

Genetically Modified Mosquitoes in the Fight Against Malaria: Representations of a Controversial Biotechnology in the Village of Souroukoudingan in Burkina Faso

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ABSTRACT

Biotechnology is now an important means of tackling some of humanity's problems. They are proving their worth in areas such as agriculture, by improving productivity and crop yields, and health, by combating certain diseases. In Burkina Faso, conventional means of combating malaria have shown their limitations, so researchers have turned their attention to the biotechnology of genetically modified mosquitoes as a potential means of eradicating this disease, which is still endemic in the country. The aim of this study is to contribute to a better understanding of how the people of Souroukoudingan perceive the genetically modified mosquito as a means of combating malaria. The methodological approach used was qualitative. We collected data through a review of grey literature, individual semi-structured interviews and focus groups. Data was collected from forty people individually and in two focus groups. The results show that the people interviewed have different perceptions of genetically modified mosquitoes. These representations are motivated by the experiences and expectations of the populations with regard to the project which aims to introduce the genetically modified mosquito into the basket of malaria control tools. They are also determined by people's perceptions of malaria itself.

HIGHLIGHTS

- Biotechnology is highly controversial in the world and in Burkina Faso.
- It is being experimented with through genetically modified mosquitoes in the fight against malaria
- It is the subject of several representations
- These representations are determined by several factors, including the representations that people have of malaria itself.

Keywords: Genetically modified mosquitoes, malaria, biotechnology, representation, Souroukoudingan

Genetic engineering is a rapidly expanding technology. It is used in a variety of fields, and according to its proponents is seeking to find lasting solutions to humanity's various problems. Genetic engineering is used both in agriculture and in the fight against certain diseases. Many countries use it to combat agricultural pests and

certain diseases. It has already proved its worth in countries such as Malaysia, the Cayman Islands

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and Brazil in the fight against dengue fever (Bonny, 1998; Manga 1999; WHO, 2020; Barry, 2020). In Burkina Faso, biotechnology is a promising tool in the fight against malaria. Malaria is a parasitic disease caused by the bite of an infected female mosquito of the genus *Anopheles* (EIPBF, 2014). Indeed, despite several efforts to curb malaria, it still remains a public health problem in Africa and in Burkina Faso, where it is endemic with a seasonal outbreak from June to October. Burkina Faso is combating malaria through a programme known as the National Malaria Control Programme (PNLP), which focuses on preventing and treating cases of malaria. Despite this programme and the efforts of a number of partners, malaria remains the main cause of hospitalisation, consultations and even mortality, with children under the age of five being most at risk (EIPBF, 2014). Consequently, this gloomy situation has led the WHO and its partners to support the idea of developing more tools to combat this disease more effectively, including the need to use genetic engineering biotechnology. Burkina Faso, a country where malaria is still fatal, has not remained on the sidelines of this search for additional tools to combat malaria. The Target Malaria project is a research project aimed at developing genetically modified mosquitoes to control the disease (Barry, 2020). The use of this biotechnology comes at a time when people have recently had a more or less controversial experience with a typical biotechnology in the field of agriculture, namely genetically modified cotton. Indeed, given the existing controversies surrounding genetically modified organisms, it is necessary, in the process of developing this biotechnology for malaria control, to take an interest in the social representations people have of these genetically modified mosquitoes. This makes it possible to understand not only people's motivations for accepting these mosquitoes, but also their interpretations of them.

This report is structured as follows. It begins by highlighting the methodology used to conduct the research and the environment in which it was carried out. Next, it shows the various results that emerged from the field survey. Finally, the article analyses and discusses the results obtained.

MATERIALS AND METHODS

In this section, we present the geographical and

administrative situation of the area where the study was carried out. Secondly, we show the methodological approach adopted to achieve the results.

Research Environment

This research was conducted in the village of Souroukoudingan. Located at 28 km from Bobo-Dioulasso (Burkina Faso) on the Bobo Banzon road, it is part of the Karangasso Sambla department and the Houet province. It is bordered by the following villages Soungalodaga and Bama to the north, Koumbadougou to the west, Bana to the east, Bouendé to the south-west and Sambla-Toukoro to the south.

Founded by a farmer called Sinoa Sogbowein, the name of the village comes from the fact that the site was located near a cave that was home to hyenas. Souroukoudingan therefore means "hyena hole" in Dioula. Several village chiefs have succeeded one another at the head of the village and the succession to the chieftaincy is from brother to brother. If necessary, the eldest son of the family takes power.

The village has a population of 1,522, according to a census carried out by the Karangasso Sambla prefecture in 1998. The population is made up of 774 men and 748 women. It includes the following ethnic groups: Sambla, Mossi, Peulh, Bobo, Samo, Dagari, Dafing and Nouni. The Sambla are the indigenous people and the most numerous. There is very little rural exodus from Souroukoudingan. However, the village receives 2 to 5 migrants a year.

The population of Souroukoudingan is mainly made up of farmers. Indeed, the main and historic activity of the locality is agriculture (96.6%). Other activities include livestock rearing and trading. Cotton is undoubtedly the most widely grown crop in the commune of Karangasso Sambla, and by extension in the village of Souroukoudingan. It is followed by maize, millet, sorghum, groundnuts, etc. (INSD, 2007).

1. Choice of Research Environment

Given that Souroukoudingan is the site of the Target Malaria project, which aims to develop genetically modified mosquitoes, and that this population has also had experience with genetically modified cotton, a biotechnological tool that has failed and



is highly controversial in Burkina Faso, our study focused on the entire population of this village in general and certain categories of people in particular.

Methodological Approach

Given that the aim of our research is to highlight people's social representations of the genetically modified mosquito, it seemed more appropriate to base our methodological approach essentially on a qualitative approach. Indeed, our choice of a qualitative approach was dictated by the requirements of our subject of study, which seeks to understand and describe in a scientific manner people's representations of the biotechnology of the genetically modified mosquito. In addition, the scarcity of literature on this subject also played a part in the choice of method adopted for this study, since, as M.F. Fortin (2010: 457) argues, the description of phenomena is favored in qualitative research when they are little known or little studied.

The data was collected using several techniques. We conducted semi-structured individual interviews and group interviews. In addition to these techniques, we also collected data through a review of grey literature. The interview guide and reading grids were used as data collection tools. The data were collected using a dictaphone and then transcribed in full using Microsoft Word. The transcribed interviews were processed and analyzed using QDA Miner, a qualitative data processing software programme. In total, we conducted 40 individual interviews and 2 focus groups. The data was collected to saturation point and sampling was carried out on a purposive basis. As an analytical model, we used the concept of systems of social representations as defined by D. Jodelet (2003: 9), who considers social representations to be a form of knowledge that is socially developed and shared, with a practical aim and contributing to the construction of a reality common to a social group.

RESULTS AND DISCUSSION

Results

1. The Genetically Modified Mosquito Project: A Project with Multiple Representations

The people of the village of Souroukoudingan have

several views on the genetically modified mosquito. In fact, the project in charge of developing this biotechnological tool has, as part of its process, put in place a community participation mechanism aimed at integrating the local population into the running of the project through activities as well as information and awareness-raising sessions for the village community. The data collected show that not all of the Souroukoudingan population is involved in this scheme and that, as a result, people's perceptions of the project and its subject matter, genetically modified mosquitoes, are also divergent. The results also show that the people who participate in the project's community participation mechanism also have divergent representations.

2. The Definition Attributed to the Genetically Modified Mosquito by the People of Souroukoudingan

With regard to representations of the mosquito as a modified being, the opinions of a certain category of our respondents were almost unanimously convergent. These were the people who were involved or had already been involved in the project's activities. They believe that genetically modified mosquitoes are castrated mosquitoes whose eggs cannot hatch, or even if they do hatch, the majority of the young will be male mosquitoes that cannot transmit malaria. This is what this interviewee had to say:

It's a modified male mosquito. They modify the genital apparatus of male mosquitoes in such a way that when the malaria mosquito mates with the female, the majority of their offspring will be males, and as they say that male mosquitoes don't transmit malaria, the disease will diminish (T.S.O., 29, mosquito catcher, interviewed on 22/11/2022).

Another added

The MGM is a transformed mosquito. In other words, it has been transformed so that it cannot mate normally with normal mosquitoes, our mosquitoes. If they do that, they'll reduce the number of mosquitoes and their strength, and that's what's going to cause malaria to end up here. We don't have any other thoughts about mosquitoes, we just know that it's to fight



malaria (T.G.S., 30 years old, mosquito catcher, interviewed on 12/11/2022).

In addition to the above opinions, another player drew comparisons with agricultural biotechnology, saying: “GMOs are the fruit of research:

GMOs are the fruit of research. You know there are chickens that lay eggs but are not fertile, there is maize that only lasts two months, even though we know it’s for four months, there is also millet for two months, or is it? These too are GMOs. This is the change we want to bring to mosquitoes. Not so that the mosquitoes end up daih, but rather so that we can reduce them so that malaria can also be reduced. (T.F.S., 38, complaint management committee, interviewed on 20/10/2022).

3. The objectives of the genetically modified mosquito

The opinions of the people interviewed on the objectives of the genetically modified mosquito are of two kinds. While some of the people we spoke to thought that the tool being developed in their village would indeed be used to combat malaria, others were sceptical and thought the opposite.

The following verbatims reflect the viewpoint of those who believe that the genetically modified mosquito will indeed be used to combat malaria.

The aim is to fight malaria. As it is female mosquitoes that give malaria disease, they modify the disease so that when it mates with females most of the offspring will be malaria and a small proportion will be female, which will reduce malaria (...).(T.G.S., 30 years old, mosquito catcher, interviewed on 12/11/2022).

Another agrees, saying:

The aim is to carry out research to combat malaria, which is why their research focuses on the mosquitoes that cause the disease. I think that’s very commendable, because I know that they don’t do this in every village. If they’ve chosen our village, we should salute them” (T.G.F., 32, mosquito catcher, interviewed on 12/11/2022).

These points of view are mostly specific to the category of respondents who take part in the project’s community participation activities. Nevertheless, within the same category of respondent, some think that the genetically modified mosquito, although it wants to fight malaria, will not be able to do so because, according to them, malaria is not a disease that is caused solely by the mosquito. According to them, there are several causes of malaria, such as eating foods that are too sweet or too fatty, and eating unripe fruit. To justify himself, one of the people we spoke to said the following:

“(…) the fight against the mosquito is a good thing, but you have to realize that it’s not just the mosquito that causes malaria. When you eat food that’s too sweet or has a lot of oil, you can also catch malaria, so even if the mosquitoes get rid of it, malaria won’t (T.Y., 48; mosquito catcher, interviewed on 14/11/2022).

Another person supported this respondent’s comments by saying the following:

It’s true that it’s good to fight the disease, but you know very well that malaria isn’t caused by mosquitoes alone, so even if they modify the mosquitoes, malaria won’t end. (T.F., aged 46, mosquito catcher, interviewed on 10/12/2022).

For another party, this project cannot aim to combat malaria because, despite its presence, people are still falling ill with the disease. This interviewee said:

I don’t like the GMO mosquito project because malaria still strikes people. Despite all the work they’re doing on mosquitoes, there are still mosquitoes around and malaria doesn’t seem to be much of an issue any more. (T.A., 37, general population, interviewed on 11/11/2022).

Some even think that it’s the new mosquitoes released in the village that are causing malaria to intensify. One respondent supported this view, saying:

(…) we all know that the mosquitoes they release are different from ours. When they release mosquitoes, it’s only diseases that we go to hospital for. They don’t release them during the day, they release them at night in the middle of the village. If these mosquitoes bite you, it makes



you itch until you have to go and fetch yourself. They've already bitten me (...). (T.S., aged 31, general population, interviewed on 20/11/2022).

The same respondent went on to say:

Before, when the rains stopped here, there were no more mosquitoes. Since they arrived here, the mosquitoes bite us every time; they take the mosquitoes from somewhere else and release them on us (...). These mosquitoes can cause itching. The mosquitoes that are released can bite you even if you're under the mosquito net, even if you stick to the net a bit they'll come and bite you from outside. The net itself does nothing for them.

4. Public perceptions of the control of genetically modified mosquitoes

At the end of our interviews, it emerged that some of those interviewed thought that the genetically modified mosquito was not harmful. According to these people, even if the mosquitoes were to become harmful by causing other illnesses in the population, the project managers would be able to recapture all the experimental mosquitoes that had been released into the wild. They see this as a kind of insurance. The following comments are proof of this:

"In case of inconvenience, we can capture all the mosquitoes released. They can control genetically modified mosquitoes because they are marked with a kind of paint and are recognisable (...)", (T.I., 30 years old, mosquito catcher, interviewed on 14/11/2022).

Others, however, believe that these mosquitoes can in no way be controlled. They think that they have already started to cause problems and that the project should be stopped. They believe that it is not possible to recapture the released mosquitoes, as other respondents believe. One resident shared this point of view:

We can already see the disadvantages (...), but I think these people are liars. They say they can recapture the mosquitoes they've released, but how can that be possible? They put paints on them so they can catch them. I don't believe that. If it were up to me, these people would leave here

(...). (T.D., 41, general population, interview conducted on 11/11/2022).

5. Genetically modified mosquitoes and the expectations of the people of Souroukoudingan

Despite the many perceptions that the people of Souroukoudingan have of the Target Malaria project, a research project aimed at developing genetically modified mosquitoes, they have built up their own expectations of the project, expectations that they do not hesitate to emphasise in their speeches. Indeed, it appears that these expectations have influenced the participation and even the acceptance of this project by many of our respondents. As one respondent put it:

... the chief, (...) who died there, he said that the project there, what we are doing there, benefits us, so we have to accept it. Given that the young people of the village are earning a bit of money from it, it's very good that it's helping them, so it's good that they're participating. So we can only pray that the project goes ahead. (T.F.S., 38, complaint management committee, interviewed on 20/10/2022).

This opinion is supported by another of our respondents:

We talked to them about something, like building a house, so if they come they'll be able to live in the house. People in the village will know that something is being done in their area and if a foreigner comes too, he'll know that there's a project here, it's things like that they have to do to give us strength" (T.G.F., 30 years old, mosquito catcher, interviewed on 10/12/2022).

In the same vein, this respondent thinks that the project should be able to help them open their dispensary, especially as it is there to fight malaria, which is a disease. He said:

"They have to help us solve the problem of water and the hospital. As they are fighting the disease, they look like doctors, so all they have to do is help us open our dispensary" (T.S., 49, farmer, interviewed on 22/11/2022).



Another makes no secret of his ambitions when he says:

“It’s because of the money that I’m taking part in the project’s activities as a mosquito catcher. If there wasn’t any money in it, we wouldn’t be able to work, but if there is money, we’ll work”, (T.S.G., 20 years old, mosquito catcher, interviewed on 22/11/2022).

Another makes no secret of his ambitions when he says:

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In the light of the above, we can say that people’s attitudes towards the genetically modified mosquito project are motivated by the direct interests they gain from it. Indeed, the main objective sought by the genetically modified mosquito, which is the fight against malaria, is rarely cited as a factor determining the acceptance of this tool by our respondents.

DISCUSSION

1. Social representations of the genetically modified mosquito

Our results show that our respondents had a variety of perceptions of the genetically modified mosquito project taking place in their village. These representations often differed according to the category of stakeholder surveyed, but were also shared in some cases. They are of several kinds and appear to be sources of motivation that are at the root of the various positions that the populations adopt with regard to this project in their locality and the biotechnological mosquito.

Some of the people questioned about their perceptions of the transgenic mosquito seem to have almost the same point of view. They draw on “lay knowledge” that comes from information they have received either from those involved in the project or from members of the village themselves to explain or define the transgenic mosquito. They believe that the genetically modified

mosquito is either “castrated” or “weakened”, and that it either cannot produce “children”, or that if it does produce children, most of them will be “male” mosquitoes. With this in mind, these respondents, although sometimes sceptical, felt that the project was important because it would help to reduce the number of mosquitoes, and that these weakened and/or castrated mosquitoes were in no way harmful. As for the representations of these respondents concerning the definition of the genetically modified mosquito, our results converge with those of Barry (2020), who shows that the population of Bana defines the “genetically modified mosquito” as being a “sterile male mosquito”, which they designate in Dioula (a local expression) *sozzo kô bôni/*, (*sozzo* = mosquito; *kô* = back; *bôni* = remove, ôter), the literal translation of which is “castrated mosquito”.

However, our results differ slightly from those of Barry (2020) in that they show that people’s perceptions of the term genetically modified mosquito are a factor that modifies the acceptance or acceptability of these mosquitoes and, by extension, of the project.

It also emerged from the results that our respondents had various representations regarding the potential risks of genetically modified mosquitoes and the regulations governing the project. Analysis of our results shows that this category of representation appears to be one of the determinants that guides people’s views on the transgenic mosquito project. These results are of two kinds. There is a category of respondents who think that biotech mosquitoes are to be feared because, in their view, the project’s proponents have no control over the effects that these mosquitoes could have on health. Some respondents in this category thought that these mosquitoes had already escaped their control because, despite the project’s activities, malaria still exists and is more widespread than before. In turn, they would even like the project to stop its activities in their village. These results correlate slightly with those of Barry (2020), who showed that a minority of the Bana population expressed fear of the mosquito release activities, which they considered to be a risky practice for the population. These results must be qualified with those of Barry (2020) because their particularity lies in the fact that in the representations of our respondents the negative



effects of the project are already visible. In addition, the above results converge with those of Joly *et al.* (2000), who show that the debates surrounding the issue of modern biotechnologies give rise to multiple discourses, due to the multiple angles from which they can be approached and the multiple social actors involved (consumers, researchers, NGO activists, industrialists, politicians, etc.). Another author goes in the same direction and confirms our results by showing that the positions taken on GMOs are often no more than a reflection of the general trends of each individual IUCN (2004).

However, in contrast to these results, the specificity of our study lies in the fact that we are dealing with a specific modern biotechnology, the multiple representations of which by our respondents constitute determining factors in their positions with regard to this tool.

In addition, for some respondents, the genetically modified mosquito is not a tool that will make it possible to curb malaria. These views are guided by their perceptions of the causes of malaria. According to them, malaria is a disease caused by several factors other than the mosquito. Others do not even mention the mosquito as one of the causes of malaria. Consequently, modifying the mosquito in order to combat malaria is already a lost cause. These results are confirmed by studies by authors such as Somé and Zerbo (2007) who show us that the mosquito is not in fact perceived as the sole cause of malaria. They show that even when citing the mosquito, people refer to other causes. In addition to this author, the attribution of multiple causes of malaria is also confirmed by Dossou-Yovo *et al.* (2001) quoted by Koudougou (2021, p6) who reveal in their study carried out in Côte d'Ivoire that "*mosquito bites are recognised as the main cause of malaria, but exposure to the sun and eating too much fat are also regularly mentioned*".

Finally, our results highlighted the potential expectations of the Souroukoudingan population with regard to the genetically modified mosquito project. Indeed, it emerged that one of the motivating factors for the people concerning this project is the expectations they have of it. Whether or not people were for or against the project depended on what they hoped to gain from it, either for themselves individually or for the village as a whole. In this way, we agree with Boudon (1979) who shows

that, to paraphrase him, individuals are rational because their actions and choices are guided by an interest, a value and even tradition. The people of Souroukoudingan therefore hope to receive benefits from the genetically modified mosquito project in their village.

It is clear from this data that there is a diversity of representation regarding the genetically modified mosquito. The people we are interested in have mobilised knowledge from their social and professional environment to construct these representations. This is reflected in the theory of social representations as defended by D. Jodelet (2003). These representations prove to be determinants of the acceptance or acceptability of the genetically modified mosquito in the fight against malaria.

CONCLUSION

Conducted in the village of Souroukoudingan, which is located in the rural commune of Karangasso Sambla, the study focused on the representations of the people of Souroukoudingan regarding the genetically modified mosquito. The genetically modified mosquito being tested in the village of Souroukoudingan is the subject of various social representations within this population.

This article shows us that while for some of our respondents this biotechnology is welcome because it will make it possible to combat malaria, others are much more reticent and think that this transgenic mosquito is not only harmful to their health but will also not make it possible to combat malaria because this disease has several other causes. Our results also show that many people have accepted and are participating in this project in their village because their expectations are different from the real objectives of genetically modified mosquitoes, which is to combat malaria.

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