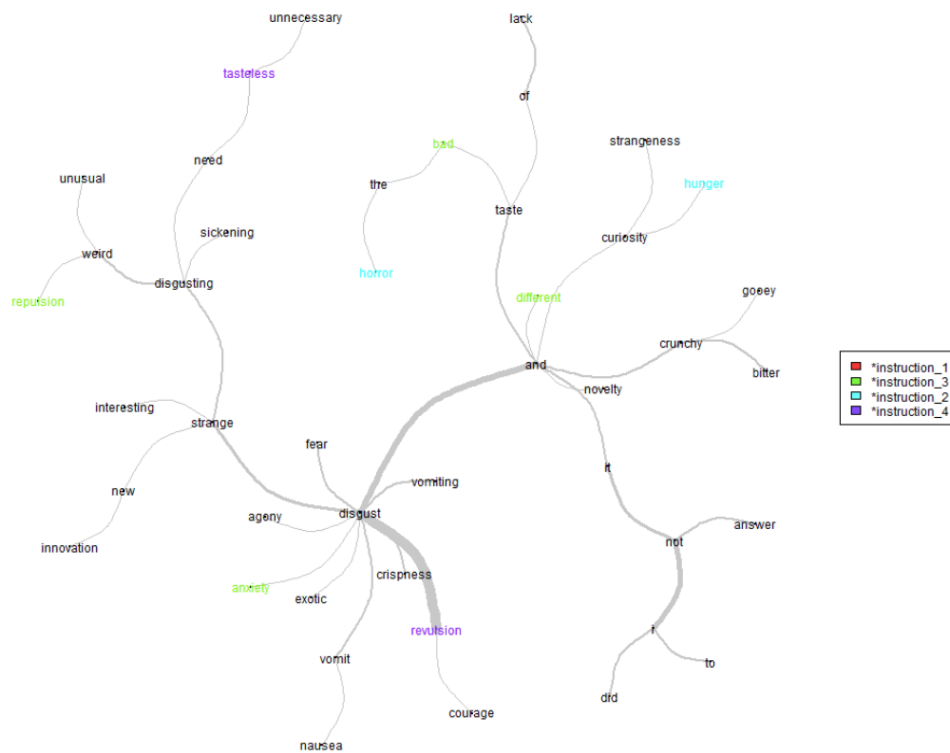


Figure 5 - Similarity tree corresponding to the question “Quote words that best represent the emotions felt when thinking about insect incorporation”. With level of education as an independent variable.

Other observations could be made as we analyze the tree having gender as a determinant variable (Figure 6). For women, more significantly than for men, the most prominent feeling related to the structural axis of representation was expressed by the word “disgusting”. For men, the overall emotion was highlighted by the word “unnecessary”. As there is no consensus in Western literature concerning the occurrence of neophobic attitudes determined by the individuals’ genders, it becomes difficult for this study to seek theoretical explanations for the results found.

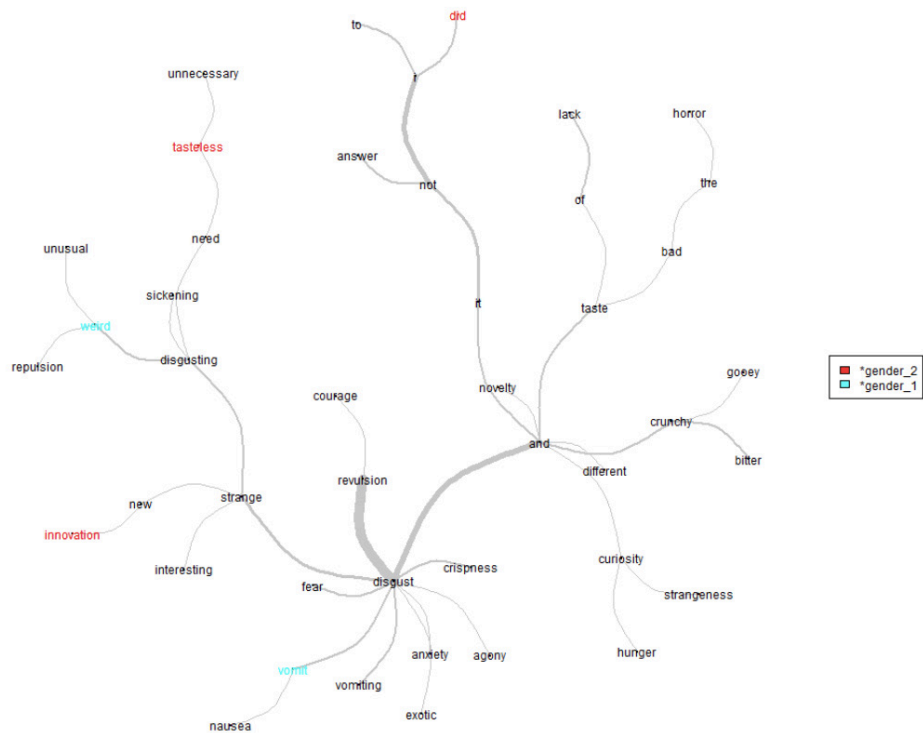


Figure 6 - Similarity tree corresponding to the question “Quote words that best represent the emotions felt when thinking about insect incorporation”. With gender as an independent variable.

The results allowed the symbolic and communicative function of food to be seen through the consumers’ speech concerning their perception of insect incorporation. As presented, the animal meanings as food were more often found in the individuals’ evocations related to its nutritional value and in no way to its hedonistic sense. The words characterizing the symbolic sense of the animal for consumers represented their beliefs and attitudes since they organized their representations.

## 5 | CONCLUSION

The main reasons for which the studied sample did not give insects food status was the difficulty in characterizing them as edible or an alternative protein source for humans. Through the similarity analyses, the calculation of the distance between the strongest links of the organizing element of representations and the other expressions allowed us to understand the most significant perceptions expressed by the consumers. The most striking opinions or expressions were “no” and “disgust”. Thus, it will not be enough for public and private sector agents, who are interested in the insects supply chain management, to advertise its advantages; i.e., insects have good flavor, they are rich in protein and minerals, their production is sustainable with reduced water consumption compared to other proteins and low gas emission. Instead, they have to convince the consumers and make this food incorporation acceptable.

It would be interesting to conduct this research in other Brazilian States in order to identify different attitudes about insects as food, as cultural influences explain such different approaches. For example, a food which was rejected in a region could be

accepted in other. Finally, insects to be consumed as food must be good to eat and think of.

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## **SOBRE A ORGANIZADORA**

**MÔNICA JASPER** é Doutora em Agronomia pela Universidade Estadual de Ponta Grossa (2016), com graduação e Mestrado (2010) na linha de pesquisa Manejo Fitossanitário. Professora na Universidade Estadual de Ponta Grossa e no Centro de Ensino Superior dos Campos Gerais, atuando principalmente nas disciplinas de Entomologia Geral e Aplicada, Manejo de culturas, Morfologia e Fisiologia Vegetal, Fitopatologia Geral e Aplicada, Biologia, Genética e Melhoramento Genético e Biotecnologia.

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