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EDITOR'S LETTER

Welcome to number 27, Volume X of the Journal of Scientific Dissemination of the Universidad Autónoma de Chiapas: Espacio I+D: *Innovación más Desarrollo*.

One year after the confinement or quarantine began in Mexico, due to the COVID-19 pandemic, and having moved the publishing activities outside our facilities, today we present the fifth issue carried out in this way and we want to make a count of the learnings achieved this year, by way of gratitude and tribute to those who during this difficult year did not have the opportunity to continue with us.

As an editorial and university team, we corroborated that solidarity, responsibility, and empathy go far beyond the facilities. Our work was not affected or interrupted thanks to the technical support that the university gave us and the influx of collaborations. For this reason, in this issue, we also share some brief materials that contributed to the national vaccination campaign for teachers, in which the UNACH participated with very positive results and which is largely what allows us today to see a more positive and a return to a different reality, but one that, we trust, is better than last year.

As always, in this issue, we incorporate national and international materials and from our own institution, with varied topics. The multimedia report on an investigation coordinated by Dr. Lilia González, a professor at our institution, on the effects of the pandemic on university students' learning stands out, as well as the one dedicated to copyright and intellectual property.

We hope that you enjoy reading this issue, that the materials are useful to you, and that they can contribute to your work as researchers and academics, while we hope that you will help us sharing them. We invite you to continue participating as collaborators and readers so that we continue to form a community. We also encourage you to take a look at our social networks and means for the dissemination of academic and scientific content, using the various channels that technology offers us through our official website: www.espacioimasd.unach.mx, youtube channel: Revista Espacio I más D UNACH as well as Twitter @espacioImasD and Facebook / Espacioimasd.

Enjoy this Space of Innovation!

"*Por la conciencia de la necesidad de servir*"
Universidad Autonoma de Chiapas

The editors

ARTICLES

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HISTORICAL REVIEW OF RICE BREAD PRODUCTION COMPANIES IN THE COLOMBIAN ORINOQUÍA REGION

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— Abstract—

This article shows the results of the research carried out on rice bread companies in the municipalities of Acacías, Restrepo, San Martín, and Villavicencio, belonging to the Meta department, in the Orinoquía region, Colombia. Through a qualitative and historical descriptive approach, we interviewed the owners or representatives of the participating companies. The research aimed to discover the art of business evolution of rice bread producers, a traditional product in the region, through a historical review that allowed achieving a characterization of the business sector and establishing a timeline of the rice bread industry in Colombia, highlighting cases of entrepreneurship. As a result, we identified a continuous evolution of this business sector with a view to growth, which depends on a very significant culinary cultural tradition in the region. It was possible to identify the entrepreneurship cases of fourteen companies from the different municipalities of the region. We also established a timeline from 1971 to the present, and relevant aspects of the business sector: 43% of the companies interviewed are of family origin, the same percentage have been in the market for more than twenty years, which demonstrates their stability, with a formality index of 93%.

Keywords

Producing companies; historical review; rice bread; entrepreneurship; traditional product.

According to Vásquez (2007), citing Rosegger, regional development is based on promoting the adjustment of the productive system, increasing employment, and the self-sustained development of local economies, in this sense, the development of the territory is achieved by using its existing potential. In the particular case of the Colombian Orinoco or Llanos Orientales region, it has a great trajectory in the agricultural sector, where rice cultivation is a relevant step in Colombia. "The total production of rice in the agricultural phase amounts to 2.6 trillion pesos in 2018, in this year, 87.1% of production is concentrated in three zones; the Llanos zone represents 39.4% of total production" (DANE, 2020), allowing to achieve regional development around this.

Taking into account the dynamics developed through the production and marketing of rice bread at the regional level, as a product related to the progress of agribusiness around the agricultural vocation of the region, it is considered a traditional snack (Instituto Departamental de Cultura del Meta, 2016). On top of that, the concept of endogenous development stands out, which according to Garafoli (1995), is the ability to innovate at the local level, being relevant to the capacity of society to respond to the challenges of increased competition in the markets.

The production of rice bread has significant relevance in the Colombian Orinoco region, "since the middle of the last century; it has been consolidating in the grocery market, whose initial producers are in the urban areas of San Martin de los Llanos and Restrepo" (Ardila, 2016). In this regard, the declaration of the product as Departmental Intangible Cultural Heritage: the traditional culinary practices of rice bread in the department of Meta, through ordinance 924 of 2016, stands out (González, 2016). Hence its commercialization has great participation in the local economy, "according to the Chamber of Commerce of Villavicencio the production of rice bread brings to the department 7,526 million pesos each year" (Ardila, 2016).

But what has been the business evolution of rice bread production in Colombia? Knowing "history, tradition, and culture have great value in the food industry, these characteristics are valuable in terms of brand management" (Otero *et al*., 2017) and currently the product has been highlighted from the cultural and gastronomic aspect, however, there are very few studies from the business perspective, so the need for a historical review to these companies was evidenced. Today's market is demanding and changing, and proposes constant challenges to all companies to mobilize their teams and strategies to stay ahead over time (Estela *et al*., 2016).

With this in mind, the present study aimed to build the state of the art of entrepreneurial evolution of rice bread production in the department of Meta, focusing on the four main producing cities, namely Acacías, Restrepo, San Martín, and Villavicencio, to learn about the cases of entrepreneurship,

establishing a timeline of relevant facts and characterizing this business sector "where knowledge, and food and culinary practices that remain as part of our cultural heritage and identity are concretized (Meléndez and Cañez, 2010). In this regard, the state of the art allows having a broad and detailed vision of the current state of the subject to be addressed, in addition to the evolution it has had over time, "provides elements to know the current balance of its object of study" (Guevara, 2016).

The methodology was based on a qualitative and descriptive historical approach, with the participation of producers, entrepreneurs, and people linked to the production of rice bread through interviews. In this research, two methods were applied for the analysis of business evolution, the case study and the historical reconstruction. The first "are stories about situations in which individuals or groups can make decisions or solve a problem" (Camacho, 2011), which allows the availability of information for learning, that facilitates the generation of a series of analyses for decision-making; and the second "seeks to specify the important properties of people, groups, communities or any phenomenon that is subjected to analysis" (Torres and Labarca, 2009).

As a result, it was possible to characterize the business sector of rice bread production, a gastronomic cultural tradition in Colombia, in the department of Meta in the Orinoco region, highlighting that the highest concentration of companies is in Restrepo, followed by Villavicencio, showing greater business development in these cities, as well as the presence of this production throughout the department. 43% of the organizations studied are of family origin and are characterized by the permanence of the family members in the different activities, leading mainly areas such as administration, production, and commercialization; and in the same percentage, they have been operating for more than 20 years, growing in terms of production capacity and product demand, demonstrating their stability in the regional market.

With the timeline, we can see a process of evolution of this group of companies. They began formal marketing in 1971, with time it developed to a sector, emerging new entrepreneurs, which sought to aggregate in a cluster or association of producers, as well as develop markets, highlighting that 93% are formalized with registration with the Chamber of Commerce of Villavicencio. Finally, it was possible to structure and detail the knowledge created through fourteen cases of entrepreneurship, which allowed an objective analysis critically for future studies, clarifying the panorama of this group of companies, taking into account that companies improve their competitiveness and growth by combining strategies from different areas, as well as other aspects of their current state (Espitia and Moya, 2008).

METHODOLOGY

The present research uses a qualitative and descriptive historical approach (Hernández *et al*., 2014), where the methodological tools applied were the semi-structured interview, the timeline, and the historical reconstruction as a business case study, complemented with the collection of secondary information (Martínez, 2016).

Initially, a non-probabilistic sampling of census study was carried out in which the elements of the population were studied (Hernández *et al*., 2014), i.e., it was sought to include all rice bread producing companies in the department of Meta. For the present research, reference is made to 14 companies in the municipalities of Acacías, Restrepo, San Martín, and Villavicencio that agreed to participate through the signing of informed consent by the owner and/or legal representative. During these interviews, it was possible to learn about the history and evolution of these companies in the Colombian region of Orinoco.

This was achieved in two phases; first, the rice bread companies in the four municipalities were characterized, systematizing the results of the interviews by identifying aspects such as origin, age, location, as well as other relevant data, "where individual and organizational knowledge is the basis for the creation of capacities of the company to become a source of competitive advantage" (González, 2010). Secondly, a timeline was constructed, through which the evolution of rice bread production in the department of Meta at the socioeconomic level can be identified. Finally, a historical reconstruction was carried out, identifying the stories of entrepreneurship as a case study, since knowing the history of these companies allows understanding some aspects and states in which they currently are (Valobra, 2014).

CHARACTERIZATION OF THE BUSINESS SECTOR

To learn about the business sector being addressed, its origin, evolution, positioning at a regional and national level, a series of interviews were conducted with rice bread producing companies in Colombia, listed in Table 1.

Table 1
Companies interviewed

Name of the company	Municipality
Comestibles el Gaván	Restrepo
Panadería Lanzallamas	Restrepo
El Alcaraván	Restrepo
El Samán	Restrepo
Panadería Lanzallamas 2	Restrepo
Panadería y Panificadora Rosquipan	Villavicencio
Rosquillanos	Villavicencio
El Chino de los Mandados	Villavicencio
Roscas del Llano	Villavicencio
Roscas el Catire	Villavicencio
El Caporal	Villavicencio
Panificadora Celchi	Acacías
El Buen Gusto	Acacías
Casa del Pan de Arroz Trigos	San Martín

Source: Prepared by the company

On the systematization of results regarding the characterization of the business sector, it is highlighted that of the companies interviewed 7% are located in San Martín, 14% in Acacías, 36% in Restrepo, and 43% in Villavicencio being San Martín the municipality with the oldest rice bread company in the market. With this in mind, "the place of origin is disputed between San Martín and Restrepo, however, there are factories that have migrated looking for better opportunities" (Otero *et al*., 2017), which is why Restrepo and Villavicencio have the highest proportion of companies.

The companies in the region have been characterized by the cultural tradition regarding the economic activities carried out by the population, which are derived from the agricultural sector, "in the department of Meta, there is a broad culinary tradition. As part of this, the different preparations derived from rice and the products resulting from cattle farming stand out" (Instituto Departamental de Cultura del Meta, 2017), which is why a large number of family businesses have been born. Considering the above, in the rice bread industry, it was identified that 43% are family businesses of tradition, inheriting their leadership to the following generations of the family, and 57% have been purchased or created some years ago due to the entrepreneurial opportunity they observed due to the demand for the product, which evidences that "family businesses have been one of the elements of greater social efficiency" (Ginebra, 1997) in the Orinoquia region for socio-economic development.

Image 1 shows the time of operation of the companies, where 21% have been in the market between 11 and 20 years and 43% for more than 21 years, highlighting that the two oldest companies in San Martín and Restrepo are 48 and 41 years old, respectively, which shows the stability of rice bread production in Colombia, as well as its acceptance and expansion in recent years, as indicated by the Chamber of Commerce of Villavicencio (CCV, 2018), which highlights "throughout almost 70 years in which this snack called Rice Bread has been produced, in the department of Meta, until only approximately 12 years ago there has been a constant evolution of the production process" (CCV, 2018).

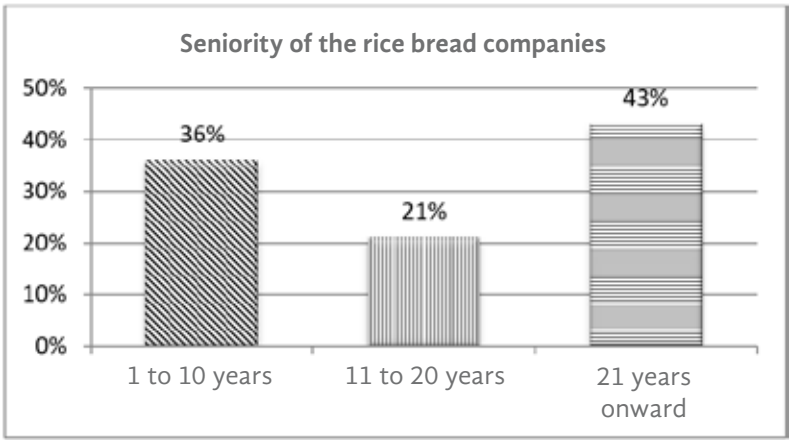

Image 1. Age of the rice bread companies . Source: Own elaboration

The companies interviewed have a formality indicator of 93%, i.e. they are registered with the Chamber of Commerce of Villavicencio, which contributes to the recognition of rice bread production, allowing the companies to have greater opportunity for marketing and expansion to other departments and also to bet on an international market, a path they have already begun to travel (Estela *et al*., 2016).

Regarding aspects of associativity, it was determined that 64% of the companies interviewed are linked to the Association of Producers and Marketers of Rice Bread of Meta (ASPAMET), which aims to "contribute to the economic development of the rice bread production chain to improve the quality of life of its associates" (ASPAMET, 2018). However, according to the study conducted on the Analysis of the impact of the rice bread cluster, it highlights that "among the different rice bread manufacturers there has been individualism and consequently lack of cooperative spirit" (Molina and Gutiérrez, 2020), which has hindered the development of some joint actions.

On the other hand, for a company that wishes to evolve according to the new market trends of online shopping and the acquired culture of social

networks, it has become essential to have a website and/or have a presence in any of the social networks available in the market (Pérez *et al*., 2013); because of this, 64% of the rice bread producing companies have a social network, mainly Facebook, through which they carry out part of their marketing process.

It is also identified that these companies generate great employment opportunities since the 14 factories interviewed provide around 134 jobs, not counting those generated indirectly and along the value chain, with the suppliers of raw materials, such as curd and rice, as well as with the distributors of the product in the different municipalities. Within the national accounts of the Gross Domestic Product (GDP) in Colombia, it is observed with a growth trend "The added value of the industrial phase of rice, in the period 2016-2018 has an average participation within the added value of the "Manufacturing Industry" activity of 0.66%, an average participation of 2.30% in the added value of the "food and beverage industry" (DANE, 2020).

Finally, Image 2 highlights the main problems for rice bread producers, where 43% consider that no problems are present, however as in any other business sector, they have gone through difficulties and gaps for their business evolution, highlighting aspects such as the quality of raw materials, especially curd (Instituto Departamental de Cultura del Meta, 2017), "as it does not meet quality standards, since it does not have certifications" (Red Clúster Colombia, 2015); and financial difficulties, emphasizing the lack of support provided by state institutions to entrepreneurs in the region and in the illiquidity presented by these to be able to expand their businesses, the above according to the statements given by the entrepreneurs in the interview process.

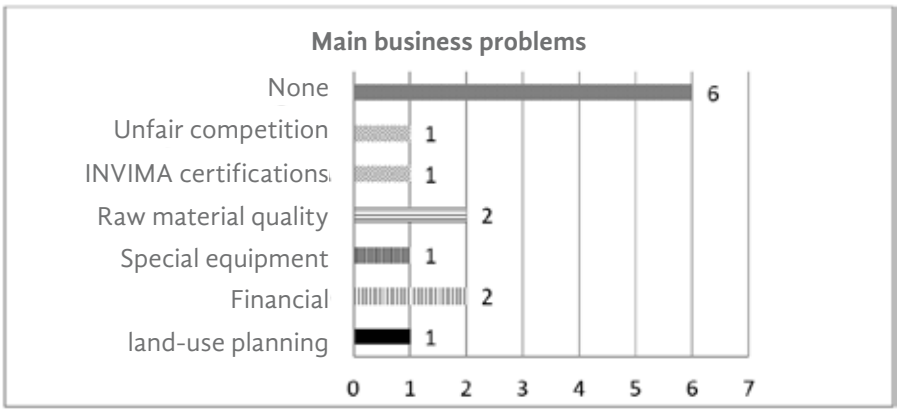

Image 2. Main business problems. Source: Own elaboration

Another problem they highlighted was obtaining food sanitary certification for rice bread before the National Institute of Food and Drug Surveillance

(INVIMA, 2020), which according to the current status implies for the entrepreneurs to make structural changes such as investment in facilities, industrialized processes, suppliers, among others, to comply with sanitation policies and management system. Specialized machinery is considered, as some have their own designs according to their needs, indicating that production traceability is necessary, where the lack of machinery to be able to cover a larger production is notorious. Unfair competition from some companies is another problem, which results in the sale of rice bread of lower quality and without the traditional raw materials to lower the price.

We found land use planning as the last problem, specifically in the municipality of Restrepo, due to the construction of the dual carriageway of the Villavicencio-Yopal road, which is in phase 1 (COVIORIENTE, 2017), a situation that affects the companies located on this national road, which had to change their place of establishment after years of recognition in the sector.

TIMELINE OF THE RICE-BREAD INDUSTRY IN COLOMBIA

Image 3 shows the timeline of the rice bread industry, which began in 1971 when the *Casa de pan de arroz Los Trigos* was created in the municipality of San Martín, a pioneering company and the only one with a handmade production since it does not have machinery. The second company founded in the country was Lanzallamas in 1978, in the municipality of Restrepo, by Mrs. Edilma Novoa de Zambrano, recognized as a Metense 2019 Golden Citizen, for her contribution to the development and progress of the municipality. Four years later Alcaraván was born in Restrepo and six years later Rosquillano in Villavicencio.

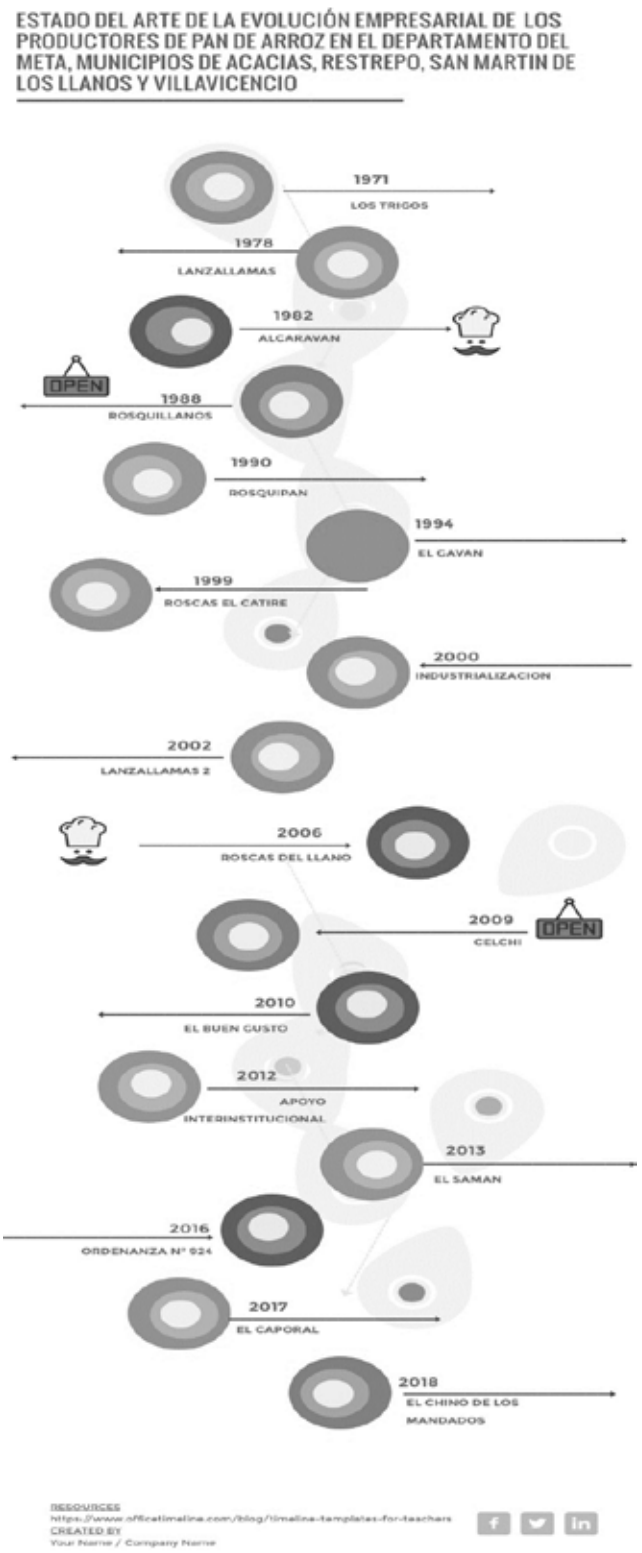

Image 3. Timeline of the rice bread industry in Colombia. Source: Own elaboration

In the 1990s, three companies stand out: Rosquipan, Comestibles El Gavan, and Roscas El Catire, which, based on the education received by the founders from their parents, continued as the second generation of rice bread bakers. Today these companies have more technology and have several points of sale at the departmental level, national distribution and are making inroads at the international level. Likewise, in 2000 the industrialization era began for this business sector, acquiring special machinery to increase production, due to greater demand and to comply with sanitation regulations, and at the same time, the need arose to hire personnel other than family members. In 2002 Lanzallamas 2 was created, so the pioneer family in Restrepo continues to expand its tradition by continuing to lead companies with other family members.

Due to the acceptance and recognition of rice bread in the region, companies began to emerge that saw it as a business opportunity and a growing industry, which led to the creation of Roscas del Llano, the Celchi company, and El Buen Gusto. In the same vein, in 2012 the relevance of the business sector for the socio-economic development of the region was observed, so higher education institutions, the governor's office of the department of Meta, and the Chamber of Commerce of Villavicencio began to provide support on issues such as marketing, international business, the formation of the cluster, the rice bread association, the recognition of the product as a gastronomic heritage, the designation of origin, among others.

In 2015 El Samán was born in Restrepo, as an entrepreneurial initiative of its owners, currently with great recognition. In 2016 the production of rice bread obtained its greatest recognition since the Departmental Assembly of Meta approved in first debate the draft ordinance for the declaration of the product as heritage (Molano, 2016), and that same year, ordinance No. 924 was issued, through which the traditional culinary practices of rice bread in the department of Meta were declared departmental intangible cultural heritage (González, 2016). In 2017, the socialization of the special safeguarding plan for culinary practices associated with rice bread was carried out (Instituto Departamental de Cultura del Meta, 2017). Finally, as a sign that this business sector continues to grow, in 2017 El Caporal was sold and in 2018 El Chino de los Mandados was founded in Villavicencio.

Cases of entrepreneurship

Knowing the history of the rice bread companies allows us to understand some aspects and states in which they are at present, "we must apprehend the recurrent dynamics and the transforming dynamics that occur within the organization through history" (Betancourt, 2003), based on this, the histories of 14 companies interviewed were identified, which are shown below.

Casa de pan de arroz Los Trigos. The production of rice bread in the city of San Martín and the Trigos family has always been a tradition, initially to share in the evenings and festivities. Mrs. Mery de Trigos knew this gastronomic tradition and after the death of her father-in-law in 1971, who was in charge of cooking the rice bread, she received a quantity of raw material (rice and curd) given as an inheritance with which she started her own business. Mrs. Mery says that she used to prepare rice bread rolls, tubs, and tungos, but due to the low population of the municipality, she had to travel to other cities for commercialization, such as Acacías and Villavicencio, where she offered her products in transport terminals, market places and door to door. For two years she dedicated herself to this activity mainly on weekends, where she detected an increase in her sales. Then, she moved to his place of residence and opened her premises for the sale of the product.

The Trigos family believes that cultural traditions should be respected for the next generations, which is why they refuse to use any industrialized or mechanized process and refuse to change their clay ovens and knead manually since that is where their essence lies. Currently, the company is formed by the same family and workers who have accompanied them for over 20 years.

Companies in the city of Restrepo

a. Lanzallamas Bakery. The Lanzallamas Rice Bread Factory was founded on January 20, 1978, by Mrs. Edilma Novoa de Zambrano. She started her enterprise due to a lack of economic resources, as she was the mother of 12 children. She had no experience but says that she learned empirically, as it was enough to try a package of rice bread, and with a minimal investment she started manufacturing. In the beginning, it was difficult, she began to sell among the neighbors, and as time went by the quality improved. In 1990 they rented a place with 5 employees, they had already bought the mills and gas ovens, the quality of the product was recognized, but there was some money mismanagement that almost led them to bankruptcy. However, they were able to overcome the difficulties and the factory continued to grow thanks to the quality and prices, which gave way to look for a larger facility, currently, they have electric mills, stainless steel cans and increased to 20 direct employees.

b. El Alcaraván. In 1982 Mrs. Odilia Flórez de Melo created the company with a very humble infrastructure, an old ranch, and a wood oven, where the employees were her children and the customers only bought to take away. The machinery for storage and production was second hand, it was sold in paper bags, after 6 months they began to pack in plastic bags; after 10 years of operation, the first non-family worker joined the company. After 15

years, the product began to be distributed in baskets to different stores in the municipality, with packaging that identified them. Then they acquired health responsibilities, for which they remodeled the internal infrastructure of the establishment, achieving the industrialization of its production process, as well as the external area, for the convenience of customers who consume the hot product in the establishment. It is worth noting that they acquired land as a second point of sale in the municipality, which allowed them to increase their sales and positioning.

c. Comestibles el Gaván. This company started the production and sale of rice bread in 1994 with its manager and founder German Gordillo and his wife Jenny Moreno. The production facilities were established in their residence in the city of Villavicencio, where other products such as cassava bread and sago bread were also produced. They expand their customers to other cities in the country and by the year 2008 they begin a process for their commercialization at an international level, for which they formalize the company in 2012, achieving a factory with Good Manufacturing Practices (GMP) and greater production capacity, for which they make investments in machinery, make improvements to their packaging, and in 2018 they inaugurated their industrial production plant in the municipality of Restrepo. All of the above comply with the different regulations and facilitate the marketing of the product in chain stores in Colombia and internationally such as the United States and Panama. They also have product innovations such as brown rice bread with quinoa.

d. Lanzallamas Bakery. It was founded in 2002 by Mrs. Martha Lucia Melo Flores and her husband, son of the creator of the Lanzallamas bakery; it began with an investment of approximately seventy million pesos and second-hand machinery, ovens valued at ten million pesos, mills, and refrigerators. At that time, each member of the family had a responsibility in terms of sales, bread and cake manufacturing, distribution, among others; with the growth of the company, it currently has 12 employees.

e. El Samán. At the beginning of 2013, it was founded by Mr. Ferney Flórez Acosta, who since he was young had a passion for cooking, together with his wife Mrs. Nidia Fuentes. Both started as collaborators in a local company dedicated to the manufacture of rice bread and then became independent because they had acquired the necessary knowledge to manage their own business and took the house of his wife's father as a lease. They started with an investment of 500,000 pesos in the living room of their house, a manual oven, a mill, dough, and three tables.

Initially, their main distribution area was the department of Cundinamarca, where the product had great acceptance, since then they began to distribute to different cities such as Girardot, Villeta, Rio Negro, Bogota, Santa Marta, among others. This strategy played an important role

in the advancement of the organization and marketing of the product since, at the municipal level, not all companies had the prospect of expanding. By 2016 they decided to make an investment of approximately 200,000,000 pesos for the implementation of better machinery and increase their production, as were the mixer, molder, sealer, and two industrial ovens (rotary), currently has 7 employees.

Companies in the city of Villavicencio

a. Rosquipan bakery. Founded by Mrs. Myriam Marlen Gordillo Novoa on January 10, 1990, who has a history of more than 30 years in the production of rice bread that she learned with her parents and grandfather, but gained more experience in marketing and industry with her aunt, the founder of Lanzallamas. Mrs. Myriam, being a mother and head of household, started the initiative in her own lot, where she built her house and the factory was located in the back, which consisted of a shop, patio, warehouse, and production area. In the beginning, operations were carried out manually, the ovens were drawer ovens, they were packed in baskets, and marketing was done on foot and sometimes by bicycle. The initial capital investment was $200,000, which covered the cost of the oven and the mill used to grind the rice and curd.

In 2003, the plant was remodeled and they had the opportunity to leave only one property for the factory; they invested in rotary ovens, a very important achievement for the company since the processes were accelerated with efficiency and productivity. In the beginning, they had no employees, but currently, they have ten direct employees in the factory. Likewise, each of Mrs. Myriam's children continues to play important roles in the company, such as leading the administration, marketing, logistics, and production areas.

b. Rocas del llano. Founded in 2006 by María del Carmen Pulido Gutiérrez, who decided to create the company to generate income for her family, considering that rice bread is a typical and traditional product of the plains. The initial investment was $500,000 and with little machinery, they produced 100 units in 5 hours. The company has grown and now has specialized machinery, which allows for an efficient production process, and it now takes 15 minutes to produce 100 units of the product. The most important strategies implemented are quality and innovation; they have a brand called *Rozquetas*, which, unlike traditional rice bread, has a softer and crispier texture because it is made with cheese and is packaged as a lunch box; they also have a traditional product.

c. Rosquillano. The company started in 1988, but the current owners bought it in 2009 for $450,000,000. Mr. Juan Francisco Díaz Plata, who had

experience in the production and management of bakeries, decided to focus on this business because he considered that rice bread is one of the typical products in the area and the region. When they started, they had only four workers for the production and packaging of the product, currently, they have thirteen employees and two external vendors. They stand out for the sale and marketing of an original and quality product.

The administrative area has always been managed by the family and the other areas by private personnel. When Mr. Juan acquired this factory, it only had drawer ovens. After a year, they bought an electric rotary oven, and with the increase in production, they decided to buy two more ovens.

d. Roscas el Catire. Brigadier Giraldo Gordillo Novoa acquired the gastronomic skills of his parents who started with the manufacture of this dough in Restrepo in 1999, which they learned from a Venezuelan citizen who moved to live in the municipality and had lived in San Martin where they already made it. Initially, rice bread was made in a clay oven and at that time they were the only ones who had one. Mr. Brigadier worked with his parents for several years, but due to violence, he was forced to leave the municipality and settle in Villavicencio, when he decided to found his own company in 2009, where he works with his wife, 3 daughters, and a nephew.

e. El caporal. A company originally from Restrepo, it was purchased in November 2017 by Mr. Henry Reina, when he was bankrupt with an investment of $38,000,000, motivated by working on a gastronomic heritage product of the department. Despite the difficulties and short time they have been with the company, they currently have customers nationwide, sending products to Ibagué, Bogotá, Cartagena, La Macarena, and Vaupés. In Villavicencio, they distribute the product to small businesses such as neighborhood stores, supermarkets, grills, hotels, restaurants, and tourist sites.

Mr. Henry and his wife Doña Marina emphasize that they prefer to make the product manually and traditionally because it is more homemade and the public likes it better; however, they have machinery such as ovens, packing machines, weights, and threading machines. The whole family works in the company; the wife is in charge of production together with their children. Initially, there were five direct employees, but now there are 12.

f. El chino de los mandados. The business initiative arises in a conference that Mr. Raul Rodriguez attends along with entrepreneurs in the region, where he saw the opportunity in the food sector to start a franchise chain to be taken outside the department, to promote rice bread as a typical product of the department of Meta, for this he gets Mr. Leonardo Granados as his strategic partner and in early 2018 they start their operation. The origin of the company's name is based on the song of the llanera music singer-songwriter Walter Silva, but Mr. Raul indicates that it is also a dedication

to his son, whose image is part of the logo and likes to interpret this song on every special occasion.

Companies in the city of Acacías

a. Celchi Bakery. Mr. Marco Antonio Celis started his microenterprise in 2009, asking for a loan to buy a small second-hand oven and a manual mill, his wife was the one who knew about the production process. They began offering the product in the transport company La Macarena to passengers, stores and bakeries, so they became known in their municipality and began to make larger orders. As demand increased, they were forced to take out a loan to acquire more tools. They currently have six employees and machinery such as a sealer, mill, mixer, and industrial ovens. They make home deliveries in Granada and San Martín but mainly sell the store to store, making their product known.

b. El Buen gusto. In 2010, Mrs. Yolanda Pavi and her husband decided to invest $7'000,000 to buy the company from the previous owners, who had been in business for 17 years. They do not need to hire employees, so Mrs. Yolanda and her husband are the only ones who work in the manufacture and sale of the product, which is done in the same facilities, since it is a good point of sale and they have recognition in the municipality, so they do not distribute to other establishments.

CONCLUSIONS

This study, from a business perspective, is relevant for the recognition of the rice bread industry in Colombia, as a business sector that has been evolving as it has been accepted and known as a traditional product, achieving its distribution at the national level and some markets at the international level. It is important to recognize that companies are dynamic and changing, so they should be studied from a holistic approach, which "allows generating organized information to understand the essential situation" (Martínez, 2015), and making these aspects known through the characterization made to the business sector is remarkable for the learning of other entrepreneurs, as well as the analysis of weaknesses and strengths for the same entrepreneurs of the sector. In this regard, it was possible to identify the permanence of the companies in the market, evidencing a favorable economic outlook for the growth of agribusiness in the region.

Through the timeline of the industry, it is possible to highlight the main events in a quick way, where the change of the sector has been seen with the emergence of companies not only as a family tradition but also as a business opportunity.

It was evidenced that greater innovation is required, which agrees with the study conducted by Ruiz *et al*. (2016); in aspects such as packaging and distribution channels for marketing, but some entrepreneurs do not seek the expansion of their companies, as they require a high investment or are satisfied with how they currently operate, so they do not have enough machinery to increase production, in this sense the inter-institutional support remains key.

On the other hand, through the cases of entrepreneurship, it is possible to highlight the cultural and family tradition that characterizes the manufacture of rice bread, where the implementation of a strategic process is fundamental, since "the determination of values, implications, family vision, patrimonial vision and resources" (Araya, 2016), are aspects that over the years have been developed and strengthened, consolidating themselves as great entrepreneurs in the region.

Finally, this historical review allowed identifying the motivation and events that led these llanero entrepreneurs to form their organizations, knowing their stories promotes and highlights the entrepreneurship and business evolution that these companies have achieved, which glimpses their great potential, as well as the needs for strengthening as a business sector.

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THE OPINION OF BASIC EDUCATION TEACHERS ON INCLUSIVE EDUCATION POLICIES

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— Abstract—

Inclusive education at an elementary level is important to foster environments that inspire students to continue their studies and achieve school and social success, and although it is the ideal proposed by the educational system, in practice it does not always turn out as it is expected in the speeches and educational documents, hence the need to carry out descriptive research with teachers from zone 063 located in Osumacinta Chiapas to identify their opinions regarding inclusive education policies. For this purpose, a deliberate sample of 17 teachers was formed who agreed to participate in the study and express their opinions in a questionnaire proposed by Both and Ainscow (2022). The results allow us to find that although the majority of the teachers agree that there is inclusive leadership, they also question the little recognition they have and which impacts the collaborative work they do in addition to the little preparation they have for their concern of diversity. Although the study is the first approach to know about the processes of inclusive education, it allowed us to have an idea of what the teachers think. More in-depth work is still necessary, with more qualitative methodologies to contrast their responses with practices and inclusive culture.

Keywords

Inclusive education, exclusion, opinion, teachers, academic training.

Chiapas is considered a state which is usually fell behind in many aspects. In the educational environment, the National Council for the Evaluation of Social Development Policy CONEVAL (2016) identified that there was a 53.25% illiterate population based on the social backwardness index in 2015. This data is considered a weighted measure that has a series of indicators covering education, access to health services, housing quality, basic services in housing, and household assets as the most representative. In this context, the research was carried out with the general objective of identifying the opinions of elementary education teachers in school zone 063 located in Osumacinta, Chiapas, on inclusive education policies.

The conditions in which some primary schools are located are often opposed in terms of access, language, the economy of the community where they are located, and other elements that configure school practices that can be different and that affect in different ways the degree to which students learn and are formed. It is not the same, the school of a municipal capital to one that is located in the periphery or even in a remote community that does not have basic services, where the most important thing is survival and the second is education.

We carried out our research within this context, in a school zone that houses seven different primary schools, CONAFE, of the complete organization, with buildings to house all the students and cover their needs. It is not possible, therefore, to speak of inclusion from the diverse contexts of the geography of Chiapas, since some school zones experience education in unequal conditions. This must be taken into account, together with the conditions of teacher training for the achievement of inclusive education and especially related to the working conditions for the achievement of educational improvement.

In this article, an initial theoretical approach to the concept of inclusive education as a fundamental right related to education for all is presented. This educational policy, implemented almost two decades ago at the international and national level, as a scheme that replaces educational integration in special education, is reviewed to account for the most significant concepts that are important for its implementation in the classroom. Secondly, a review is made of the progress that has been made in terms of teacher research on inclusive education practices. The third section presents the methodology, the contextual framework, the results, and the main conclusions reached in the study.

It is important to consider that, at the state level, there are still many deficiencies that need to be resolved, some related to the satisfaction of the basic needs of the populations; while others have to do with the development of quality educational processes that do not generate a risk of exclusion for

the student body, which persist in some educational spaces, as mentioned in some research results.

The findings provide elements of analysis to rethink the strategies of training and consolidation of the teaching staff to create a community, generate new values from the inclusive culture, and set the guidelines for new practices that generate learning opportunities for students within a framework of attention to diversity. These differences, which for many represent a challenge, from the language of inclusive education are presented as opportunities for learning and growth, of course, as long as they are understood in this way, leaving aside attitudes that favor the exclusion of those who are different from the educational spaces.

With these results, it is expected to encourage reflection on the diverse conditions in which it is intended to move from the discourse to the practice of educational inclusion, which requires a sustained, important, and permanent effort to meet the conditions that allow the creation of a community and especially an inclusive culture.

DEVELOPMENT

Inclusive education is a discourse at the level of education systems worldwide, which has as its main antecedent education for all in the exercise of promoting equity, proposed by UNESCO and international organizations that have considered the importance of every human being to exercise his or her right to be educated.

The proposals to promote equity have a long history, dating back to 1948 with the Universal Declaration of Human Rights, the Declaration against Discrimination in Education in 1960, in 1989 with the Declaration of the Rights of the Child, the World Declaration on Education for All signed in Joimten Thailand in 1990, followed by a series of meetings and agreements in Salamanca, Dakar, Incheon, among others (UNESCO, 2008).

The concern has not been minor, especially when reviewing the statistics of highly impoverished countries where education is not the priority but the search for survival. In this scenario, diversity appears as a necessary concept to understand rights despite differences and that far from being considered an obstacle, they should be opportunities to enrich learning.

Inclusive education has an important antecedent in special education, which together with the concept of Special Educational Needs (SEN) sought and still seeks equality for all, particularly for the insertion of people with disabilities into regular schools. However, it is necessary to recognize that this confusion should give way to a broader approach, as a reform that aims to counteract the elimination of social exclusion, which may come from

various sources, but particularly from the beliefs and attitudes of society. It is therefore important to clarify the concept.

Echeita and Ainscow (2011) have established four elements that define it and give clarity to this concept, especially for its practice in the daily life of the classroom, these ideas are synthesized in the following premise: inclusion is a process that seeks not only the presence but also the participation and achievement of learning of all students. For this, it is necessary to identify and eliminate the barriers that may limit their participation to benefit from learning opportunities. However, it is necessary to pay attention to students who may be at risk of exclusion leading to school failure.

> Generically, we must understand as barriers, those beliefs and attitudes that people have regarding this process and that are embodied in the school cultures, policies, and practices that they individually and collectively have and apply, and that when *interacting* with the personal, social, or cultural conditions of certain groups of students -within the framework of existing educational policies and resources at local, regional or national level-, generate exclusion, marginalization or school failure (Echeita and Ainscow, 2011, p. 33).

In the analysis of the barriers to carrying out the inclusive education process, Sancho, Jardón, and Grau, gather the following from the Spain Report published in 2010: the first, related to inadequate funding of the resources that should be allocated to ensure an accessible and comfortable environment. The second is related to discriminatory attitudes towards people with disabilities. The third, with scarce information and little training for teachers who must carry out inclusion practices. The fourth, with the distance between the school administration and the educational centers, in the sense of not identifying academic needs, and the fifth with the dissociation that exists between families and the school community.

Durán and Giné (2011) state that when talking about inclusion it is necessary to pay attention to the context and not to the student, since what is important is how the students are received, the concern for valuing them as integral human beings and responding to their needs, so it is necessary to focus as an educational institution on the construction of a solid educational proposal adapted to meet diversity. They also suggest that greater opportunities should be promoted for all children and not only for those who are at greater risk of exclusion and failure, thinking that everyone should benefit from institutional changes in the search for inclusion. It should also be understood that when talking about inclusion, it should be seen as a process (Ainscow & Miles, 2008) where institutional improvement is sought with the participation of all the actors of the educational community, so that

inclusion is not a goal of arrival, but a permanent commitment to change for improvement, understanding then the concept of school in movement.

Therefore, thinking inclusive education means a global change of the educational system and although it is recognized that it has its origin in the business world, it should be characterized according to Muntaner, Roselló, and Iglesia (2016) by two major objectives: the first related to the success of all in school, regardless of their condition and the second associated with the struggle to overthrow any form of exclusion and/or discrimination.

Therefore, they propose that good practices should have an innovative character, effectiveness, sustainability, and replicability. Based on these features, it is expected that the practices should serve to provide new and creative answers to existing problems, as well as demonstrate a positive and tangible impact for improvement. It is also expected that they can be sustained over time with lasting effects and can serve as a model for developing policies and actions in other areas.

Equity, quality, and inclusion are the key principles on which inclusive education is based, which is why working in classrooms to address student diversity is one of the great challenges facing today's education systems, which have not yet fully understood how to meet these challenges.

Although, the term has been redefined and in the discourse of inclusion we speak of Barriers to Learning and Participation (BAP), the intention is to favor the search for alternatives so that, regardless of their social, economic, or cultural condition among others, people can access all educational spaces.

UNESCO (2017) develops a guide to assist countries in the process of incorporating inclusion and equity in education policy to bring about system-wide changes in overcoming barriers to quality education that allows access, participation, processes, and learning outcomes. It is of fundamental interest that all students are valued and participate equally in school life.

This same document points out that the incorporation of the principles of equity and inclusion in education policy implies an important effort by all governments to achieve not only to value the presence of everyone in the classroom but also that they can be able to participate and have achievements, regardless of where they come from or their characteristics. (UNESCO, 2017). It does not matter the color of the skin or socioeconomic status, or disability in some cases.

Therefore, it is not necessary to assess those who are at risk of exclusion because they should not be. This also means that there should be broad participation of all educational actors because to that extent this collaboration will be to the benefit of the quality of education.

Teachers and their ongoing training become another of the pillars on which the inclusive education process must rest, who must carry out both adaptations to the curriculum and evidence-based interventions to diversify

teaching and promote changes that fundamentally take care of the socio-emotional aspect.

In coincidence with this concern for teachers, Fernández (2012) proposes a series of teaching competencies that, from her point of view can propitiate good educational practices concerning inclusion and that were the product of the descriptive and exploratory research she carried out with secondary education teachers, classifying them into:

- Pedagogical-didactic competencies in which he/she knows how to set goals, plan, evaluate, establish priorities, organize resources according to results, among others.
- Leadership skills with interpersonal skills to lead and make timely decisions, generating a climate of trust and communication. Ability to manage conflicts and act as a link between the different diversities of the school.
- Group management and cooperative learning skills in discussing objectives achieved, evaluating work relationships, managing methodologies, using different communication strategies.
- Research competencies, manifesting an attitude for research, particularly action research.
- Interactive competencies to generate a climate of tolerance, coexistence, cooperation, and solidarity among all students.
- Ethical competencies with a permanent concern for the welfare of the student body in which they are a role model.
- Social competencies for the establishment of trusting relationships with the family to favor communication and collaboration with other educational agents.

Both and Ainscow (2002) have developed the Index for inclusion conceived as "A set of materials designed to facilitate the development of inclusive education in our schools.

The objective is to build collaborative school communities that foster high levels of achievement in all students" (p. 7). This is proposed from an action-research exercise, expecting the commitment of schools to favor the conditions for inclusion.

To build these school communities, a process of self-evaluation must begin in three dimensions: a) culture, b) policies, and c) inclusive education practices. The participation includes teachers from the school or technical council, students, and families to identify the BAPS in the definition of priorities in the development and maintenance phases in the follow-up of the processes to be implemented.

In Mexico, the Ministry of Public Education (SEP) issues a document in 2018 called *Strategy for equity and inclusion in basic education: for students with disabilities, outstanding aptitudes, and severe learning, behavior, or communication difficulties*, to continue with the route to consolidate quality education. At the same time, it describes it as a guide for the transformation of new public policies and is based on the Index for Inclusion proposed by Both and Ainscow (2002).

In the analysis of the document, its novelty is that being a guide, it includes topics that help clarify concepts to avoid confusion about what it means to educate inclusively. For example, it introduces a table about correct and incorrect terms, as well as describes the transition from special education to inclusive education.

An important aspect is the way it addresses what should be eliminated, phased out, and promoted with inclusive practices. In this way, it hopes to eliminate segregating models that encouraged the separation of "special" students from the rest of the "normal" students. Likewise, it proposes that those models of attention characterized by attention in separate groups of people with special educational needs or what is now known as barriers to learning and participation should be gradually abandoned. Finally, it considers that care models should be promoted in contexts that are as standardized as possible.

In this scenario, he proposes a flexible curriculum, understanding curricular flexibility as an extremely important element that allows responding to the characteristics of students coming from diverse geographical, social, cultural, and linguistic contexts.

In our country, this is relevant because there is a wide socio-cultural diversity with living ethnic groups and populations living in unequal conditions of distribution of wealth and access to services. It is not the same to live and attend schools in metropolitan cities as in communities with difficult access, as is the case in some regions of Chiapas.

Lledó and Arnaiz, (2010) researched the educational practices of school teachers to identify indicators of improvement for inclusion. Their starting point is related to the importance of both the training and attitudes of these teachers to achieve inclusive education. A total of 545 teachers from pre-school and elementary schools in the province of Alicante, Spain, belonging to the public, private, and subsidized private schools were evaluated. A 30-question questionnaire was used to inquire about aspects related to teacher training in special needs education and about educational strategies and practices and organization of the regular classroom and their relationship with inclusive practices. In this last aspect, they explore learning strategies, adaptation measures, classroom organization, and inclusive

practices. Lledó and Arnaiz (2010) point out the following concerning the participants' responses based on the type of center to which they belong:

> There are no significant differences between teachers from public and subsidized private schools in any of the aspects considered. The results of the one-way analysis of variance carried out on the total scores in each of the aspects considered indicate that in no case are there significant differences between urban, semi-urban, and rural centers. Both centers have similar perceptions of the different aspects involved in attention to diversity (p. 102).

These results suggest that, ten years after the research carried out, it could be assumed that there is a generalized version of the attention to diversity, regardless of the type of center, on the part of both tutor teachers and specialists.

González-Gil, Martín-Pastor, Poy, and Jenaro (2016) conducted a descriptive-correlational study and with ex-post-facto measures on teachers' perceptions of inclusion, with a sample of 402 teachers, who voluntarily decided to participate, in which they used a questionnaire developed ad hoc with 80 items to incorporate the three dimensions proposed by the Index for Inclusion.

The results found in this research show that there are differences in terms of the type of institution, whether public or private, as mentioned in the following:

> Regarding Cultures and Policies, teachers from public schools offered significantly lower ratings than those belonging to subsidized schools. Regarding Practices, private centers obtained significantly lower scores than those belonging to subsidized centers (González-Gil *et al.* 2016, p. 18).

It is interesting to note that concerning the information held and the beliefs of teachers, there is diversity in the way inclusion is conceived. It also influences the degree to which schools are concerned with the ongoing training of teachers to break down these barriers that limit inclusive practices in the daily life of the classrooms.

Mellado, Chaucomo, Hueche, and Aravena (2016) investigated the perceptions on inclusive education of the teaching staff of a school with School Integration Program using the descriptive method with a mixed research approach to a purposive sample of 36 education professionals belonging to the team (School Integration Program (PIE) and classroom teachers of a school center in the Los Ríos Region, in Chile. To collect data they used a survey with a 28-item questionnaire, which evaluated the pedagogical-didactic dimension, cooperative learning, ethical, and social

performance, and the semi-structured interview that took up the dimensions of the questionnaire.

It was found in the didactic pedagogical dimension that "the teaching team tends to recurrently segregate students with special educational needs" (Mellado *et al*., 2016). This is done through scarce didactic strategies with a weak pedagogical interaction that hinders meaningful learning. Likewise, it was found that homogeneous and individual teaching strategies predominate, favoring the exclusion of these students, in addition to showing traits of distrust to relate with them.

For their part, Peñalva, López-Goñi, and Barrientos (2017) explore through a documentary type research intended to establish the relationship between the concepts of burnout, engagement, emotional intelligence, and emotional skills. With the help of four databases, the aforementioned terms were introduced for their search, performing a content analysis of the articles.

In the case of the term burnout, they found that the review of personal factors such as self-esteem, perceived self-efficacy, dispositional optimism, and emotional skills are increasingly important. Through the analysis of research on this concept, they consider it important to generate teacher training programs, which should be based on the work of Salovey and Mayer (1990) based on the development of three skills:

- Emotional perception, which involves identifying our own.
- Emotional integration, as to how perceived and expressed emotions, influence cognition.
- Emotional regulation or the ability for one's thoughts to be promoters of emotional, intellectual, and personal growth (Peñalva, López-Goñi, and Barrientos, 2017, p. 209).

From a qualitative point of view Jiménez, Rodríguez, Sánchez, and Rodríguez (2018) researched the discourse around inclusive education with 12 school principals and 12 teachers of compensatory education, therapeutic pedagogy, hearing, language, and classroom tutors guided by an expert moderator. A discussion group about the meaning of inclusive education was held with the help of a scale (*Escala Acoge*) to evaluate the quality of education in the classroom from an inclusive perspective. Thus, through the studies presented, it is recognized how important it is to investigate teachers to review to what extent this factor affects inclusion processes. Both their beliefs and attitudes may to a large extent be affecting their teaching practice. However, in other cases, good practices have been identified, finding that it is possible to generate positive changes in schools. For this reason, various alternatives have been proposed to promote training.

METHODOLOGY

The research was carried out with a descriptive methodology, which allows for a series of tasks that include the description, recording, analysis, and interpretation of the current nature of an object of study (Rodriguez, 2005). This exercise implies the methodological decision to take into account a series of instruments such as the survey and observation to learn first-hand what the participants think and their traits that establish significant differences.

The research was carried out with a sample of 17 teachers who work in zone 063 of Osumacinta, Chiapas, which was composed of 82.4% of teachers in front of the group, 5.9% of principals, and an equal proportion of music teachers and assistant principals. A total of 58.8% (f. 10) have been teaching for 1 to 5 years. A 5.9% (f.1) have 6 to 10 years, while 17.9% have been teaching for 11 to 15 years. Finally, an equal proportion of 5.9% of teachers is in the 16 to 20 years, 21 to 25 years, and 26 to 30 years of age. 52.9% (f. 9) are male, and 47.1% are female. Of the sample, 64.7% were in the 25 to 30 years of age range. 5.9% are between 31 and 35 years of age, 11.8% are between 41 and 45 years of age, and the same percentage of respondents are between 46 and 50 years of age. A further 5.8% were in the 56 to 60 years of age range.

For this research, a questionnaire suggested by Ainscow and Both (2009) was used as an instrument that explores inclusive policies corresponding to Dimension B, Indicator B1, which explores the development of a school for everyone. In this dimension, it is expected to place inclusion at the center of the inclusion process since policies are fundamental in the process of change to improve the learning and participation of all students. It is necessary to understand that when thinking about inclusion, it must be recognized that the benefit is not for a few, but rather that, to the extent that institutional conditions change in search of improvement, together with all educational actors, everyone will benefit.

This instrument is composed of 13 Likert scaled questions with options a) agree, b) neither agree nor disagree, c) disagree, and d) need more information. This instrument was applied in the 2019 school year during September and October, due to the necessary consent of the teaching staff.

The decision to consider only this indicator is based on the assumption that the teaching staff has not managed, at least in this school zone, to generate inclusive culture and practices, hence the need to explore specific aspects related to the teaching staff in the categories that will be analyzed later.

The analysis and processing of the data were carried out with the Statistical Package for Social Sciences (SPSS), version 21 with the use of descriptive statistics.

CONTEXTUAL FRAMEWORK

The research was carried out in school zone 063, located in Osumacinta, Chiapas, and is composed of 7 elementary schools, 4 of which are considered general elementary schools with public support, dependent on the Ministry of Public Education. Of these, only one school has a complete organization with two groups per grade. Two are identified as primary schools of the *Consejo Nacional de Fomento Educativo* (CONAFE), with public support, and one as an indigenous primary school with public support and dependent on the *Dirección General de Educación Indígena*. All of them with a morning shift.

A characteristic that distinguishes the CONAFE type school is that the groups are organized according to the number of students, the locality can have a maximum of 29 children and can operate as a rural community, indigenous community, and migrant community elementary schools. The educational proposal for the renovation of pedagogical practices with learning based on collaboration and dialogue is proposed as a model that guarantees the right of children to receive a quality education that takes into account their needs based on the context to which they belong.

It is also expected that the efforts of the leaders will achieve the constitution of learning communities. (CONAFE, 2016). These leaders committed to promote in students the choice of a catalog of subjects of their interest and regularly work under the scheme of multilevel schools.

Of the total number of general elementary school teachers, only 17 agreed to participate in the study, two work at the Lázaro Cárdenas del Rio school in Nueva Esperanza, one at the Dr. Jaime Torres Bodet school in El Paraíso, and the rest at the Vicente Guerrero school, located in the municipal capital of Osumacinta.

It is worth mentioning that, although they are considered to be fully organized, the material conditions are not sufficient, that is, the number of classrooms is not adequate; in the case of one of them, there are only two classrooms, one of them for students from first to third grade and the other for fourth, fifth, and sixth grade.

In addition to this situation, an interesting fact is that 75% of the teachers participating in the research are interim teachers, indicating that their employment situation is unstable; they terminate their contract when the person who has the permanent teaching position returns to the institution. This could explain to a great extent the answers found at the time of the application of the questionnaire.

RESULTS

Research on teachers' opinions is of utmost importance for understanding educational practices in the classroom, especially when changes are introduced in the usual ways of teaching. Throughout this article, it has become clear that this type of work is of great importance for making decisions in various aspects that may include changes in hiring, training, or resource management. For the case of this research, the opinion on the educational policies of inclusion was organized into the following categories:

- Inclusive leadership.
- Recognition of teachers' work.
- Collaborative work.
- Impact of preparation.
- Infrastructure.

Inclusive leadership

According to Muntaner *et al*. (2016), leadership is a fundamental factor because through it, conditions can be generated and practices can be developed so that students learn in a context of equality, respect, and excellence. This implies developing spaces for collaboration among teachers and with the members of the school community as a whole.

In the study, the interest was focused on analyzing the responses of the respondents according to their position, finding that 64.7% of the teachers responded that they agreed that the school has a participatory development process. Both the principal and other assistant teachers agreed with this question. Only 17.6% of the teachers in front of the group answered neither agreeing nor disagreeing.

About whether the school maintains an inclusive leadership, 58.8% of the teachers and the rest of the auxiliary personnel agree. However, 23.5% of the teachers answered neither agree nor disagree.

When asked about helping the whole team to integrate, 52.9% of the teachers in front of the group, the director, and auxiliary teachers answered agree, while 23.5% of the teachers indicated neither agreeing nor disagreeing and 5.9% disagreed. These results allow us to identify the conditions for carrying the same idea, there is no consensus and, therefore, although it is not the majority, it does represent a point of alert and attention for those who do not intend to join the commitment in favor of inclusion as suggested by Both and Ainscow (2002).

Recognition of teachers' work

The teacher in this process of inclusive education requires, as already mentioned, a fundamental element to generate changes in favor of inclusion, which requires a deep recognition of his or her experience, of what he or she can and should do and, as far as possible, support from the management.

The research found that the principal and 58.8% of classroom teachers agree that appointments and promotions are fair, but not 23.5% of classroom teachers and auxiliary staff. However, when asked about the recognition and utilization of their experience, the responses of classroom teachers were divided between 35.3% who agreed, the same as the principal and assistant teachers, but 11.8% of these teachers responded neither agreeing nor disagreeing and 35.3% responded disagreeing. In other words, the experience is not taken into account to generate possible changes, which is a symptom of uneasiness among the teaching staff.

These data show that the organizational climate around the recognition of the experience is not the most appropriate; there seems to be a kind of discontent among some of those who answered the instrument, which does not contribute to change for the improvement of the school.

Collaborative work

An important aspect to know is related to the form of organization of the schools concerning favoring equity in the support of all students. We found that the opinion is again divided among the teachers in front of the group, in such a way that 52.9% of the teachers in front of the group, together with the principal and assistant teachers, answered that they agree. However, 17.6% of the teachers answered neither agree nor disagree and 11.8% answered disagree, which implies a review of collaborative work by all members of the educational community.

If collaborative work is not part of the school community's life, it is difficult to reach an agreement on the changes that should be implemented for the development of inclusive practices. Inclusive education cannot be thought of if there is no readiness for collaboration and change.

Impact of readiness

Respondents were asked about how well prepared their students are to perform in non-academic contexts, with 17.6% of teachers, along with the principal and assistant teachers responding that they agreed. It is noteworthy that 47.1% of teachers responded neither agree nor disagree, while 11.8% responded disagree. This could mean that they doubt that a good formative

process is being carried out so that students can transfer what they have learned to non-school situations.

With this divided response, it is possible to notice the concern of some teachers, who assume that the quality of learning is not sufficient or expected, giving rise to new questions to know the reasons for their answers when they disagreed. Not receiving adequate preparation accentuates the barriers to learning and participation of students who suffer exclusion from the educational system.

Infrastructure

Infrastructure for inclusive education is very important because it involves not only curricular adaptations, but also access adaptations that have to do with ramps, bathrooms, specific didactic resources, translators in some cases, without which inclusion becomes complicated.

The teachers were asked about the accessibility conditions of the educational centers, finding that 64.7% of the teachers together with the director and assistant teachers answered in agreement. However, 5.9% answered neither agree nor disagree, and 11.8% disagreed.

Likewise, they were asked about the design of buildings and playgrounds to facilitate the participation of all, in which 52.9% of the teachers together with the principal and assistant teachers answered to agree. A 5.9% answered neither agree nor disagree, and 23.5% answered disagree.

The responses regarding disagreement are worrisome, due among other things, to the fact that the conditions for working with people who have physical barriers may impede access to the school and be at risk of exclusion. This is also the case for those students who, due to their sensory disability, do not have the personal and institutional resources to be able to access and remain in the classroom.

In many Mexican schools, infrastructure is a serious problem, especially in some rural contexts. Although efforts are made to solve it, the inequality of resources allocated to education compared to other areas causes them to live in a poor situation, as was observed in the research in the case of unitary organization schools.

CONCLUSIONS

This research opened many questions, from the reluctance of teachers to participate in the identification of the reasons for not accessing the study, to those aspects related to daily school life. This study constitutes the first approach to learn about the educational policy regarding inclusion in the classroom in an educational scenario characterized by a teaching staff that,

although it considers that it is changing, these are still not enough. The research opened the possibility of finding the issue related to job stability as a factor that can influence these changes.

Although other research has been carried out on the inclusion process, in this study it was possible to learn about a series of problems that, although they were not initially part of the study, were observed. For example, the presence of different educational modalities in the school zone, where some teachers have to work in unequal conditions. It is not the same to work in a fully organized school as in a CONAFE school.

Another important aspect evidenced by the research is that a medium-term immersion as a researcher in educational scenarios is necessary to understand the problems related to inclusion and the implications of teachers' work for the implementation of strategies to promote inclusive education, so it is necessary to carry out more qualitative research work.

The important role of inclusive leadership that can be transformative with the possibilities of empowerment to accept the commitment to accept the challenges of inclusive education is evident. Some authors talk about the concept of inclusive pedagogy to analyze good teaching practices so that the teacher believes in the changes, knows how to do it, and carries them out as suggested by Rouse (as cited in Orozco and Moriña, 2019).

These practices should not be taken as cooking recipes, especially for young teachers, but as possible horizons on which to build a more just education society (Orozco and Moriña, 2019) where the main thing is to ensure the rights of the student body.

It is necessary to advance with teacher training to break down beliefs regarding what it means to educate in contexts of diversity, which requires work both from the Ministry of Public Education and from the management teams to assume leadership in search of quality in educational improvement.

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CORN GROWTH IN LUNAR PHASES, DIDACTIC ACTIVITY DESIGN FOR A TZELTAL COMMUNITY

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— Abstract—

We consider that it is possible to incorporate social environment elements in didactic activities, such as the cultural aspects of native peoples, to favor the understanding of the relationship between the pending parameter concerning the inclination of a straight line. Variational thinking and language can also be incorporated into the didactic activity to play an important role in understanding those mathematical topics. The cultural aspects from the Tzeltal perspective are the stages of corn cultivation in different lunar phases. A three stages methodological strategy is established, in which the first stage the theoretical contributions that correspond to Dietz's cultural reproduction were used, in the second stage elements of the notion of prediction have been incorporated to promote rationality of thought and Variational language for understanding the relationship between the pending parameter concerning the inclination of the straight line. A third methodological stage consists of a staging, where it is expected that arguments arise that show approval for the understanding of the relationship between mathematical concepts.

Keywords

Variation, growth of plants, phases of the moon.

This paper proposes a didactic activity design based on corn growth in lunar phases, which has been taken from the cultural aspects of a Tzeltal collaborator, a student of the Civil Engineering degree (CE) at the Universidad Autónoma de Chiapas (UNACH). Although there are more collaborators from other ethnic groups, in this article only the Tzeltal language is mentioned because it is the most worked activity.

Concerning the educational panorama in which the didactic activity is intended to be incorporated, it should be mentioned that from the field of Educational Mathematics (EM) a problem is pointed out within the mathematics classroom. This problem recognizes a confrontation between mathematical work and school mathematics, which is assumed as an element that hinders meaningful learning of mathematics or lacks meaning. Then it is said that school mathematics is not functional, some works in this discipline have reported that school mathematics does not transcend the student's daily life (Gómez, 2015), interpreting that "...: what is learned at school, stays at school" (Mendoza & Cordero, 2015, p. 1).

On the other hand, and in the case of Tzeltal communities, we are facing a problem with different numbering systems. One is decimal, which is taught in the classroom, and the Maya (from the Tzeltal community) is vigesimal. Therefore, the measurement systems are different. This becomes more complex in education when children bring empirical knowledge from the family since they are different categories of thought and taxonomies. However, Micalco (2009) shows the knowledge developed in various community practices related to mathematics in a group of young Tzeltales from Chiapas, both schooled and unschooled. In this study, they use the vigesimal system linked to cultural practice and the use of the first language in the community. Schooled students often use multiplication referring to the base 20, while non-schooled students use the number twenty of the vigesimal system of the Tzeltal language. Thus, Micalco points out that there is an interrelation between the Indo-Arabic decimal numbering system and the knowledge of the vigesimal system. In this same sense, Cruz and Butto (2013) point out that socializing the structure of the vigesimal *tu'un savi* system based on the extremities of the body, specifically on the fingers and toes, it can serve as a didactic resource to teach how to group natural numbers.

Then it can be proposed to incorporate cultural practices inherent in the Tzeltal communities as didactic resources in the teaching of mathematical content. In this sense, our proposal would be the incorporation of these practices for teaching linear functions and the concept of slope, the particular case of the relationship between the slope parameter to the straight line inclination. Since in the particular case of the linear function, Córdoba *et al.* (2013) point out that students present some difficulties in establishing

the existing relationship between the slope parameter concerning the inclination of the line, the relationship that exists between the algebraic representation and the sketch of the graph, and the representation of the intersections with the coordinate axes using the function criterion.

Therefore, it is considered that from the social environment, it is possible to construct phenomena of teaching, learning, and communication of mathematical knowledge. That allows a frame of reference for the functionality of a mathematical topic such as the relationship between the slope parameter concerning the inclination of the straight line. In the sense of considering the social environment for the design of didactic situations, Peña-Rincón and Blanco-Alvarez (2015) tell us that

> We are so naturalized with the idea that mathematics is unique and has a universal character, that we do not even imagine the possibility of the existence of other mathematical knowledge and practices that expand and complement the mathematics disseminated by the West. But if we analyze mathematics from a sociocultural approach, we can see that they do exist... (p. 216).

These phenomena of teaching, learning, and communication of mathematical knowledge based on sociocultural approaches can be introduced to the mathematics classroom, therefore López and Victoria (2015) tell us that "teachers must propose didactic strategies that respond to the essential features that characterize each culture, this to make the teaching and learning of mathematics a formative pretext." (p.53). However, when performing a design, there are "...difficulties manifested in the linguistic interpretation, in the problem statements, [that] influence the free and rapid learning of the basic concepts of a given topic." (Lopez & Victoria, 2015, p.54).

Therefore, a harmonization must be made between the proposed statements in Spanish and the community of native language speakers where the design is to be implemented therefore, "...from the social environment, the task must go further because it becomes necessary to harmonize the terms. The social uses and meanings that the terms have in one and the other language must be identified..." (Avila, 2018, p. 192).

Given this scenario, the construction of didactic activities based on practices related to the culture of an ethnic group can be proposed. This is to incorporate them into the mathematics classroom of native peoples' communities. For this reason, we have taken up the cultural aspects of a collaborator at the higher level, on which we have based the design of a Didactic Activity with corn planting growth in different lunar phases that involve predicting a time after the initial one, involving variational thinking and language to promote understanding of the relationship between the slope parameter concerning the inclination of a straight line. It was decided

to work with high school students due to the harmonization between aspects of Spanish and the language of the native people of origin, as well as in the translation of the didactic activity for the community's children. If they have difficulties reading the didactic activity in Spanish or the native language, the collaborators can harmonize the activity for them. However, the Tzeltal language has linguistic variants "territorially delimited" by municipalities. In that sense, Polian (2015) comments that:

> Tzeltal is a language with moderate dialectal variation: it presents undoubted differences from one municipality to another, so it is made up of a certain number of what we call here "geolects" (so as not to say "dialect", a word with a negative connotation in common speech), that is, varieties with their linguistic features, linked to certain geographical areas. (p. 4)

The National Institute of Indigenous Languages (INALI) classifies them into four categories: Western Tzeltal, Northern Tzeltal, Southern Tzeltal, and Eastern Tzeltal. Within which are located several municipalities in the state of Chiapas. (INALI, 2021).

Therefore, the participation of the Tzeltal-speaking collaborator in this research is considered relevant to harmonize the Spanish terms of the Didactic Activity with their respective community of origin.

METHODOLOGICAL STRATEGY

The methodological strategy that this research followed was in three stages. The first stage consisted of inviting people from native peoples who are students of CE in the School of Engineering (SE) of the UNACH to participate in the research. From this stage, a sample of four women speakers and passive speakers of native languages accepted the invitation. Their participation will have a double role since first, we will obtain from them cultural aspects related to the culture of plants in lunar phases and at a later stage, they will have the role of harmonization between the didactic activity and the children to whom we plan to apply the activity in the community of origin of each one of them. In the first methodological stage, cultural aspects were identified, about agriculture, through a story that each student elaborated on and in an interview conducted with each one of them.

The second stage consists of the use of the cultural aspects identified in the previous stage, which are put into play in the design of didactic activities for each of the collaborators' communities of origin, that is, for a Tzeltal collaborator the design will be for their community of origin, and so on for each of the collaborators. For the Didactic Activity design, theoretical aspects of Socioepistemology are taken up again.

The third, a staging of the didactic activities in the communities of origin of each one of the collaborators, where the narratives and the developments made by the elementary level students of each collaborator locality of origin will be recovered and analyze what arguments they use to establish the existing relationship between the slope parameter concerning the inclination of the straight line.

FIRST METHODOLOGICAL STAGE

For the incorporation of cultural aspects to a didactic activity designed for native peoples, it is proposed to take them up from a cultural reproduction, as Dietz (2017) comments:

> ..., the members of a specific ethnic group..., do not reinvent their culture daily, nor do they constantly change their group identity. Cultural reproduction, both intra- and intergenerationally, elicits - through everyday praxis - processes of what Giddens (1995) coined as "routinization," which, in turn, structures that praxis. (p. 198)

From this routinization, according to Dietz (2017), individuals manage their continuity, both in **objectified cultural aspects** such as institutions, rituals, and pre-established meanings and in s**ubjectified cultural aspects** such as practices and representations by members to the ethnic group to which they belong. For the case, this would consist of the following breakdown (image 1)

Aspectos Culturales Objetivados			Aspectos Culturales subjetivados	
Instituciones	Ritual	Significados	Prácticas	Representaciones
Instituciones comunitarias que intervengan en la agricultura	Ritual a alguna deidad, del cielo, de la tierra o del agua	Significados que se relacionan con la agricultura	Prácticas subjetivas asociadas a la agricultura	Representaciones sociales asociadas al cultivo de plantas

Image 1. Breakdown of cultural aspects for agriculture. Source: Own elaboration

We consider that one or both cultural aspects can be used for the construction of didactic activities that use variational thinking and language for the existing relationship between the slope parameter concerning the inclination of the straight line, that is, identified in the plant that is planted in each collaborator's community of origin. The instruments used to obtain information were a narrative that consisted of a story and an interview with each collaborator.

In this first methodological stage, sampling was carried out at UNACH's School of Engineering, and four collaborators decided to participate in this research (see Table 1). This educational center is interpreted as a place of

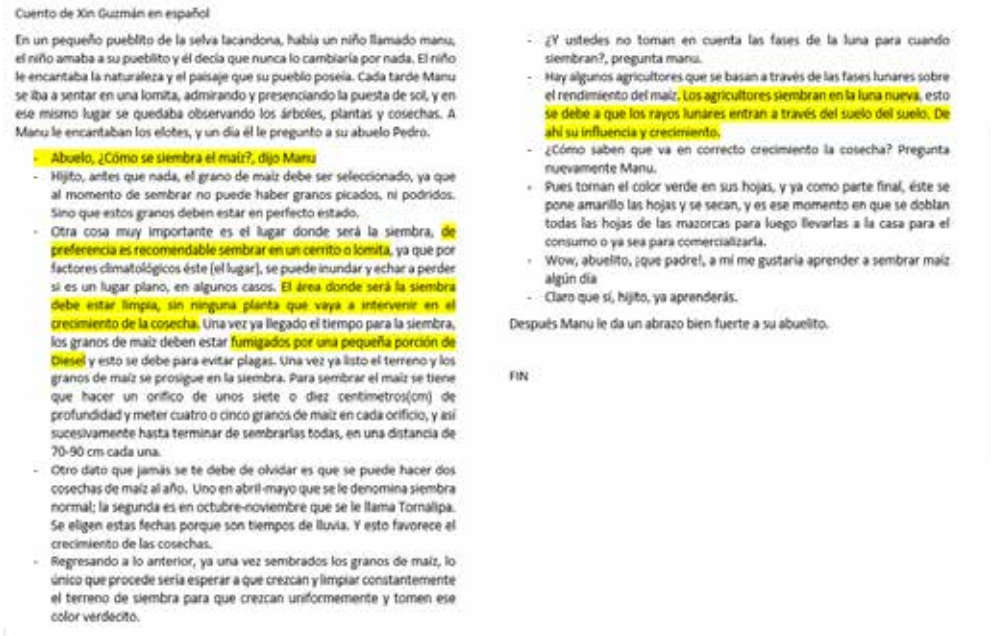
convergence of students from different regions of the state of Chiapas. The four collaborators are currently in their fourth semester at the CE. The collaborators will actively participate in the research since they will harmonize terms between Spanish and the native language to which they belong. The purpose of the story was to provide a way for them to externalize how a plant is cultivated in their community of origin, and that its growth is related to a specific lunar phase. They were asked to communicate with their relatives to support them in the realization of the story. As a result of this story, the type of plant and the lunar phase when the planting is done in each collaborator community of origin was identified. For example, in the case of the Tzeltal collaborator, as well as the *Ch'ol* collaborator, it is corn plant growth, which can be related to the linear function. For a Zoque collaborator, the plant identified is the plantain stalk, and for the other, it is the pumpkin culture. But what is shown in this paper corresponds only to the contribution of the Tzeltal student. The result of the *Ch'ol* community and the two Zoque communities' designs will be shown in another paper.

Table 1
Provenance of research collaborators

Collaborator	Speaking Language	Student's community of origin
1	Tzeltal	Nuevo Monte Líbano, municipio de Ocosingo
2	Zoque	Ocotepec, municipio de Ocotepec
Collaborator	**Passive speaker**	
3	Zoque	Tecpatán, municipio de Tecpatán
4	Ch'ol	El Limar, municipio de Tila

Source: Own elaboration with collaborators information

The following story was constructed with the Tzeltal collaborator (See Image 2).



Cuento de Xin Guzmán en español

En un pequeño pueblito de la selva lacandona, había un niño llamado manu, el niño amaba a su pueblito y él decía que nunca lo cambiaría por nada. El niño le encantaba la naturaleza y el paisaje que su pueblo poseía. Cada tarde Manu se iba a sentar en una lomita, admirando y presenciando la puesta de sol, y en ese mismo lugar se quedaba observando los árboles, plantas y cosechas. A Manu le encantaban los elotes, y un día él le pregunto a su abuelo Pedro.

- Abuelo, ¿Cómo se siembra el maíz?, dijo Manu
- Hijito, antes que nada, el grano de maíz debe ser seleccionado, ya que al momento de sembrar no puede haber granos picados, ni podridos. Sino que estos granos deben estar en perfecto estado.
- Otra cosa muy importante es el lugar donde será la siembra, de preferencia es recomendable sembrar en un cerrito o lomita, ya que por factores climatológicos éste [el lugar], se puede inundar y echar a perder si es un lugar plano, en algunos casos. El área donde será la siembra debe estar limpia, sin ninguna planta que vaya a intervenir en el crecimiento de la cosecha. Una vez ya llegado el tiempo para la siembra, los granos de maíz deben estar fumigados por una pequeña porción de Diesel y esto se debe para evitar plagas. Una vez ya listo el terreno y los granos de maíz se prosigue en la siembra. Para sembrar el maíz se tiene que hacer un orificio de unos siete o diez centímetros(cm) de profundidad y meter cuatro o cinco granos de maíz en cada orificio, y así sucesivamente hasta terminar de sembrarlas todas, en una distancia de 70-90 cm cada una.
- Otro dato que jamás se te debe de olvidar es que se puede hacer dos cosechas de maíz al año. Uno en abril-mayo que se le denomina siembra normal; la segunda es en octubre-noviembre que se le llama Tornalipa. Se eligen estas fechas porque son tiempos de lluvia. Y esto favorece el crecimiento de las cosechas.
- Regresando a lo anterior, ya una vez sembrados los granos de maíz, lo único que procede sería esperar a que crezcan y limpiar constantemente el terreno de siembra para que crezcan uniformemente y tomen ese color verdecito.
- ¿Y ustedes no toman en cuenta las fases de la luna para cuando siembran?, pregunta manu.
- Hay algunos agricultores que se basan a través de las fases lunares sobre el rendimiento del maíz. Los agricultores siembran en la luna nueva, esto se debe a que los rayos lunares entran a través del suelo del suelo. De ahí su influencia y crecimiento.
- ¿Cómo saben que va en correcto crecimiento la cosecha? Pregunta nuevamente Manu.
- Pues toman el color verde en sus hojas, y ya como parte final, éste se pone amarillo las hojas y se secan, y es ese momento en que se doblan todas las hojas de las mazorcas para luego llevarlas a la casa para el consumo o ya sea para comercializarla.
- Wow, abuelito, ¡que padre!, a mí me gustaría aprender a sembrar maíz algún día
- Claro que sí, hijito, ya aprenderás.

Después Manu le da un abrazo bien fuerte a su abuelito.

FIN

Image 2. Story by Xin Guzmán

Upon analyzing the story, corn is identified as the plant to be used in a Didactic Activity. The new moon is also identified as the beginning of planting and can be interpreted as an initial condition. After analyzing the story, other cultural aspects related to the cultivation of corn can be found, both objectified and subjectified, which are described in Image 3.

Aspectos Culturales Objetivados			Aspectos Culturales Subjetivados	
Instituciones	Ritual	Significados	Prácticas	Representaciones
Familia de la comunidad de origen. ***Manu le pregunta a su abuelito Pedro***	La montaña, como una representación de la tierra, sigue siendo para los tzeltales un símbolo de la fertilidad. (D'Alessandro y González, 2017, p.282) ***Sembrar cerca de un cerrito o lomita.***	Significado sobre el Efecto lunar sobre el crecimiento del maíz. ***Esto se debe a que los rayos lunares entran a través del suelo. De ahí su influencia y crecimiento.***	Practicas transmitidas de una generación a otra y asociadas al cultivo del maíz. ***Limpieza del terreno.*** ***Los granos de maíz fumigados con Diesel.***	El género masculino asociado al cultivo del maíz. **Manu (un niño), le pregunta a su abuelito Pedro (Hombre)**

Figure 3. Objectified and subjectified cultural aspects that emerge from the Tzeltal collaborator's story.

An interview was also conducted with the Tzeltal collaborator, to complement the cultural aspects obtained from the story. In the interview with the Tzeltal community collaborator, she gestures about the plant's growth in the variation of the lunar phases. This is interpreted as a behavior where

the plant stops growing for some lunar phases with growth for later phases. This resulted in the construction of the graph shown in image 4.

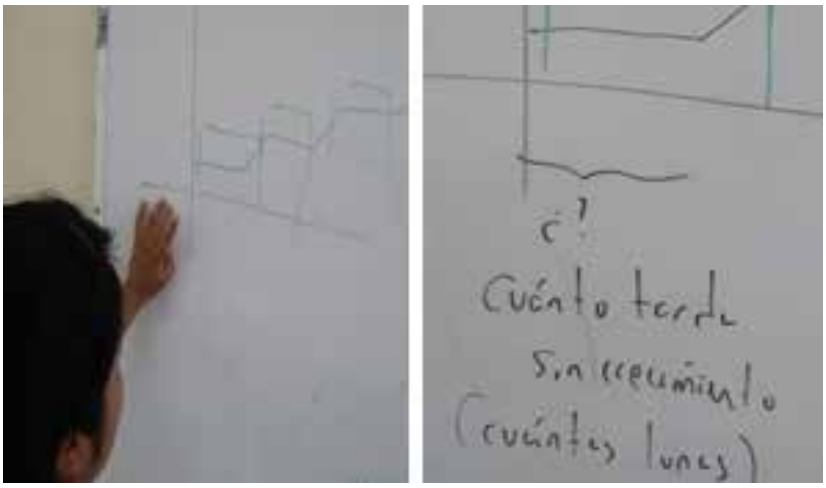


Image 4. Construction of a graph of a plant's growth behavior

This methodological stage ends with elements on the cultural aspects, both objectified and subjectified by the Tzeltal collaborator, student of UNACH's School of Engineering. It is considered to retake part of them for the Didactic Activity design for the Tzeltal community. As well as each contribution of the other collaborators will be taken in the respective didactic activity design for each one of their communities of origin.

SECOND METHODOLOGICAL STAGE

For the Didactic Activity design for the Tzeltal community, we based ourselves on the Socioepistemological theory, taking up some cultural aspects of the story and the interview with the Tzeltal collaborator. This theory, "focuses attention on knowledge-generating practices beyond the mathematical object" (Balda, 2018, p.91). As a knowledge-generating practice, aspects of prediction are taken up, which according to Caballero (2018), is carried out by human beings and allows the generation of variational thought and language. In our case, this will be used to promote the understanding of the relationship between the slope parameter concerning the inclination of the straight line.

To recognize the notion of variation in the didactic activity, it is necessary to consider the following aspects (Caballero, 2018)

> ... at least three essential aspects are required to be aware of the notion of variation. The measurement of change consists of the quantitative recognition

> of that which changes [concerning a second aspect], the analysis of how that measure evolves consists of describing and quantifying how the measure of change is modified in an interval. [Finally], the recognition of why variables change in the way they do allude to a characteristic of prediction, it is a matter of establishing a rationale for the evolution of change in an interval. (pp. 49-50)

Therefore, we consider that the phases of the moon, Image 5, can be used to establish a quantitative recognition of change, descriptions, and quantifications of how the measure of change in plant growth is modified in the phases and finally, the recognition of why plant's growth changes in the way it does.

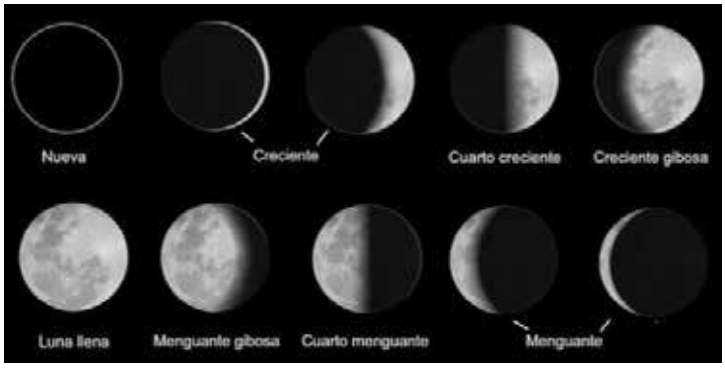


Image 5. Names of the phases of the moon as seen from the northern hemisphere of the Earth. Source: Geoencyclopedia (2019)

Therefore, it is proposed to place in the Didactic Activity a height measurement for a corn plant in a lunar phase and a different measurement in a later lunar phase. With this, we consider it is possible to establish quantitative recognition of that which changes as mentioned by Caballero (2018), see image 6.

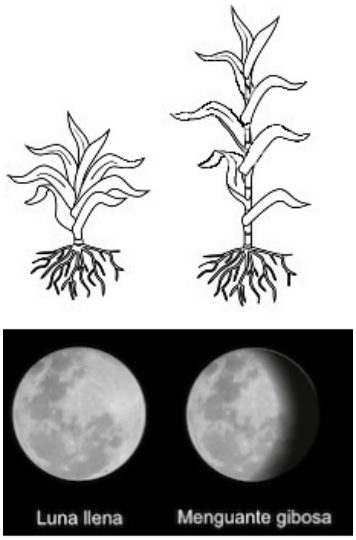


Image 6. Quantitative recognition for different lunar phases. Source: The authors

On the other hand, "Studying change in a phenomenon requires recognizing intermediate states to analyze the process of variation of variables, that is, to give a sense of temporization to the phenomena of variation, which allows us to address the question "how does it change?" (Caballero, 2018, p. 95), this for the analysis of how that measure evolves. In this sense about temporization, Caballero (2018) clarifies:

> Timing comprises two senses: the first is the identification of states that are suggested or explicit in some activity or situation, for example, in the case of a numerical table, each of the numerical values of the dependent variable can be considered states, while, in a graph, each of the values of the horizontal axis can be considered states if it has an explicit numerical scale. The second sense consists in the construction of the states when they are not explicit in the given situation, for example, when establishing specific values of the variables in a graph that does not have an explicit scale, or when recognizing specific instants of time in the movement of a body. (p.96)

Therefore, the following design is proposed, where the analysis of how this measure evolves consists of describing and quantifying how the measure of change is modified in a lunar interval by establishing specific values of the variables in a graph that does not have an explicit scale, as shown in image 7. We can propose different slopes in the linear growth in three lunar phases and question the corn plant's growth speed. Where a steeper slope would mean a faster growth rate for the plant. We consider that the existing relationship between the slope parameter concerning the slope of the straight line can be gestated in the analysis of this behavior when studying the change in a phenomenon requires recognizing intermediate states to analyze the process of variation of the variables as mentioned by Caballero (2018).

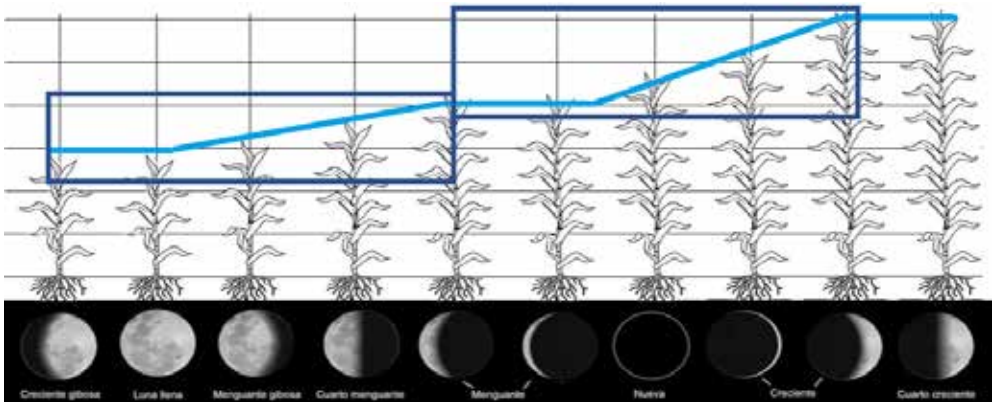


Figure 7. Behavior of maize-based on cultural aspects of the Tzeltal university student collaborator

Finally, the recognition of why the variables change in the way they do alludes to a characteristic of prediction, it is about establishing ***rationality*** to the evolution of change in an interval. Caballero mentions that this rationality is manifested in a variational reference system (image. 8).

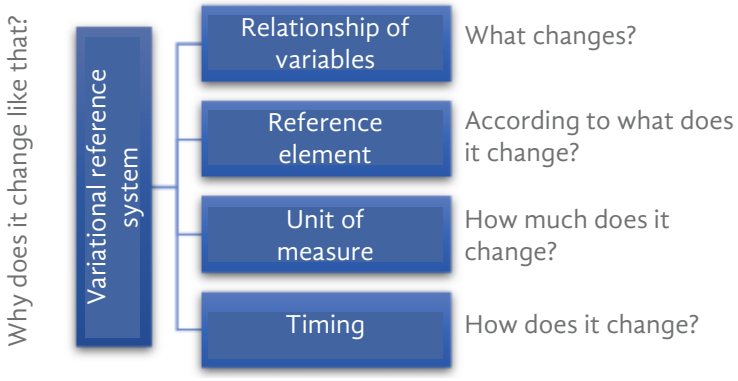


Image 8. Rationality for variation. Caballero (2018, p.99)

A boy or girl from the community of origin of the Tzeltal collaborator, in the third methodological phase, could associate in his or her rationality with some of these cultural aspects to justify the variational in the understanding of the existing relationship between the slope parameter concerning the inclination of the straight line (image 9), to mention a few.

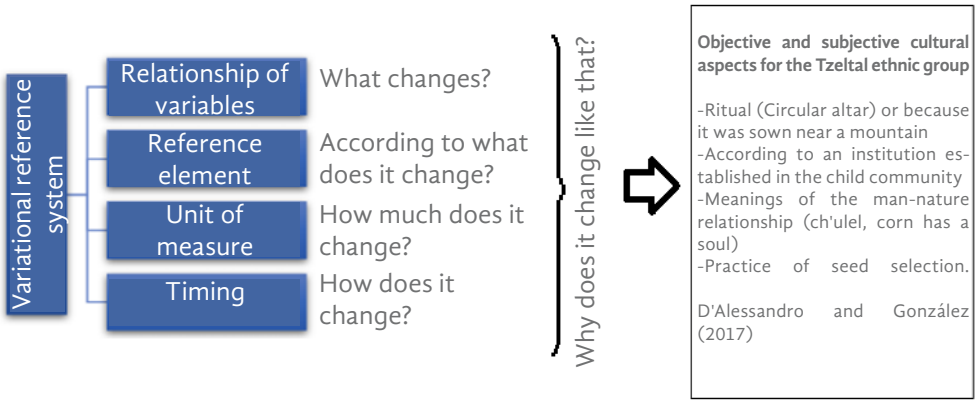


Image 9. Cultural aspects that can emerge as arguments for the variational in the Nuevo Monte Líbano community's children

Although it is expected that he or she identifies a unit of analysis and the type of inclination in each of those units. It is expected to establish a relationship between vertical growths concerning horizontal growth according to the type of inclination observed (image 10).

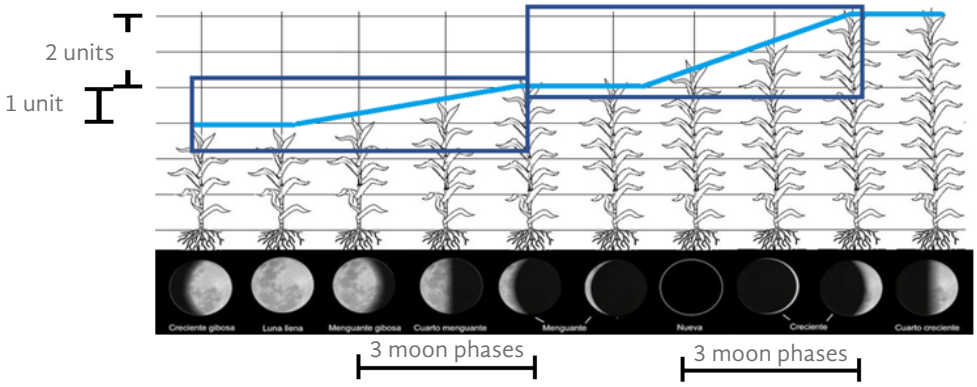


Image 10. Identification in the unit of analysis of a different slope for the straight line

Recalling that the notion of slope (m) of a straight line is a quotient relation between the distances of the ordinate with the distances of the abscissae. (Lehmann, 1989).

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

And its relation with the straight line's inclination is

$$m = \tan \propto$$

Where $\propto$ is the angle between the straight line and the positive x-axis (see Image 11).

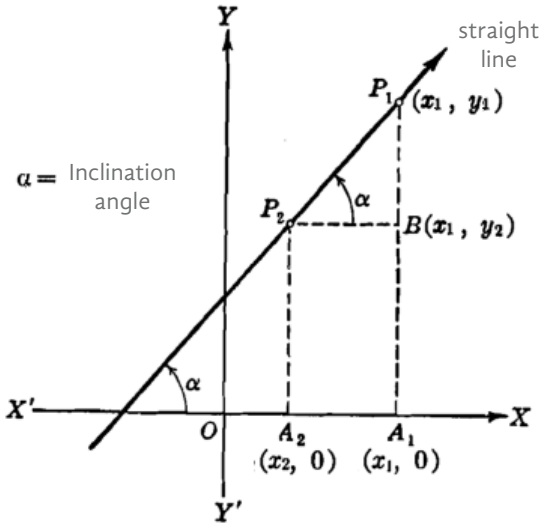


Image 11. Graphical representation of the inclination angle. Source: Lehmann (1989, p.18)

The second methodological stage ends with a Didactic Activity built for the Tzeltal community of Nuevo Monte Líbano, as shown in APPENDIX A and B.

IN CONCLUSION

It has not been possible to carry out phase three of the methodological strategy, due to the academic pause due to the pandemic caused by the virus Covid-19. This has resulted in a limiting factor for the continuity of the research project. The strengths that we consider can emerge from a proposal such as this one, is to create a frame of reference that denotes how it is possible to favor the understanding of the existing relationship between the slope parameter concerning the inclination of the straight line using the objectified or subjectified cultural aspects of a community speaking an original language for the state of Chiapas, as is the design shown in this paper and for the community of Nuevo Montelíbano. We agree with Cantoral (2013) who pointed out "A fundamental question of contemporary importance consists of adapting a teaching, in the broadest sense of the term, to the demands of thinking, learning and the historical, institutional and cultural contexts that mathematical activity requires" (p. 13). In this sense, we rely on the practices of corn culture about the lunar phases, which make sense culturally speaking for the children of Nuevo Monte Líbano, since they, at an early age, take care of the harvest, and are familiar with following the moon, according to what Xin comments to us.

> "...from ten years old, children already go to the fields..., they already know how it is, how plants grow...and if they would understand it, based on those questions..." (Interview excerpt).

On the other hand, an opportunity that we visualize for this proposal is to consider cultural aspects such as corn growth in different lunar phases incorporated into the variational thinking of the Tzeltal collaborator, a student of the School of Engineering of UNACH. One interpretation of this is when the collaborator suggests constant behaviors to then continue with the plant's growth. This is interpreted as a variational graph and we consider that it is her contribution that we can reflect it in the graph of Image 4, to apply it to the children in her community. In that sense Avila (2018).

> To perform the task of harmonizing terms, it would be very useful to generate spaces of speech, communication, and exchange between teachers and students in the classrooms, so that children also collaborate in the construction of a relevant and meaningful school mathematical language. (p.193)

Thus, a return to the community of origin of the Tzeltal collaborator in this research is proposed, for students' significant learning of concepts such as the slope of a linear function implicit in the figures proposed in the didactic activity, such as the straight line in the case of the first part of the design, as shown in image 12, where last plant's growth represented does not coincide with the inclination of the straight line implicit in the activity.

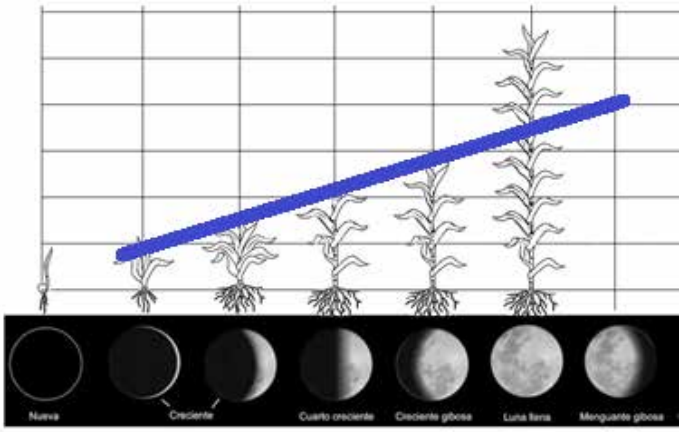


Image 12. Implicit straight line in plants' growth with a certain inclination

In the second part of the Teaching Activity a form similar to the integer part function, $f(x)=[x]$, where constant growths are perceived in certain lunar phases, but at different heights of the "y" axis, and in others with linear growths, for example, $f(x)= x$, is proposed. Setting up a piecewise function, as shown in image 13. And it will ask for the plant growth in a future lunar state, which does not appear in the lunar phases of the graph.

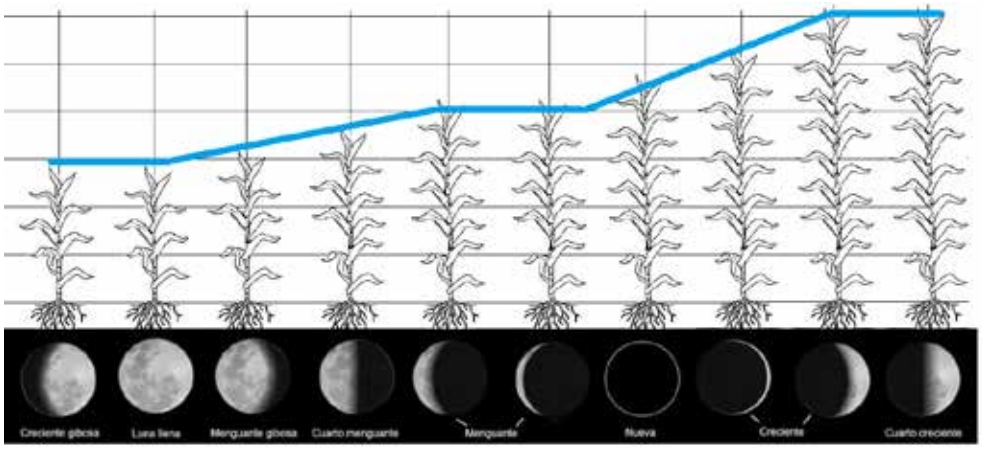


Image 13. Implicit function to stretches in the plant's growth in different lunar phases

This concludes the two proposals for the design of the Didactic Activity for the Tzeltal community of Xin. These proposals are based on lunar phases that the members of the Xin community do not know by name, but they do know their behavior in the sky since they have observed the moon.

> "well yes, [But, how do they do it?] they observe the moon, but in and on itself, but they know what it is... they don't know the specific name... they only do it close to the full moon or the new moon" (Fragment of interview).

We consider it relevant to base ourselves on the two strands that emerge from routinization for cultural reproduction (Dietz, 2017), for the arguments that may arise in the children of a Tzeltal community to justify the use of variational thinking by complementing concepts such as the existing relationship between the slope parameter concerning the inclination of the straight line when the third methodological phase is performed. When intervening in the mathematics classroom at the elementary level in a rural community in the state of Chiapas, we can mention that the ages of the children to whom a Didactic Activity will be applied will depend on the information provided by the collaborators in this research. As in the case of the information provided by the collaborator from Nuevo Montelíbano, municipality of Ocosingo, we can establish an age of 11 years old to apply it.

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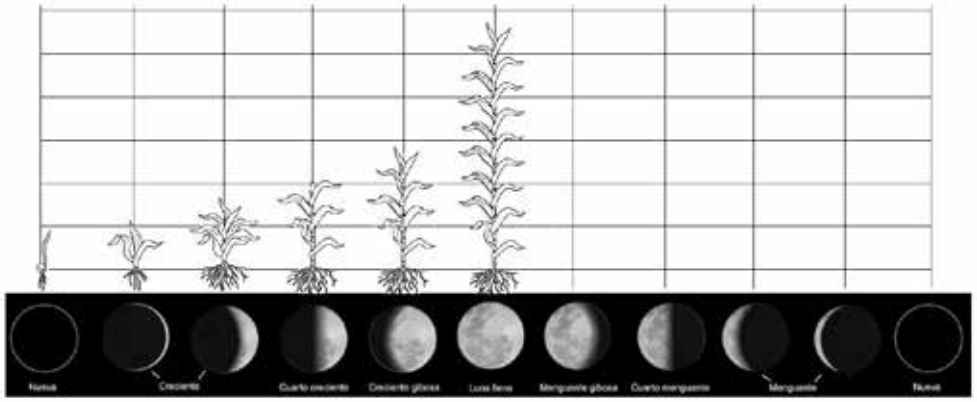
ANNEX A

PART 1. - The height of a corn plant at the full moon is as shown in the figure.

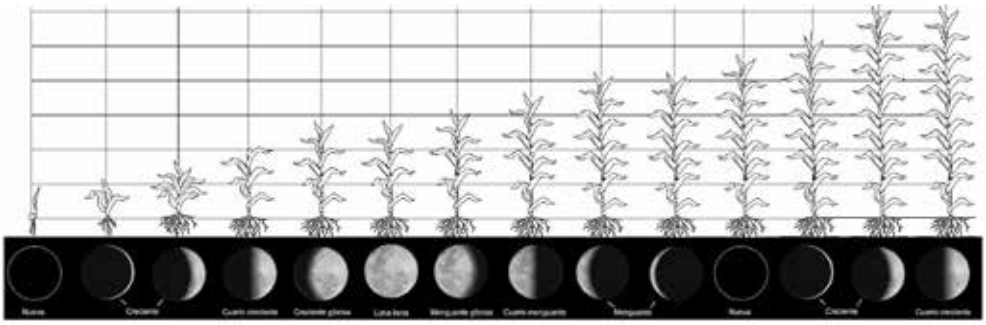


a) Is that height what the plant should be? If yes, why?

b) If no, what should the height be?

c) How did you know what the height should be? What calculations did you make? Post your procedure. Draw pictures to explain how you calculated the height.

PART 2. – A corn plant grows as shown in the following image.



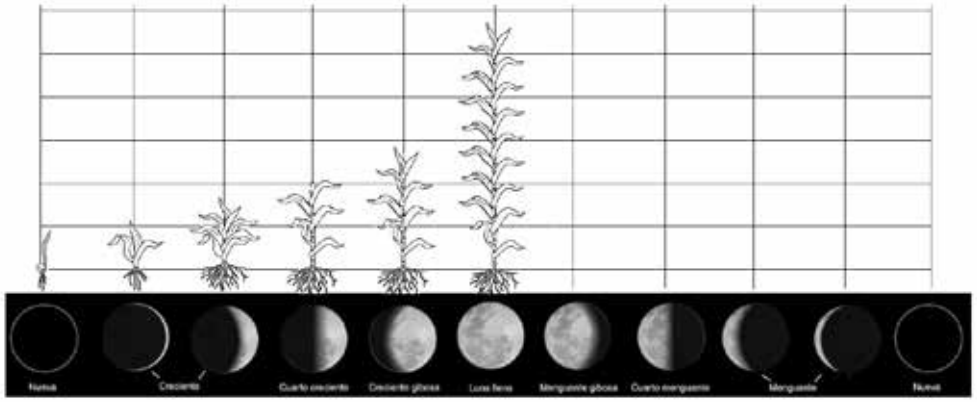
a) What would be the height of the plant at the next full moon?

b) How did you know what the height should be? What calculations did you make? Post your procedure. Draw pictures to explain how you calculated the height.

c) Why does the plant behave like this? (Make drawings to explain your answer if you think words are not enough to explain it).

ANNEX B

PARTE 1.- Ja' te stoyolil te ixim-ej ta syijil uj aj' te yax chiknaj te ta lok'ombaj.

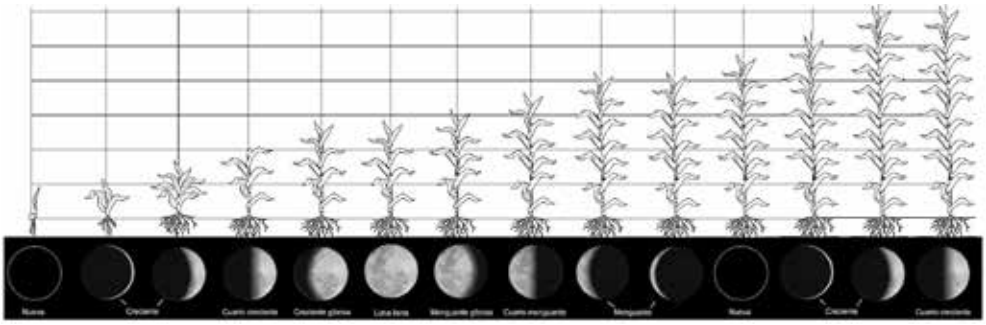


a) ¿jich bal stoyoyil xch'ijyel ixim-aj? Te me melel-ej, ¿biun?

b) Te me mauk-ej, ¿bin yilel wan xch'iyel aj

c) bit'il ya ka na' bin smuk'ul xch'iyel aj?, ¿bin kalculo la ja pas?, Te me ya xu' awu'une pas-aj slok'ombal te bit'il la ja pas kalcular te smuk'ul xch'iyel te ixim-ej.

PARTE 2.- Ja’ te xch’iyel te ixim-ej ja’ te ya xchiknaj te ta lok’ombaj.



a) ¿Bin wan smuk’ul xch’ijyel ixim-aj te ta syijil uj?

b) ¿bit’il la ja na’ bin smuk’ul xch’ijyel aj?, ¿bin kalculo la ja pas?, Te me ya xu’ awu’une pas-aj slok’ombal te bit’il la ja pas kalcular te smuk’ul xch’iyel te ixim-ej.

c) ¿Bin swenta te Jich ya ch'ijybal te ts'umbal ej?(te me ma' ka na' yalel o xcholel ta k'optik, pasbeya slok'ombaj ta lejchel Jun te bin ta jok'obeyelat ej)

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SEROPREVALENCE OF ABORTUS DISEASES THAT COMMIT THE BOVINE REPRODUCTIVE EFFICIENCY IN TWO DAIRY AREAS OF CHIAPAS

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— Abstract—

The objective of the present study was to determine the seroprevalence of antibodies against Brucella abortus, Leptospira spp, and Neospora caninum in cattle in two dairy areas of the state of Chiapas. Blood serum was collected from 76 and 103 female bovines from the municipalities of Tecpatán and Juárez respectively. The detection of antibodies against Brucella abortus was performed by the Card test and its confirmation with Rivanol, microplate agglutination against seven serovars of Leptospira, and enzyme immunoassay against Neospora caninum. The results found show a seroprevalence of antibodies for Brucellosis of 0 and 6.8%; 29 and 63% for leptospirosis for the municipality of Tecpatán and Juárez respectively, being the serovars with the highest frequency of seropositivity Icteroahemorrhagiae and Tarassovi, in both municipalities, while seropositivity against Neospora caninum was 46 and 21% respectively. It is concluded that the presence of antibodies against Brucella, Leptospira, and Neospora caninum may be related to the reproductive efficiency of cattle in the municipalities of Tecpatán and Juárez, in the state of Chiapas.

Keywords

Ruminants, Brucellosis, Leptospirosis, Neosporosis..

Abortion is one of the main causes affecting the economics and competitiveness of dairy production. It is a problem of growing importance that significantly impacts herd productivity by decreasing herd viability and productive performance, reducing the potential number of replacement heifers and milk production, as well as increasing costs associated with feeding, treatments, insemination, and premature culling. It can occur sporadically, endemically, or in the form of an outbreak, among its causes can be mentioned some viral, bacterial, or parasitic infections, although determining exactly what causes it is complex. In Mexico, more than 70% of abortions are classified as of unknown origin (Escamilla *et al*., 2007), which limits the implementation of strategies to reduce their occurrence in herds.

Brucellosis is a zoonotic disease caused by bacteria of the genus *Brucella*, being *Brucella abortus* the main species in cattle. Abortions generally occur between 6 and 9 months of age. However, it is estimated that in unvaccinated cows infected in the first trimester of gestation, up to 80% of abortions can occur. Diagnosis can be made by isolation of the bacteria from uterine fluid, milk, placenta, fetal lung, fetal stomach contents, or by serological or milk agglutination techniques.

Another disease of worldwide distribution is leptospirosis, which is more common in tropical and subtropical countries with high humidity, where conditions for its transmission exist (Artiushin *et al*., 2004), especially during the rainy season, where the number of infections increases (Subharat *et al*., 2012). Other risk factors reported in dairy production systems include high animal density, even for short periods of time, and defects in the integrity of the facilities that facilitate the accumulation of excreta, contributing to the spread and maintenance of infection, making vaccination and antibiotic use inefficient (Martíns *et al*., 2012; Llanco *et al*., 2017).

Leptospira hardjo has been identified as the main responsible, individually or in association with other pathogens such as *Neospora caninum* or *Brucella abortus*, for causing bovine abortion in Mexico (Escamilla *et al*., 2007). On the other hand, in some Latin American countries such as Venezuela, Mexico, Colombia, and Brazil, seroprevalences of 42, 10, 61, and 45%, respectively, have been reported (Godoy *et al*., 1997; Nilson, 2003; León *et al*., 2008; Martins *et al*., 2012).

The most important economic impact on cattle farms is the reproductive problems that are mainly manifested by the presentation of abortions, the birth of weak animals, and a decrease in reproductive efficiency.

Bovine neosporosis is a parasitic disease caused by the protozoan *Neospora caninum*, which is characterized by causing abortion at any stage of gestation and can occur more than once in the reproductive life of cattle (Dubey *et al*., 2007). Neosporosis can be acquired by postnatal exposure,

after ingestion of food contaminated with tachyzoites from abortions, infected placentas, or oocysts present in the feces of dogs (Wouda, 2000). It is recognized as one of the main causes of economic losses in production units because it is associated with embryonic losses and is considered one of the main causes of abortion (Quiroz, *et al*., 2011). In studies of neosporosis seroprevalence in cattle in the municipality of Villaflores, Chiapas, 26% was reported (Santiago and Velasco, 2014) and the Istmo-Costa region (Girón and González, 2017) reported 8.33% of seropositive animals.

With this background, it becomes necessary to perform serological tests that allow the identification of the different agents involved as a cause of reproductive failures in the bovine dairy of the region. The objective of the present study was to determine the seroprevalence of antibodies against *Brucella abortus*, *Leptospira* spp, and *Neospora caninum*, in cattle with a history of reproductive problems in two dairy areas of the state of Chiapas.

MATERIALS AND METHODS

The present work was carried out in Tecpatán and Juárez, Chiapas, two of the most important municipalities in the production of milk and its derivatives in the state. The municipality of Tecpatán is located at 17° 098'' N and 93° 19'' W, at an altitude of 320 masl. The climate is hot and humid with rainfall throughout the year. The municipality of Juarez is located at 17°36'27''N 93°11'35''W at an altitude of 150 masl. It presents a warm humid climate with rainfall all year round. (INAFED 2018).

Sample size determination

To determine the sample size, the formula described by Milian (1998) was used, where N = 3.84 P (1-P) / t^2. where N = Sample size; P = Is the prevalence estimate (.28), 3. 84 = Z value of the standard normal distribution; t^2 = Limit within which the prevalence estimate is desired (.10) with a confidence level of 95%, obtaining a total of 76 animals to be sampled in 16 herds in the municipality of Tecpatán and 103 animals in 22 herds in the municipality of Juárez, Chiapas.

Collection of samples

Blood samples were obtained by puncture of the coccygeal vein from dual-purpose cows (*Bos taurus X Bos indicus*), all of them with a history of abortion, repeated estrus or anestrus, with a minimum age of 4 years, and without a history of vaccination against brucellosis and leptospirosis. The collected samples were centrifuged at 2500 rpm for 5 min to obtain blood serum.

Antibody Detection

The detection of antibodies against *Brucella spp* was performed by the 8% card test and its confirmation by Rivanol, with the microagglutination test (MAT) antibodies against six serovars of *Leptospira spp* of national importance were detected.

For the detection of IgG antibodies specific to *Neospora caninum*, the enzyme-linked immunoassay test (ELISA) was used, using the commercial package neospora 2/strip anti-N. *caninum* (IDDEX® Laboratories, Inc), with a sensitivity of 98.6% and specificity of 98.8%. The test was performed with a single 1:100 dilution, identifying positives and negatives at the absorbance of 450 nm. Sera were tested paired and the cut-off point was 0.50, with those with mean readings of ≥ 0.50 being considered positive.

The study was descriptive cross-sectional, the sampling design was simply random, observing the frequency with which antibodies against the diseases studied were present. The positive results were expressed in terms of the Prevalence Rate for each municipality considered in this study.

RESULTS AND DISCUSSION

Seroprevalence of Brucellosis. In none of the serums (0/76) from the 16 herds considered for the study in the municipality of Tecpatán, antibodies against *Brucella spp*. were detected; however, in the serums from the municipality of Juárez, the positive seroprevalence rate was 6.8% (7/103), after performing the Rivanol test for confirmation, four of them showed the presence of antibodies against this bacteria, which belonged to 3 of the 22 herds considered for the study (Image 1).

Gonzalez *et al*. (2006) mentioned that the 8% Card test is highly sensitive but not very specific, that is why the Rivanol test is used for the confirmation of brucellosis in cattle; however, the specificity of the latter can be diminished when used shortly after vaccination of animals with the S19 strain or due to revaccination. The serological results found during this study in cattle in the municipality of Juárez show that although the samples came from negative herds free of brucellosis, the abortion problems reported in the herds sampled could be caused by the disease since there is no history of vaccination in these herds. It is important to highlight that the clinical signs of brucellosis are frequently observed during the first gestation and in subsequent calvings remain asymptomatic carriers and continue to eliminate the bacteria through milk, calving products, and vaginal exudate; these characteristics put calves that will be considered as new replacements at risk of contagion, so it would be advisable to establish a correct serological

monitoring and segregation program within herds, especially in those where there are few biosecurity measures (Fernandez *et al*., 2018).

Seroprevalence of Leptospirosis. Twenty-nine percent (22/76) of bovine blood serums from the municipality of Tecpatán showed antibodies to at least one serovar of *Leptospira spp*, while the seroprevalence rate of positive cases in the municipality of Juárez was 63% (65/103), (Image 1).

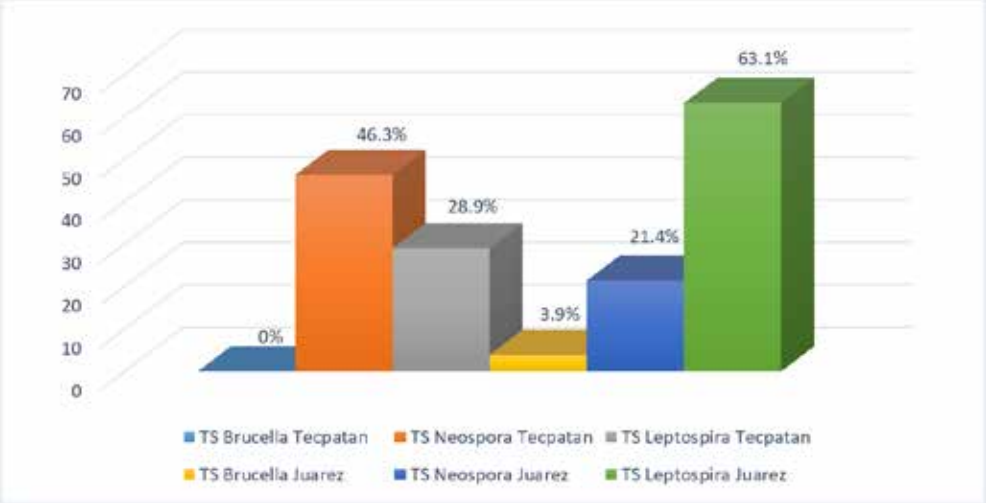

Image 1. Seroprevalence rate of bovine reproductive diseases in the municipalities of Tecpatán and Juárez, Chiapas. Source: Own elaboration

The most frequently identified serovars in Tecpatán were *Tarassovi* (47%), *Icteroahemorrhagiae* (23%), and *Bratislava* (20%); in Juárez, the most frequently reported serovars were *Icteroahemorrhagiae* (33%), *Tarassovi* (30%), and *Bratislava* (21%) (Image 2). All herds considered for this study were shown to have at least one animal seropositive for *Leptospira spp*. demonstrating that these serovars should be considered in vaccines against *Leptospira prevention*. Favero *et al*. (2017) reported that the presence of rodents and canines, as well as poor hygiene and the absence of vaccination programs within the herd, increase the probability of infection by *Leptospira spp* in cattle. The results obtained in this study show that in both municipalities the serovars with the highest frequency of seropositivity were *Icteroahemorrhagiae* and *Tarassovi*, both of which have been frequently reported in ruminants in Mexico and are generally associated with interspecies contact: rodent-bovine. On the other hand, *L. hardjo* has been identified as the main responsible, individually or in association with other pathogens such as *Neospora caninum* or B*rucella abortus*, for causing bovine abortion in Mexico (Escamilla *et al*., 2007).

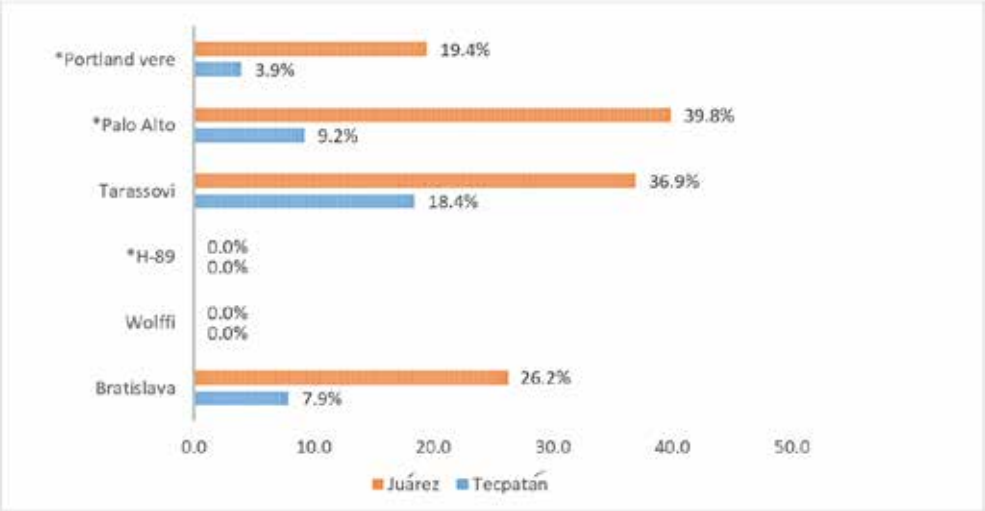

Image 2. Seroprevalence of *leptospira* serovars found in cattle in the municipalities of Tecpatán and Juárez, Chiapas. Source: Own elaboration

Seroprevalence of Neosporosis. In the blood serum samples of cattle from the municipality of Tecpatán, a seroprevalence rate of 46% was observed, that is, 35 of 76 samples showed antibodies against the disease. All herds considered for the study had at least one seropositive animal. In the municipality of Juarez, the seroprevalence of positive cases was 20% (21/103), 13 of the 22 herds had at least one animal with antibodies against *Neospora caninum*. The presence of this disease has already been reported in Mexico, as in other countries, and is related to the coexistence of cattle with dogs. In a study conducted by Sierra *et al*. (2011) and Pulido *et al*. (2017), showed that the presence of dogs seropositive to *Neospora caninum* is a risk factor for cattle in production units located in rural areas, these characteristics were frequently observed in cattle herds of this study, although canines are considered in addition to companion animals, a species used for the control of noxious fauna or as alert animals in most of these herds, it is necessary to raise awareness among producers that their presence can put the health of cattle at risk since they serve as vectors or carriers of some diseases.

CONCLUSION

The presence of antibodies against *Brucella abortus, Leptospira spp*, and *Neospora caninum* suggests that these agents may be related to the reproductive efficiency of cattle in the municipalities of Tecpatán and Juárez, in the state of Chiapas; therefore, it is necessary to implement measures to prevent the spread of these diseases among cattle, as well as to adopt strategies for their control. However, it is also necessary to consider the presence of other non-infectious factors that compromise it.

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SCIENTOMETRIC ANALYSIS ON RESEARCH AND TECHNOLOGICAL INNOVATION TRENDS IN THE EXPLOITATION OF COCOA (*THEOBROMA CACAO L.*) BY-PRODUCTS

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— Abstract—

Cocoa is one of the strategic crops for Colombia's rural development policy. Its production chain has an important role not only in economic sectors but also in social and environmental sectors, as it has been considered for the substitution of illicit crops and the restitution of lands. Colombian cocoa bean is recognized worldwide for its quality and aroma and is used as a raw material in the confectionery and chocolate, cosmetics, and pharmaceutical production industries. In Colombia, more than 35.000 families of small producers derive their livelihood from cocoa cultivation.

Approximately, 20% of the fruit is used for the cocoa derivatives industry and the remaining 80% is dried as residues in the form of a pod husk, mucilage, and bean shell. To determine the potential of cocoa residues as an additional source of income for cocoa farmers, scientometric techniques were used to extract indicators of scientific output and inventiveness. In this work, scientific indicators and relational matrices were obtained based on a review of articles and patents that enabled the potential use of cocoa residues to be determined within the principles of the circular economy, which may derive in additional income options for cocoa farmers. Chemical compounds such as polyphenols, alkaloids, and polysaccharides of interest to the food, cosmetic and pharmaceutical industries, were identified, mainly within products obtained from valorization processes. Environmental applications that involve the development of products from cocoa pod husk for soil bioremediation are also highlighted, as well as agricultural applications such as the use of bean shells for the production of biofertilizers, bio fungicides, and growth regulators.

Keywords

Circular economy; cocoa, by-products; exploitation, scientometrics.

Cocoa is a crop of strategic importance worldwide due to its growing demand, mainly as a raw material in the global food and cosmetic industry (Campos *et al*., 2018; Vásquez *et al*., 2019). In Colombia, cocoa cultivation ranks fifth in harvested area with 6.5% of the total area of agro-industrial crops and is surpassed only by coffee crops (29.8%), oil palm (14.1%), sugarcane (11.8%), and sugarcane (8.7%) (DANE, 2014).

According to the *Fondo de Estabilización de Precios del Cacao*, FEPCACAO, between 2013 and 2017, world cocoa bean production grew by 19% (from 3.34 to 4.63 million tons). Of this increase, 76% corresponded to cocoa from Africa, 16% from the Americas, and 8% from Oceania. In contrast, between 2011 and 2017, the increase in Colombian production was 62.7%, which earned it the 10th position in bean production worldwide (FEPCACAO, 2018).

According to FEPCACAO (2020), Colombia has been increasing interest in this crop, since in just 10 years, between 2009 and 2019 it went from producing 36,118 to 59,740 tons of dry beans.

The production of dry cocoa beans generates a significant volume of crop residues, including mucilage and pod husk. At the industrial level, an additional by-product known as bean shell is generated. The mucilage corresponds to the white covering of the seed, the bean shell to the covering of the kernel, and the pod husk to the covering of the entire fruit. The pod husk and mucilage are the residues that are generated in the greatest quantity during the grain fermentation and drying processes (Sodré *et al*., 2012; Lu *et al*., 2018; Campos *et al*., 2018; Vásquez *et al*., 2019).

From the perspective of sustainability, Colombia has included the bioeconomy to achieve green economic growth and within it, the circular economy as one of its fundamental axes. Additionally, residues from agricultural production, also known as residual biomass, are an integral part of the bioeconomy and circular economy perspectives in the country. (National Planning Department, 2018a).

In this sense, and consideration of the high content of biomolecules of industrial interest present in these residues, their revaluation is key to generate new products or inputs that supply crucial demands of bioactive ingredients for the cosmetic, pharmaceutical, food, and agricultural sectors (National Planning Department, 2018b).

Based on the Colombian production of dry beans in 2019 (59,740 tons) and that approximately 80% of the cocoa fruit corresponds to pod husk and mucilage (Campos *et al*., 2018; Vásquez *et al*., 2019), it could be stated that in that year's production approximately 238,960 tons of biomass were discarded during harvesting and fermentation, material that is generally underutilized at the cocoa farm level (Lu *et al*., 2018; Vásquez *et al*., 2019).

Currently, in the environment of Santander producers, it is also common for cocoa harvest residues, such as pod husk, to be discarded and piled in the

lots to be later incorporated as organic matter into the crop. However, unless the pod husks are subjected to a composting process, stacking in the lot is recognized as an inadequate practice, as it constitutes a potential source of proliferation of pests and diseases for the crop (Sodré *et al*., 2012; Lu *et al*., 2018). For its part, mucilage is generally lost as leachate (drained) during the seed fermentation process or is used for jams production.

Although there is current information on the use of cocoa residues, the enormous volume of records available in specialized databases makes it difficult to categorize the information and to know both the trends and the dynamics of research on the use of pod husk and mucilage. This situation makes it difficult to make decisions regarding the orientation of basic or applied research processes to develop the potential of these residues, which would result not only in the diversification of income for cocoa farming families but also in the reduction of these residues as sources for the spread of pests and diseases.

Thus, through the development of a scientometric exercise of scientific articles and patents, potential uses of cocoa harvest residues were identified by obtaining products and compounds of interest in different consumer industries, using keyword relational databases.

2. MATERIALS AND METHODS

To establish the scientific dynamics related to the use of cocoa residues, the scientific articles indexed in the *Scopus* reference database (Elsevier, B.V. 2020) during the period 1980-20l9 were considered. For the inventive step, the Derwent Innovation Index patent database (Clarivate, 2020) was used for the time interval 2000-2020. In both cases, the search terms used were: "*Theobroma cacao*"; cocoa; cocoa waste*; residue*; epicarp*; mucilag* "pod husk"; endocarp*; mesocarp*; "bean shell"; "bean husk"; pulp*; biomass; "residual biomass"; valorization; valorisation; by-products; exploitation.

Once the information was obtained, trends in the valuation of harvest residues were identified using scientometric indicators (publications by year and country) and matrices that related the different types of cocoa waste and non-food uses. The data obtained were analyzed using the text mining program VantagePoint® (Search Technology, Academic Version 12.0) and vos viewer (version 1.6.15, 2020, Centre for Science and Technology Studies, Leiden University, The Netherlands).

3. RESULTS AND DISCUSSION

The most relevant results of this scientometric analysis are presented below.

Scientific and inventive dynamics related to the use of cocoa waste at a global leve

According to the structured search equation, 1042 scientific articles and 3717 patent families were retrieved: Image 1 shows an increasing trend in the number of documents in the study period. For articles, the annual growth rate was calculated from 1980 using Price's Law (Price, 1976), which presented a value of 9.37% with a high correlation of the data (R^2 = 0.96). In the case of patents, 2001 was taken as a reference and a growth rate of 26.01% was obtained with a correlation of R^2 = 0.93.

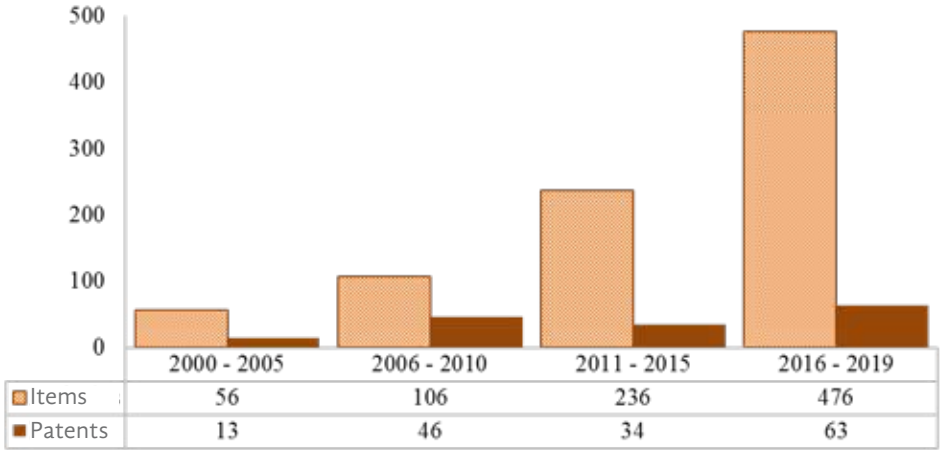

Image 1. Dynamics of scientific and inventive activity in the valorization of cocoa harvest residues. Source: Own elaboration

Most productive countries according to the number of scientific publications related to the use of cocoa residues

In terms of scientific production worldwide, Brazil recorded 146 publications, followed by Nigeria with 103, the United States with 93, and Malaysia with 83, as the most important countries researching this topic. In Latin America, in addition to Brazil, Colombia stands out with 40 registrations, Mexico with 32 and Ecuador with 20. In the case of patents, the patent offices, where innovations related to the use of cocoa residues in non-food applications, are registered and analyzed. Russia was identified with 57, China with 23, the United States with 21, and Brazil with 18.

Relational matrices

Within the residues generated in the cocoa harvest, three (3) groups of interest with potential for valorization in industries other than food were identified. According to the search equation structured for this study, 12

publications were found for the waste called mucilage, 147 for "cocoa bean shell" and 146 for "cocoa pud husk". In general, different applications can be derived from these residues as shown in Image 2.

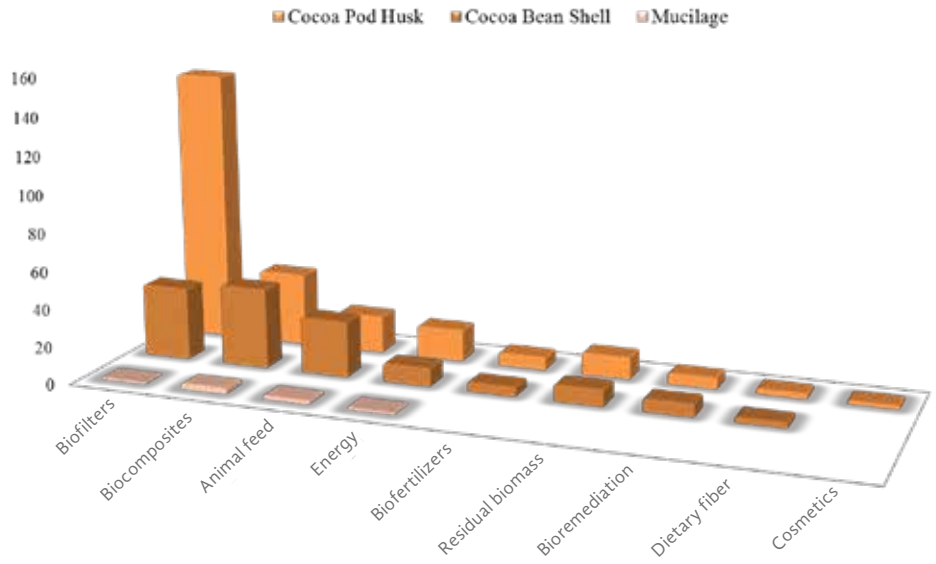

Image 2. Potential uses for the valorization of cocoa (*Theobroma cacao*) organic residues. Source: Scopus database (Elsevier, 2020). Vantage Point (Academic Version 12.0)

A matrix was obtained that relates the potential uses of these cocoa residues with the countries worldwide and in Latin America that research the subject the most (Image 3). Bio-compounds, activated carbon, animal feed, and residual biomass are the applications on which research efforts are concentrated in Brazil, Nigeria, The United States, among others, as can be seen in Image 3. In the case of Colombia, interest is focused on obtaining bio-compounds, activated carbon, and the use of residual biomass. For Mexico, the main focus is on activated carbon.

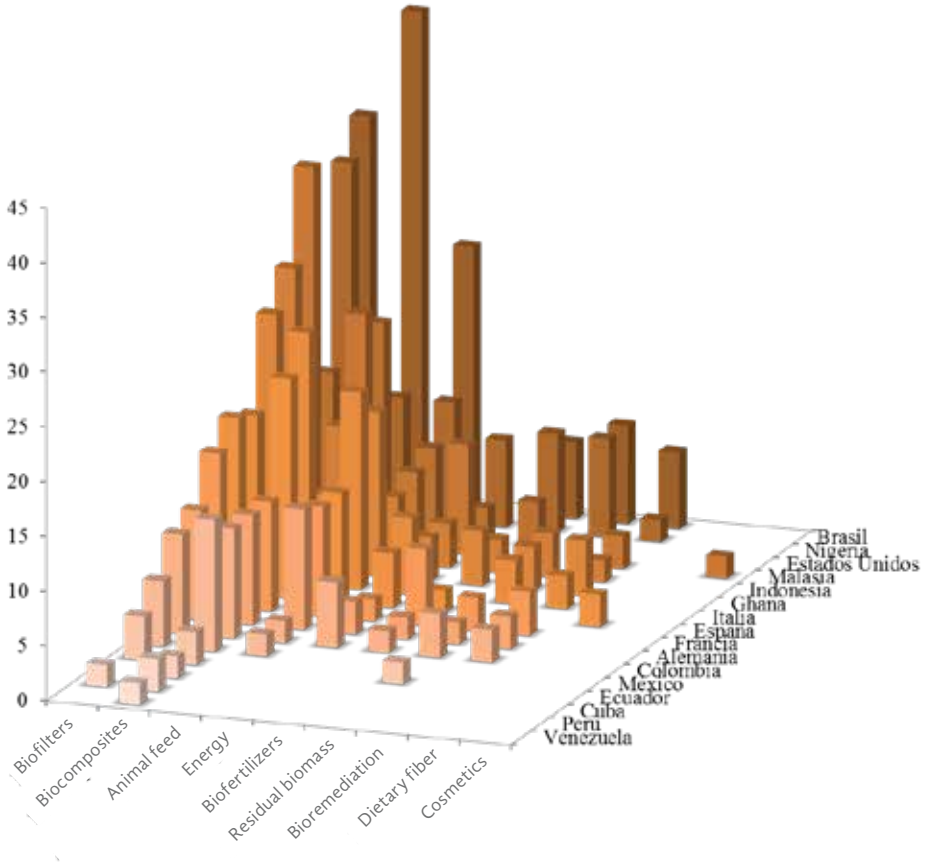

Image 3. Distribution by country of the main products for the valorization of cocoa (*Theobroma cacao*) organic residues. Source: Scopus database (Elsevier, 2020). Vantage Point (Academic Version 12.0)

Inventive trends related to the uses of cocoa residues

Regarding inventive dynamics, the same query criteria were used as in the scientific activity. As a result, 7586 basic patents were obtained, which were purified considering only those related to the three cocoa residues of interest (pod husk, bean shell, and mucilage). Based on this criterion, 122 families were identified that show the use of cocoa residues for food and non-food purposes. In order to characterize the non-food uses, which are the subject of this study, the natural language phrase decomposition algorithm was applied with Vantage Point® software. The attributes of interest were Type of waste; derived raw material; use; area of application; patent number and country.

According to the above, in addition to the potential use for the food industry, bio compounds such as polyphenols, alkaloids, and polysaccharides can be recovered from cocoa residues, which are of interest for pharmaceutical and cosmetic applications or used as residual biomass for the production of biofuels and products for different environmental applications.

From the search equation used, 17 patents with non-food uses of these residues were identified, some of which are included in Table 1.

Table 1
Relevant opportunities to valorize cocoa harvesting residues

Residue	Derived raw material	Use	Area of application	Patent	Countries
Pod husk	Sheets for roofing	Protect from electromagnetic waves	Environmental	JP2010197347A	Japan
	A mixture of shells and resin	Solid fuel	Energy	KR201464728A	Korea
	Monoliths* of activated carbon	NI**	NI**	ES2013737A	Spain
Bean shell	Shell extract	Dermatological Protection against UV rays and pollutants	Cosmetics	FR20038727A	France
	Bean shell	Biofertilizer, bio fungicide, growth regulator	Agricultural	MY2012PI700653A	Malaysia

*Although the patent is for the production of monoliths, it is worth noting that several authors have reported their use in bioremediation processes as adsorbents of heavy metals and dyes.
**Not indicated in the patent.

Source: Derwent Innovation Index database (Clarivate, 2020). Vantage Point (Academic Version 12.0)

CONCLUSIONS

Of the three cocoa harvest by-products, food and non-food uses were identified. The food ones mainly use mucilage. While pod husks have wide applications in animal feed and environmental uses. Environmental applications include the production of biofilters, new roofing materials, and products for soil and water bioremediation. The use of bean shells, a by-product generated mainly by the cocoa liquor industry, was found to be associated mainly with the development of cosmetic formulations such as sunscreens and also with the production of biofertilizers and growth regulators with potential use in the agricultural sector.

Although these harvest residue valorization options are key to generate innovative processes that provide additional income to small and medium Colombian cocoa producers, it is necessary to advance in the identification and formulation of strategies that promote the development of companies that are capable of adding value to these by-products, as well as articulating with small producers to promote new perceptions and management practices of this biomass.

Acknowledgments

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CHARACTERIZATION OF FAMILY HONEY PRODUCTION UNITS IN LLERA, TAMAULIPAS

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— Abstract—

The central region of Tamaulipas has a potential for beekeeping due to the floristic richness that produces nectar and pollen. This activity strengthens the local economy, and pollination is essential for the survival of ecosystems and their biodiversity. In the municipality of Llera efforts continue to strengthen agricultural production. The objective of this study was to characterize the Family Production Units (UPF) of honey in Llera, Tamaulipas. The information from the UPF was analyzed with 224 producers belonging to the group "Productores de Llera", who live in highly marginalized localities; we carried out surveys on their production systems and visited them for georeferencing and data collection in the field. We analyzed data in Microsoft Excel and Statgraphics. 100% of beekeepers are dedicated to the extraction of honey, with an average age of 45.7 years and 10.2 years of study. The average number of hives per producer is 79.6, in addition, 61% mention the time of abundance of pollen between February and August, and 27% mention September to January. On top of that, 83% offer sugar, 7% high fructose, with frequencies of eight to 15 days, 97% use protein supplements (brewer's yeast, soy flour, and pollen). Production per producer per year was 1,290 kg on average, its sales are mainly to the collector and a lesser extent in retail sales. Beekeeping is one of the main activities of UPF de Llera and its strengthening is very important for economic growth and well-being in the area.

Keywords

Beekeeping, pollination, economy, producers, marginalization, welfare.

The improvement of agricultural production focused on the economic scales of fewer resources is of vital importance to improve primary production in areas of high marginalization, so it is necessary to strengthen the set of rural enterprises at the family and local level, to enable them to profitably assume the economic functions of the production chains in which they participate, based on a gradual process of integration, to reduce production costs, generate added value, improve the prices of their products and income; as well as profitability and sustainability (De Grammont *et al*., 2010; Basurto and Escalante, 2012).

In Mexico, tropical climate zones represent 27.7% of the national territory, which plays an important role in agricultural production, which is very diverse. In these areas, the State of Tamaulipas is one of the most important in the country, with approximately 90 thousand producers in the main production chains such as sorghum, corn, soybeans, citrus, meat, and honey, among others (Martínez-González *et al*., 2008). Of these, beekeeping is very important, which is the raising and care of bees in order to obtain honey and other products from the hive; it is both economically and ecologically relevant since it generates jobs and contributes to plant pollination. Bees have a fundamental role from the ecological point of view, by carrying out pollination that favors production in crops (Magaña *et al*., 2016).

In 2019, 43 thousand beekeepers and 2,172,107 hives were counted in the country, which produced 61 thousand tons of honey, positioning it as 9th place worldwide. Of this production, 33 thousand tons were exported, mainly to Germany and the United Kingdom, also ranking 5th in this area (SIAP, 2020). Beekeeping activity is immersed in the flowering seasons, characterized by variations in the climate and flora of each region, which allows beekeeping to become the third-largest source of foreign exchange in Mexico's agricultural sector. This activity is closely linked to the environment and natural resources of the area that the producer uses to install his apiaries so that temporal and vegetation knowledge is important to plan the management and mobility of the hives (Luna *et al*., 2019).

Pollination is a fundamental process for the survival of ecosystems and their biodiversity; it is essential for the production and reproduction of many crops and wild plants. About 90% of flowering plants, 75% of food crops, and 35% of the world's agricultural land depend on pollination for reproduction (SIAP, 2020). Beekeeping is an activity that has developed alongside the emergence of civilization (Martínez-Puc *et al*., 2018), it has great economic importance nationally and internationally. Mexican honey has excellent quality and is appreciated and consumed in various parts of the world (Magaña *et al*., 2010).

Tamaulipas continues its efforts to position itself as a leader in agricultural production in the country, with the coordination of the three levels of

government and producers. The central and southern regions of the state have great potential to contribute to bee production due to the rich flora that produces nectar and pollen (González-Rodríguez *et al*., 2010). In the state, 690 tons of bee honey are produced, with 32,986 hives and the participation of about a thousand beekeepers, of which 300 are women; the municipalities of Llera, Victoria, Hidalgo, Padilla, and González contribute 74% of the production in the state, whose value amounts to $34 million annually (SIAP, 2020). In this production chain, 40% of the beekeepers are located in the municipality of Llera de Canales, where this activity strengthens the local economy and alternates with corn, beans, citrus, and cattle, pig, and poultry production, among others. In this region, the municipality contributes about 293 tons of honey per year (SIAP, 2020), although honey is the main product, it has ventured into value-added activities such as the production of soaps and sweets, among others (González-Rodríguez *et al*., 2010). Therefore, the objective was to characterize the family honey production units in Llera, Tamaulipas.

MATERIALS AND METHODS

Location and characteristics

The municipality of Llera de Canales is located between parallels 23° 35' and 23° 02' north latitude and meridians 99° 17' and 98° 25' west longitude, with an altitude between 100 and 2,200 meters above sea level (masl). It borders the municipalities of Victoria, Casas, González, Xicoténcatl, and Jaumave, occupying 3.2% of the state's surface, with a temperature of 14 to 26° C and an annual rainfall of 600 to 1,200 mm. The municipality's climate ranges from warm sub-humid to very warm semi-dry with summer rains (INEGI, 2009). The Llera producer group is composed of 18 localities in the municipality of Llera, Tamaulipas (Image 1).

Sampling of family production units (UPF)

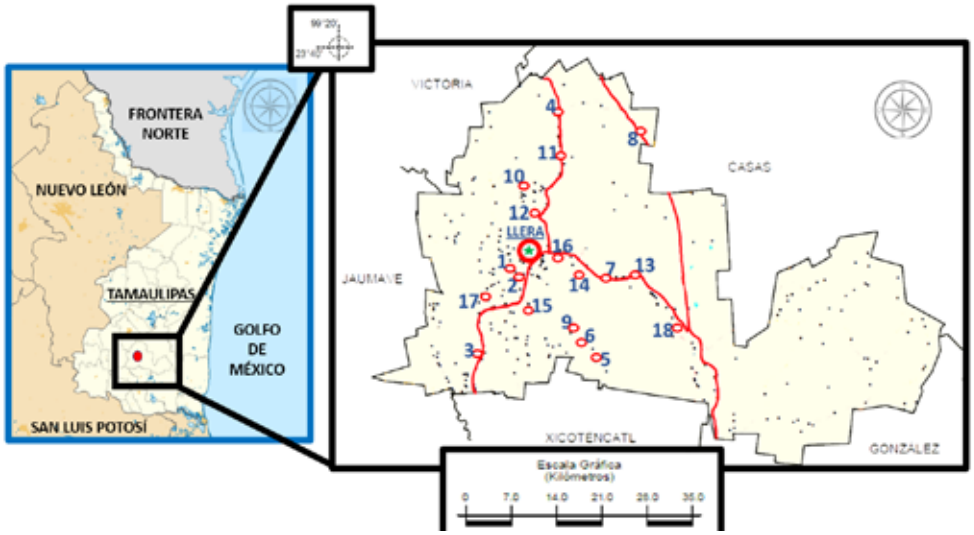
The productive, social, and economic information of the Family Production Units (UPF) was analyzed from January to March 2020. Random sampling was carried out using for the sample size the formula suggested by Rojas (1979) and Garay-Martínez *et al*. (2020); selecting the UPF at random, and taking into account the total of 224 producers of which 48 UPF were calculated as the number of surveys required employing the following equation:

$$n = \frac{\frac{Z^2 p_n q}{d^2}}{1 + \frac{Z^2 p_n q}{Nd^2}}$$

Where: Z= Confidence level (95 %), d= Precision level (10 %), Pn= Proportion of the population belonging to the group of interest (0.8), q= (1-pn) = 0.2, N= Population size and n= Sample size.

Survey for Family Production Units

The cooperating producers were gathered in the municipal capital of Llera, Tamaulipas, to generate the information by conducting surveys with the required data to be able to analyze and collect information on the states in which their production systems are located. The questionnaire was applied randomly to the owner of the UPF. The survey consisted of 57 questions for the beekeepers, which were divided into the following sub-themes: identification of the producer, characterization of the UPF, marketing, relevant data, feeding, management, natural resources, production, and infrastructure. Subsequently, we visited the UPFs of each producer in the different localities for georeferencing and field data collection to corroborate the data collected in the surveys (Image 1). The target population included the UPFs that live in the municipality of Llera, in the rural priority attention zones for the year 2019 that live in highly marginalized localities (CONAPO, 2010).



Ejido	UPF	Ejido	UPF
1. Congregación La Mina	4	10. José Ma. Morelos	11
2. Congregación San Juan	16	11. La Alberca	4
3. Conrado Castillo	4	12. La Angostura	4
4. Dos de Octubre	2	13. Las Compuertas	50
5. El Ébano	5	14. Nuevo San Luis	6
6. El Nuevo Paraíso	4	15. Rancho Nuevo del Sur	25
7. Emiliano Zapata	24	16. San Rafael	4
8. Emilio Portes Gil	4	17. Santa Isabel	16
9. Felipe Carrillo Puerto	30	18. Voz Campesina	11
		TOTAL	224

Figure 1. Location of *ejidos* and number of family production units (UPF) in Llera, Tamaulipas. Source: Own elaboration

Statistical analysis

The database was generated in the Microsoft Excel program, in which the information collected in the surveys was organized and selected, then graphed and analyzed using the Statgraphics statistical program. The information was interpreted and described using descriptive statistics such as means, frequencies, and deviations, as well as graphs.

RESULTS AND DISCUSSION

Characterization of the UPFs of the honey product system

100% of the beekeepers surveyed are engaged in honey extraction and have at least two years in this activity. 73% of the beekeepers, alternate beekeeping with other secondary activities such as livestock, agriculture, commerce, housekeeping, or paid work. The remaining 27% did not mention any other agricultural activity. The average number of apiaries per farmer is 2.6, with a minimum of one and a maximum of four; the average number of hives per farmer is 79.6, with a minimum of 10 and a maximum of 200; the number of days per week dedicated to this activity varies from one to five. Honey production is for sale and self-consumption, some for export. Luna *et al*. (2019) mention similarly to the present study that a high percentage of beekeepers alternate beekeeping with agriculture, livestock, and commerce to obtain other sources of income. Martínez-Puc *et al*. (2018) report in Campeche an average number of apiaries per producer of 2.27 and the number of hives per apiary of 20.2, resulting in an average of 45.8 hives per producer, and Yucatán Magaña *et al*. (2007) indicate an average of 2.6 apiaries per producer with the number of hives per apiary of 20.9 and several hives per producer of 53.7, results that differ from those of the present study, with a lower number of hives per producer, which may be due to the support and organization of the beekeepers as a group. According to the classification of Vélez *et al*. (2016), in the region under study, the producers are located as medium producers because on average they have between 51 and 200 hives.

Level of education and years as a producer

The beekeepers surveyed have an average age of 45.7 years and 10.2 years of study; however, the surveys showed that in this livestock activity there are producers with postgraduate studies (Table 2). Experience as beekeepers varies from two to 54 years, with an average of 13.1 years, some of them dedicated their entire lives to this activity; 38% have more than 10 years of experience (Image 5). In this regard Martínez-Puc *et al*. (2018) mention that beekeepers in the State of Campeche in the municipalities of Hopelchén and Champotón have an average age of 57 years; similar data are reported by Contreras *et al*. (2018) in the state of Yucatán, which are higher than those observed in the present study, this may be due to the incursion of young beekeepers and children that renew the generation of beekeepers in the area of Llera. On the other hand, Contreras *et al*. (2013), reports that in the State of Jalisco the average age of beekeepers is 47 years, with an average experience of 16.46 years, which agrees with what was observed in

this work, while Luna *et al*. (2019) mention that in the northern highlands of Veracruz the average experience is 22 years, the author emphasizes that experience is not an indication of a certain degree of specialization and professionalization in the beekeeping sector, this is possible since in general a large percentage of beekeepers are over 57 years old, and advanced age can be a limitation to adopt new technologies to improve the production system.

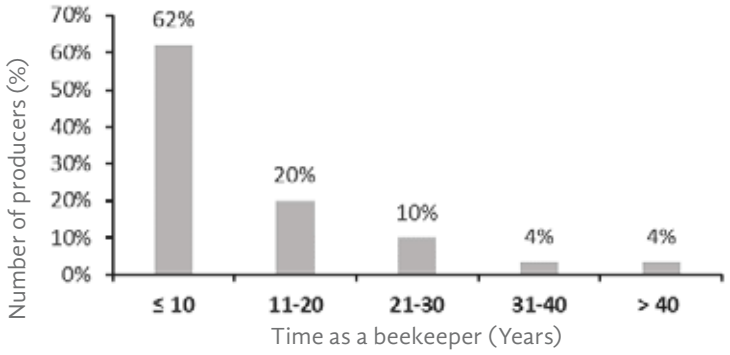


Image 2. Years dedicated to honey production by beekeepers of the Family Production Units of Llera, Tamaulipas. Source: Own elaboration

Land tenure and apiary characteristics

59% of the beekeepers mentioned that their apiaries were located on rented land, 14% on private property, 20% on borrowed land, and 7% on *ejido* land (Image 6). The land varies from a quarter of a ha to 190 ha, with an overall average of 17.4 ha. Magaña *et al*. (2007) found in Yucatan that, in terms of land ownership, apiaries are located 57.8% on private property, 16.5% on *ejido* land, and 17.3% on rented land while Chan *et al*. (2018) mentions that beekeepers in the state of Campeche have their apiaries located on *ejido* land. What was reported by both authors differs from what was observed in the present study, since in different regions of the country there are different types of land tenure and beekeepers have adapted in a versatile way to this type of characteristic in their production systems.

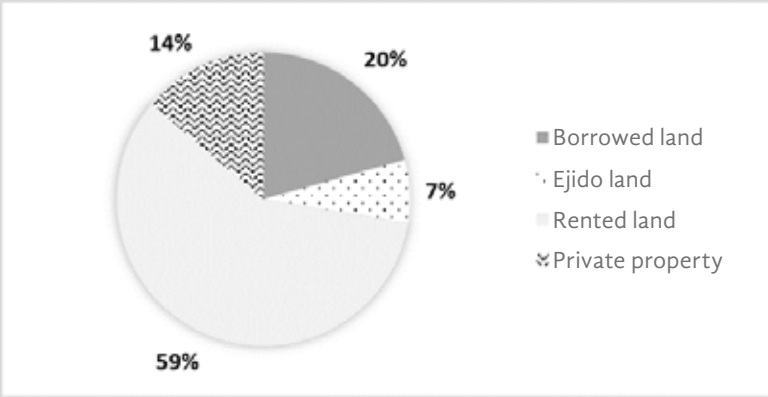


Image 3. Land Tenure by the Beekeepers of the Family Production Units in Llera, Tamaulipas.
Source: Own elaboration

Flowering time and vegetation

61% of the beekeepers report the time of pollen abundance between February and August, 27% mention the months of September to January, and 12% in both periods. This variation is because beekeepers move their apiaries to different areas of the region. Regarding the time of nectar abundance, 37% report that it occurs between March and June, another 37% mention it's between July and November, and 26% say that it occurs in both periods (Image 7). It is worth noting that 100% mention that they have been affected by the lack of rainfall during 2019. The predominant vegetation reported in the area was: citrus such as orange (*Citrus sp.*) and grapefruit, corn (*Zea mays*), sorghum (Sorghum spp), *huizache* (Acacia farnesiana), *mesquite* (*Prosopis glandulosa*), *tasajillo* (Cylindropuntia leptocaulis), ebony (Ebenopsis ebano), mouse ear (*Dichondra argéntea*), *palo de arco* (Handroanthus serratifolius), tenaza (*Havardia pallens*), *crucero* (*Colletia spinosissima*), *retama* (*Retama sphaerocarpa*), and *epazotillo* (*Hyptis verticillata*). Regarding vegetation, depending on the honey-producing zone, Mexico has a great diversity of vegetation and climates in which a great diversity of flora of great importance as a nectar-polliniferous resource develops. In the case of Campeche, the surrounding vegetation of the apiaries is mainly composed of *tzitzilché* (*Gymnopodium floribundum*), which flowers from February to May; *tzalam* (*Lysiloma latisiliquum*), from March to June; *jabín* (*Piscidia piscipula*), from February to May; *tajonal* (*Viguiera dendata*), from December to January; *chukun* (*Abarrida albicans* (Kunth), from April to June; black *chechen* (*Metopium brownei*), from March to April; *sakc atzin* (*Mimosa bahamensis*), from May to July, among others (Pat-Fernández *et al.*, 2012). In Bacalar, Quintana Roo, Aguilar-Hernández *et al.* (2019) recorded in a study a list of nectar-polliniferous species in the harvest season, of which 70% highlight the species *Chacá* (*Bursera Simaruba*), *Tajonal* (*Viguiera*

Dentata) and *Jabín* (*P. piscipula*). In the pampas of Argentina and Ecuador, several species of the Asteraceae, Fabaceae, Mirtaceae, Rosaseae, and Solanaceae families are reported to be in full bloom in September and October, as well as in October and November (Naab *et al*., 2007; Calva *et al*., 2019).

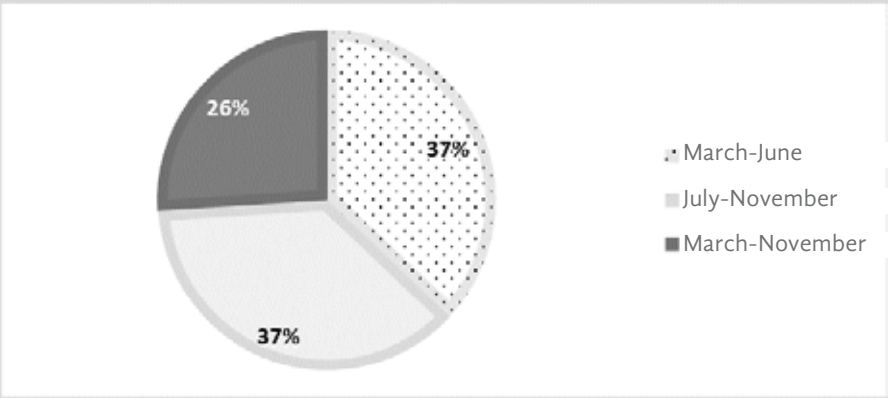


Image 4. Time of nectar abundance in the apiaries of the Family Production Units in Llera, Tamaulipas. Source: Own elaboration

Supplementation in apiaries

Regarding carbohydrate or energy supplementation by beekeepers, 83% offer sugar, 7% high fructose, and 3% bee honey during the nectar shortage season, with frequencies of eight to 15 days; only 7% do not offer any energy supplement. As for protein supplementation, 97% of the producers mentioned using commercial mixtures of brewer's yeast, soybean meal, and pollen during the pollen shortage season; the indicators used to know when to supplement are low flowering and lack of reserves in the hives. Bee nutrition is based mainly on the consumption of honey and pollen. Lack of food in the hive leads to increased susceptibility to disease, population reduction, and swarming (abandonment of the hive). Aguilar-Hernández *et al*. (2019) mention that in the State of Quintana Roo, in the municipality of Bacalar, 60% of beekeepers provide honey as auxiliary food followed by other supplementary products such as sugar and pollen.

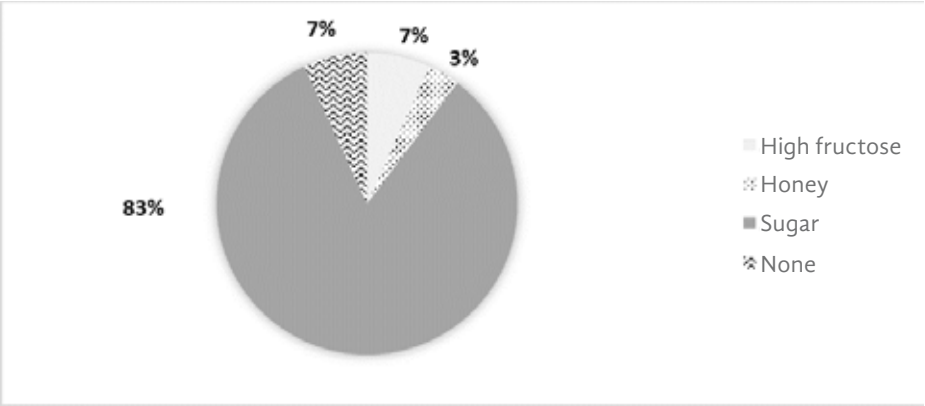


Figure 5. Energy supplements in the apiaries of the Family Production Units in Llera, Tamaulipas. Source: Own elaboration

Harvesting and marketing of honey

Production is carried out in the extraction room by 73% of the beekeepers and at home by 27%; the equipment is owned, borrowed, rented, or worked in partnership and is reported in fair to good conditions. A total of 79.3% of the beekeepers report having taken or are taking courses on good honey production practices. Last year's loss of hives per farmer ranged from zero to 60 hives with an average of 15.6, the reported causes being hive abandonment, ant attack, fire, and no flowering. The 48.2% reported that they keep production records and that their sales are mostly to the collector and in smaller proportion in retail sales; the production per producer per year was 1,290 kg on average, with a minimum of 70 and a maximum of 5,600 kg and the reported prices range from $21 to $100, with an average of $41.60 (Table 2). The harvest or collection of honey depends on the rainy season and flowering. In the municipality of Calkiní, Campeche, honey is harvested from January to June, when rainfall is null or sporadic, the same time when they get more honey, which is consistent with the abundance of flowering. (Pat-Fernández *et al*., 2012). Most of the production of beekeepers in the region under study commercializes honey with local collectors, only a low percentage commercializes their product in the community, which is in agreement with what Fernandez *et al*. (2020) and Mercado and Rimac (2019) reported.

Table 1
Characteristics of the Bee Honey Family Production Units of the Beekeepers of Llera, Tamaulipas

Datos apicultura Llera	$\bar{x}$	S	Mínimo	Máximo
Edad de los apicultores (Años)	45.7	17.7	22	81
Años de estudio	10.2	4.3	3	19
Superficie (ha)	17.4	36.6	0.25	190
Años como productor	13.1	12.4	2	54
Apiarios con los que cuentan	2.6	1.2	1	4
Total de colmenas	79.6	51.8	10	200
Días de la semana que acude a su apiario	2.5	1.4	1	5
Colmenas que perdió el año pasado	15.6	15.7	0	60
Cantidad de miel obtenida (kg/año)	1,290.3	1,352.3	70	5,600
Precio de venta ($)	41.6	18.0	21	100

x: average; S: standard deviation

Source: Own elaboration

CONCLUSIONS

Beekeeping is one of the main activities of the Family Production Units in the municipality of Llera, Tamaulipas, so it is very important to strengthen it for economic growth and welfare in the area. Continuity is required in both advisory services and in the attention given to producers. The implementation of records in production systems is important to improve problem detection and control, as well as production. There is little diversification of beehive products, as well as variants in the markets.

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CORN CULTIVATION DIAGNOSIS IN THE MUNICIPALITY OF TECPATAN, CHIAPAS

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— Abstract—

The corn grain (*Zea mays L.*) is the basic food of the Mexican people, the objective of this research was to identify the technological and socio-economic factors that impede the development of corn cultivation and its producers in the municipality of Tecpatán, Chiapas. The municipality has a registry of 1,753 corn producers, so the random sample was 59 producers. To meet the objective, in 2015 a questionnaire of 116 questions related to the aforementioned factors was applied to the sample. The individual frequencies of the variables were calculated and some were correlated, by pairs and triads, using the Statistical Package for Social Sciences (SPSS, 2010). The results allowed us to determine the multiple factors that are effectively impeding the development of the corn production chain and its producers in the municipality, therefore, with the information obtained, it is recommended to continue this investigation, which consists of developing a Comprehensive Technical Assistance System for corn producers in the municipality of Tecpatán, Chiapas, which must be applied in an inter-institutional and multidisciplinary manner. The updating of the institutional registers of corn producers is also suggested.

Keywords

Factors, systems, productivity, producers, Zea mays.

Corn (*Zea mays L.*) is the most important cereal in the world and our country, due to the volume of its production. Among the main producing countries of the grain, Mexico has occupied (between 2005 and 2015) the fifth place in annual global production that varied from 17.635 to 24.694 million tons, in a harvested area that ranged between 6.069 and 7.344 million hectares, in both cases after the United States of America (USA), China, Brazil, and Argentina, while in yield it occupied the twelfth place, with an average of 3.18 t ha^{-1}. Despite this, to meet its needs, it was the grain's second-largest importer, in the period from 2006 to 2016, with an average of 8.878 million tons per year, whose average annual value was 2.012 million US dollars (Miramontes, 2012, FIRA, 2016).

In our country there are two production systems: (a) self-consumption agriculture, related to smallholdings, based on the intensive use of rural family labor and whose main priority is to guarantee the supply of corn for self-consumption during the year and whose surpluses are sold. The states where this type of system prevails are Chiapas, Guerrero, Hidalgo, State of Mexico, Morelos, Puebla, Oaxaca, Veracruz, and Yucatan; and (b) market-oriented production, where the main characteristic is the intensive use of capital, advanced technology, market integration and the use of improved seeds. The entities that stand out for this type of system are Sinaloa, Sonora, Jalisco, Tamaulipas, and the Bajío Region (Jillian, 2011).

Vega and Ramírez (2004) indicate that a high percentage of the rural population depends on corn production, where the culture is practiced in the most diverse agroclimatic conditions with technological differences ranging from the most backward rainfed production that obtains yields of 0.7 t ha^{-1}, to irrigation systems, with improved and fertilized seeds that can obtain 12 to 14 t ha^{-1}.

In the state of Chiapas, most of the corn grain production is obtained in three economic regions headed by the municipalities of Villaflores, Ocozocoautla, and Venustiano Carranza (Ministry of Finance, 2012). These results are attributed to the use of improved seeds and good management of the culture, as farmers can carry out the activities of the production chain satisfactorily, given that the largest area is cultivated on flat land where all existing technology can be used.

However, in the mountainous region known as Los Altos de Chiapas, farmers carry out their agricultural, livestock, and forestry activities with very low availability of land and capital, resulting in extreme poverty (Parra and Díaz, 1997), which intensifies soil fertility problems and the use of fertilizers to maintain corn production (Álvarez-Solís and Anzueto-Martínez, 2004). Under these conditions, the increase in productivity, via the introduction of industrialized inputs, faces the problem of the high cost and low profitability of capital investments in hillside agricultural areas

under rainfed conditions. In general, agricultural production in Los Altos de Chiapas presents various problems, including soil erosion and loss of soil fertility, decreased yields, lower labor productivity, and a growing inability to employ family members and basic food supplies. These problems are the result of excessive pressure on the land, rugged topography, the atomization, and dispersion of plots, and the high risk of loss due to weather conditions and the artisanal nature of production techniques (Pool-Novelo *et al*., 2000).

Adjacent to this region is the study area, recently named "Region III Mezcalapa", where similar conditions prevail since it is also a mountainous region made up of nine municipalities, four of which have been selected as extremely poor, based on the criteria of the National Council for the Evaluation of Social Development Policy, which places them within the 400 municipalities of the National Crusade against Hunger. This region has 13,484 corn producers registered in the PROCAMPO, Maíz Solidario, PROMAF, and Maíz de Autoconsumo corn support programs, with 38.40, 21.63, 0.54, and 39.42%, respectively, however, they do not have a proper technical assistance program to promote and supervise the use of the support, that is, technical assistance is not instituted and therefore it is not known how these supports are used and what their impact is on the improvement of the culture and its producers.

Therefore, it is necessary and urgent to increase the productivity and production of this cereal grain. Thus, is required the generation and/or transfer of technologies, based on the results of a frame of reference or diagnosis, that identifies the edaphic, climatic, biological, socioeconomic, management, or other problems that limit corn culture development in Region III Mezcalapa, Chiapas, in the particular case of the municipality of Tecpatán, to make more accurate approaches through specific research to solve the problems of corn culture, as well as to develop and apply an Integral Technical Assistance System for corn producers in that municipality.

General Objective

To identify the technological and socioeconomic factors that impede the development of corn culture and its producers in the municipality of Tecpatán, Chiapas.

MATERIALS AND METHODS

Study area

Tecpatán is located in the Montañas del Norte, its geographic coordinates are 17° 08" North latitude and 93° 19" West longitude. Its altitude is 320 m. It has 37,543 inhabitants, a warm humid climate with year-round rainfall, an

average annual temperature of 24 to 26° C, and average annual precipitation of 2000 to 3000 mm (INEGI, 2010).

Information collection

The 2012 corn producer lists were provided by four institutions: ASERCA (Apoyos y Servicios a la Comercialización Agropecuaria), SAGARPA (Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food), SECAM (Secretaría del Campo), and FIRCO (Fideicomiso de Riesgo Compartido) and were integrated to facilitate their location in the municipality.

In addition, an overview of the regional level was included, which contemplated the agronomic characterization of corn, the geographic location of the producing areas, and the main production and marketing parameters, as well as the phytosanitary regulations, seasonality, industrialization, and production marketing.

Sample calculation

Considering that the complete study of the Mezcalapa Region, Chiapas, contains nine municipalities with 13,484 corn producers, it was decided to do a "stratified random sampling" of them ($p \leq 0.05$), whose stratified sample per municipality is the most accurate and reliable, using the formula of Scheaffer *et al*. (2004). In the case of Tecpatán, the population studied included 1,753 producers, so its sample size was 59 producers. In addition, the producers were informed about the objectives of the survey, to reduce bias in the information obtained.

Surveys

The final questionnaire applied to producers in 2015 consisted of 116 questions divided into 16 sections: general information, cost of cultural work, application of herbicides or cleaning, application of organic or chemical fertilizers, pest and disease control, harvest, marketing, financing, nature of institutional support, productive impact, social impact, environmental impact, technological impact, factors that influenced the impact, needs for complementary services, and observations, to obtain information to recommend improvements to the culture.

Our experience indicates that before starting data collection, it is necessary to visit the community authorities to inform them of the project's objectives and request their authorization and recommendation to travel through their territory. Subsequently, visits were made to the producers, either in their homes or in their work areas. To facilitate the field visits and for security

purposes, a brigade of six surveyors was formed, which also resulted in better interaction with the communities and greater efficiency in the collection of information.

Interviews

To expand and corroborate the data obtained in the field, informal interviews were conducted with managers and staff of the sector's institutions involved in corn production, either for support or in related programs.

Data analysis

The field data were organized in digital form for analysis using the Statistical Package for Social Sciences (SPSS, 2010). The frequencies of all the individual variables were calculated, and some were correlated by pairs and/or triads as deemed appropriate.

RESULTS AND DISCUSSION

The questionnaire applied to the random sample of 59 producers ($p \leq 0.05$) represents the population of 1,753 corn producers in the municipality of Tecpatán, Chiapas. For practical purposes, in some cases, the number of producers is presented, and in others the percentage of them, thus, one producer surveyed is equivalent to 1.7% of the sample, which represents 29.7 producers of the population.

Considering the population of 1,753 producers registered in the institutional registers, it was observed that the number indicated did not coincide with the number engaged in the exploitation of the culture. The main causes of these differences were: six people are in the register and did not plant corn in 2014, five of them answered the questionnaire, however, one assured that he has a degree and did not receive support from Procampo, and another who received support, no longer receives it because he stopped cultivating it, the person who did not answer, only said that he appears in the register, but does not receive support and no longer cultivates corn. Therefore, we suggest updating (biannually) the official lists of corn producers, since there are also people who produce corn and should be included in the list.

General information

The representative ejidos of the municipality of Tecpatán, where the 59 corn producers that were surveyed live, stand out, in this way, 88.1% were located in descending order in the ejidos Francisco I. Madero, El Porvenir,

Emiliano Zapata, and the remaining (11.9%) in Miguel Hidalgo y Costilla, Juan Sabines and Nuevo Vicente Guerrero. In addition, it was observed that the area planted ranged between 0.25 and 5 ha, with 42.4% planting 1 ha, 25.4% 2 ha, 10.2% 1.5 ha, and 10.2% cultivating between 2.5 and 5 ha.

The majority (79.7%) of the farmers are between 41 and 70 years old, 15.3% are between 71 and 90 years old, and 5.1% are between 31 and 40 years old. All of them have been growing corn for between 5 and 70 years, while 66.1% of the total have been growing corn for between 30 and 50 years. Likewise, schooling ranged from illiterate to bachelor's degree, where 54.2% finished primary school, 16.9% between 1st and 3rd grade, 15.3% are illiterate, 10.2% graduated high school, and 1.7% have a degree. The illiteracy described is lower than in the Chiapas municipalities of Coapilla (20.0%, Pérez & Hernández, 2016), Copainalá (21.1%, Posada & Domínguez, 2014), San Fernando (26.8%, Sánchez & Sánchez, 2013), Chicoasén (27. 3%, León-Velasco, 2016), Mezcalapa (28%, León & León, 2015), Ocotepec (36%, Grajales, 2015), and Francisco León (39%, Sánchez & López, 2016), which coincides with the 2010 information regarding that in our country, Chiapas ranks first in illiteracy in the population aged 15 years and older, with an average of 17.8% (INEGI, 2011).

Marginalization index indicators concerning education show that, at the national level, 8.3% of the population over 15 years of age is illiterate. In all marginalized and indigenous territories, the proportion of illiteracy for these ages doubles or triples. On the other hand, some factors prevent people from finishing elementary school, for example, the high opportunity cost that education represents for poor families, who see children as an additional workforce, or simply the lack of an adequate and complete educational offer. This has generated a higher dropout rate at the elementary level in municipalities and marginalized and indigenous localities. In this sense, in the national aggregate, 23.0% of people over 15 years of age who did not finish elementary school were recorded, in very high and high marginalization municipalities the proportions were 57.0 and 43.9%, respectively, while in very high and high marginalization localities the percentages are close to the average, and in indigenous municipalities, on the contrary, their proportion increases to 34.8% (SEDESOL, 2012).

The main source of income of those surveyed was agriculture (54.2%), those who practice it in subsistence whose main activity is the culture of corn, similarly 40.7% obtain their income from agriculture and livestock, while for 3.4% it was livestock.

Regarding land tenure, the majority (93.2%) own ejido land, 5.1% private land, and 1.7% rented land. On the other hand, 96.6% of producers in the seven ejidos plant corn under rainfed conditions, which are governed by climatic factors; however, 25.4% of them, distributed in six ejidos, also

plant corn under residual humidity, due to excess rainfall on their land, which means that they obtain two harvests per year. This means that in the municipality of Tecpatán there is a rainy season that begins in May and ends in February, with greater intensity and duration from May to August. In addition, from September to February there is a season known by the producers as "nortes" or "chipi chipi" during which the rains continue, although of less intensity and duration, however, this humidity allows them to establish a second culture season and obtain a second harvest. Excessive burning and deforestation have caused changes in rainfall patterns, resulting in prolonged periods of drought or severe flooding, causing crop losses, making rainfed farming the riskiest in production units.

76.3% of producers stated that they plant criollo corn, and 22.0% mentioned other names of hybrid corn and improved varieties, however, when asked where they obtained the seed, 35.6% indicated that they obtained it from the same ejido, the same harvest or that they bought it ten or more years ago, and 6.78% that they bought it from seed distributors, or people from other municipalities, but the highest frequency (57.6%) did not respond. This shows that all of them sow criollo seeds and although some corn still has their original names, they are now criollos because of the crossbreeding they have had with local maize and because the producers have selected from their harvest for the next sowing.

Thus, of the total number of producers who plant in rainfed crops, 78.0% do so in May and 20.3% in June, which is when the rainy season begins, and harvest variably from August to December, predominantly in September, October, and November. According to these data and the authors' field visits, it was observed that there are early, intermediate, and late corn, which are harvested in September (27.1%), October (23.7%), and November (32.2%), respectively. On the other hand, 25.4% of producers who make a second corn culture under residual moisture conditions did not indicate the respective planting and harvesting dates. This explains why this 25.4% of producers believe that the subsidies are not enough, since they have two crop cycles per year and the subsidies were labeled for one cycle per year.

100% of growers plant manually with a tiller or barreta. 91.5% sow at 100 cm between rows and also between sowing points, which results in 10,000 points per hectare. As they throw an average of four seeds per point, then there is a density of 40,000 seeds sown in a hectare. Assuming that both the commercial corn seed and the criollo seed sown by the producers have 85% germination, as guaranteed by the seed companies, this means that only 34,000 seedlings germinate from the amount of seed indicated, without counting those that are lost due to the action of other factors, therefore, the density of plants per hectare is low and consequently the productivity and production is also lower, compared to the places where a greater amount of

seeds are sown per hectare. Seed planting density ranged between 8 and 15 kg ha^{-1}, with 22.0% and 45.8% of producers planting an average of 10 and 15 kg ha^{-1}, respectively.

The total cost of cultural work

According to the opinion of the total producers, in 2014 the cost of culture labor varied widely between 1000 and 7920 pesos ha^{-1}, and the value of production between 2500 and 20,000 pesos ha^{-1}, as well as the value per ton of grain, was 5000 pesos. A cross-analysis of the first two variables showed that most of the producers obtained different profits. For example, 10.2% invested 5000 pesos ha^{-1} and obtained a grain production whose value was between 2500 and 20,000 pesos ha^{-1} and an average of 7833 pesos, as well as when 6.8% of producers invested between 4600 and 6500 pesos ha^{-1}, with an average of 5525 pesos, they obtained a production with a value of 7500 pesos ha^{-1}, which means that corn grain production was profitable for these producers. Undoubtedly, some producers did not obtain profits and with the value of the production the profit is lower concerning the investment, in this way, 27.1% who invested between 1000 and 7920 pesos ha^{-1} with an average of 4368 pesos, achieved a harvest with a value of 5000 pesos ha^{-1}. Others commented that they had losses in the harvest, either due to the damage of some climatic factors or the lack of fertilizers or some other cause that they do not know, however, they stated that they have to continue planting corn because the grain is of vital importance for their family's meals.

Weed control

To control weed problems, producers generally resort to chemical products, which can be applied at different stages of the culture, either pre-emergent or post-emergent (Ruiz *et al*., 2001). Note that the weeds mentioned by the growers were Zacate (35.6%), Monte Común (28.8%), as well as Monte y Zacate (10.2%), mainly, and 25.4% did not respond, which were controlled by different herbicides such as Gramoxone (45.8%), Faena (10.2%), and Esterón (8.5%), among others, with 6.8% not applying herbicides and 3.4% doing the cleaning manually with a machete. Of the total number of farmers, 39.0% said that they apply herbicides pre-emergent, and 44.1% separately, also post-emergent. In addition, they explained that few of them know or read the instructions of the agrochemicals they apply and do not know the names of the weeds, so they only said Monte, Monte Común, and Zacate.

Chemical and organic fertilizers

Regarding the application of fertilizers on a hectare of culture, 47.5% of producers use urea with quantities that varied from 15 kg to four bags of 50 kg each, highlighting 22.0% of them that apply two bags, and 13.6% that only apply one bag. On the other hand, 1.7% applied humus and another 1.7% applied humaíz, at a rate of 1 and 3 L ha^{-1}, respectively, however, 35.6% did not apply fertilizers, commenting that they did not have the economic resources for this product, and 8.5% did not respond.

In general, 54.2% of growers said that they apply fertilizer for the first time between 7 and 60 days after seedling emergence, with 50.8% of them applying it between 15 and 45 days after emergence, indicating that growers have different criteria for defining the time to apply fertilizer. Similarly, of those who make a second application, 5.1% said that they apply it when the culture is in the stage they call "parando punta", and 16.9% erroneously apply it during flowering.

Nitrogen fertilizers are recommended during corn culture growth; therefore, it was considered erroneous to apply them during the flowering stage, since at that stage the plants have already reached their maximum growth. Therefore, it is evident that producers require technical assistance, which considers both the amounts and types of fertilizers recommended, as well as the stages of the culture in which their application is more correct.

Pest and disease control

Like weeds, pests and diseases reduce crop production. Respondents stated that their culture was attacked by codling moths (84.7%), blind hen (55.9%), false cutworm (22.0%), bollworm (6.8%), armyworm (5.1%), and aphid (1.7%). In the case of the Cogollero, only 55.9% applied some products such as Foley (30.5%), Arrivo (22.2%), Gallito (1.7%), and Monitor (1.7%), where only 20.3% mentioned that they used the recommended doses. Now, for the Blind Hen, only 33.9% of producers applied Foley (16.9%), Arrivo (10.2%), both (3.4%), and Gallito (3.4%), but only 13.6% said they applied the recommended doses, although these products are not appropriate because they are contact products and the blind hen lives below the soil surface. In the case of the False Mealworm, 13.6% applied Arrivo (5.1%) Foley (5.1%) and both products (3.4%), however, only 3.4% of them indicated the recommended doses. For armyworm, Arrivo (1.7%) and Gallito (1.7%) were used, in armyworm Foley (1.7%) and aphid was not controlled. The data presented resulted from the cross-analysis of three variables (product × pest × dose ha^{-1}), as well as where there was a Pinta fly attack (16.9%) and other pests of lesser presence (6.8%). For the Pinta fly, Arrivo (3.4%)

and Foley (1.7%) were applied, where only 1.7% said they used the recommended dose. On the other hand, 3.4% controlled Ants with Foley without indicating the doses. In addition, the presence of three diseases identified by the producers as Ear Rot (1.7%), Fusarium (1.7%), and Asphalt Spot (1.7%) was observed, which were not controlled, except for Asphalt Spot in which the producer erroneously applied Arrivo, since it is an insecticide and the diseases are controlled with fungicides. In any case, in this municipality, corn crop diseases are not economically important, or possibly the producers are not aware of them.

Harvest

94.9% of farmers indicated that they harvest the ears by hand, stating that this way they make better use of the grain, i.e. it is not wasted because all the ears are lifted, even if the plants are lying down. On the other hand, 91.5% do not bale the stubble, 3.4% do, and 5.1% did not respond. However, 23.7% stated that they put cattle in after harvest, the remaining 71.2% leave the residues on the field to reincorporate them or burn them, and 5.1% did not respond.

Grain productivity fluctuated between 0.5 and 4 t ha^{-1}, where the majority (44.1%) obtained between 1 and 2 t ha^{-1}, 39.0% between 0.5 and 0.9 t ha^{-1}, as well as 5.1% between 2.5 and 4 t ha^{-1}, with 27.1% of the total who only harvested 1 t ha^{-1}. According to 94.9% of producers, the price per ton of grain in 2014 was 5,000 pesos.

After harvesting, the risk to the grain continues, as there are always insects or fungi that feed on its contents. Thus, producers commented that the grain was damaged by weevils (50.8%) and house rats (5.1%). Therefore, they use various ways to store the grain for their own food, as well as the seed for planting the following year, among which they mentioned the troja, the plastic drum, the ixtle sacks, the cobs with or without *totomoxtle* in a room, the cobs tied by the *totomoxtle* to the beams of the houses, among others.

Commercialization

83.1% of producers said that they use the corn grain harvest to feed their families, 1.7% do the same and also sell it to private individuals, while 6.8% only use it to sell to private individuals. Evidently, in Tecpatán, Chiapas, subsistence agriculture is practiced, since the majority (78.0%) cultivate between 1 and 2 ha of corn, and also the majority (84.7%) use the grain to feed their families.

When producers obtain surpluses in their grain production, another problem arises, which is the lack of market or good prices for agricultural

products, as is often the case. In this sense, 39.0% said that buyers were satisfied with the quality of the grain they purchased, 57.6% said the opposite and 3.4% did not answer. On the other hand, 96.6% said that they do not belong to an organization that helps to market the harvest and that they did not receive the institutional support that exists for marketing the grain.

Financing

96.6% of producers did not receive bank credits to sustain their culture and/or use them at their service, both in 2014 and in previous years, neither did they receive credits from individuals nor did they sell the harvest in advance, as also stated by 100% of maize producers in the municipalities of San Fernando, Copainalá, Ocotepec and Coapilla, Chiapas (Sánchez & Sánchez, 2013, Posada & Domínguez, 2014, Grajales, 2015, Pérez & Hernández, 2016, respectively).

In addition to the official support that producers have, they received herbicides (3.4%) from SAGARPA, as well as fertilizers (10.2%) and spray pumps (1.7%) from the municipal Presidency. According to these results, it is convenient to manage credit and/or support programs that allow working the culture with greater scale and technology, in addition, some producers indicated that only *ejidatarios* benefit from institutional support because that is what the assembly decides.

Nature of institutional support

86.4% of corn producers said that they received support from Procampo spring-summer, 37.3% received support from Procampo fall-winter, and 1.7% received support from the state government's Maiz Solidario program. Likewise, 89.8% of the total commented that they have received the same support during 2012, 2013, and 2014, 6.8% said no, and 3.4% did not respond.

In general, in separate percentages, producers thought that such support has been used by them in expenses for various activities in their culture such as seed purchase (13.6%), sowing (88.1%), herbicides and application (62.7%), fertilizers, and application (47.5%), pest (39.0%) and disease control (11.9%), harvest (78.0%), and grain hauling (18.6%). The trend of this information coincides with that obtained in the municipalities of San Fernando (Sánchez & Sánchez, 2013) and Copainalá (Posada & Domínguez, 2014), except that in San Fernando the majority (59.1%) carry out tracking because it has more flat land, which allows the passage of agricultural machinery.

In addition, the majority of producers stated that the support arrived on time (61.0%), complete (83.1%), without favoritism (94.9%) and without conditions (94.9%), while a minority responded that it was untimely (32.2%),

incomplete (10.0%), with favoritism (8.9%) and conditional (1.1%). This shows that there is no official supervision in the delivery and support management, nor in the land tenure and exploitation of the corn culture by registered producers.

Productive impact

84.7% of the farmers are interested in growing other corn varieties and 11.9% said no, perhaps because they do not want to discard the varieties they have been planting, which indicates that these farmers plant the varieties that have worked well for them or those that are best adapted to the climate of their municipality. Thus, those interested lean their preference for Asgrow (3.4%), Pioneer (52.5%), Cargill (5.1%), Tacsa (5.1%), and Criollo (6.8%) corn, in addition, others said Chaparra (1.7%), Tuxpeño (1.7%), yellow corn (1.7%) and the best variety (30.5%),

Similarly, the corn characteristics that farmers would prefer to grow are corn for grain (67.8%), with plants of intermediate size (64.4%), producing two (37.3%) and two or more ears (44.1%), with covered tops (84.7%), and white grain (83.1%). This preference shows that producers have some experience in the characteristics related to better productivity and production, prevention of damage caused by wind, insects, and fungi that attack the grain, as well as the taste for the flavor of the white grain, since this cereal is for self-consumption.

When asked "which crop management practice is most beneficial to production", 62.7% of producers said that "all tillage" benefits the crop, with 5.1% of them saying "all on time", and the rest said other practices, with "cleaning" (10.2%) and "fertilization" (8.5%) standing out, even though the importance of each practice during the crop season was previously explained to all respondents, showing that they have not received technical assistance related to the management of the crop.

These results coincide with those obtained by Domínguez *et al*. (2001) in Villacorzo, Chiapas where 60% of corn and sorghum producers stated that "all activities performed on time" improve production, likewise, 46.2 and 65.6% of respondents in San Fernando (Sánchez & Sánchez, 2013) and Copainalá (Posada & Domínguez, 2014), respectively, stated that "all labors" benefit corn crop production.

Social impact

Referring to the work carried out in the culture, 44.1% of producers mentioned that they used family labor, 35.6% family and hired labor, and the remaining 16.9% only hired labor. In the case of the producers' family

members, they stated that their family improved their way of life (78.0%), their food (86.4%), and their clothing (67.8%), while for the families of the hired people, the same respondents indicated that they also improved their way of life (42.4%), their food (45.8%) and their clothing (32.2%). In these six cases, the proportion of respondents missing to complete 100% of each variable denied that they had had improvements or did not respond. From the differences observed between the pairs of improvement proportions of producers vs. hired personnel, it is inferred that producers are more benefited than hired workers.

On the other hand, the producers said that other people in the community have not copied the new culture practices (81.4%), the organization of the community has improved (72.9%), they have noticed benefits with the support (59.3%), the support has not caused differences among them (86.4%), nor has the use of the support been supervised (83.1%), they do not belong to a producers' organization (94.9%), nor do they participate in a group that has a savings fund (94.9%). In this regard, it is necessary to motivate and promote the formation of corn producers' organizations, whose objectives are to manage support for their culture and also to be in a position to receive professional technical assistance, to achieve a field with greater productivity, and commercial efficiency.

Environmental impact

Producers carry out work to conserve their land, for example, by leaving or incorporating stubble (30.5%), as well as preventing erosion and planting trees (5.1%). However, 18.6% do not know how to do it, and 47.7% did not answer, so it is considered that they are not interested in conserving or improving the soil where they grow corn.

88.1% of farmers mentioned that the area under corn cultivation has not increased, and 6.8% said that it has. Likewise, 57.6% said that their soil has eroded, and 39.0% said that it has not, and 96.6% said that they have not performed soil analysis, possibly because they do not know how useful this study is. Technical assistance is essential to improve the work and consequently the productivity and production of the culture, however, 94.9% stated that the plant health board does not supervise their culture, so 86.4% consider that this institution does not work. Therefore, 79.7% indicated that they do not follow the recommendations for the application of chemical products, 15.3% that they do, and 5.1% do not apply or did not answer. On the other hand, 84.7% do not know if due to the low price of corn grain any producer no longer planted it, in 2013, or has changed the culture, only 10.2% answered yes between 2000 and 2012, because they did not have institutional support.

Regarding corn cob residues, 20.3% of producers use them as livestock feed, 8.5% leave them on the plot to fertilize the soil, 5.1% use them for tamales or as fuel, 32.2% burn or discard them, 20.3% do not use them, and 13.6% did not respond. In all forms, except burning and discarding, the use that producers give to *totomoxtle* and *olote*, generates other direct or indirect income that has not been considered within the profits of the culture.

The production systems are defined as the various ways in which the land is exploited, so 66.1% of farmers grow corn associated with beans, so they also obtain an additional income to grain production, while 30.5% only grow corn as a single crop. In this case, the proportions observed are similar to those presented by the diagnosis of corn culture in the municipality of San Fernando (Sánchez & Sánchez, 2013) and Copainalá (Posada & Domínguez, 2014), reaffirming that the predominant production system in the Mezcalapa region, Chiapas, corresponds to corn associated with beans (León-Velasco, 2016).

Respondents carried out work in 2014 to improve corn productivity and production, including cornfield improvement (23.7%), land preparation (25.4%), the reincorporation of crop residues (20.3%), planting of live barriers (8.5%), the use of contour lines on the land (5.1%), and irrigation of cattle or poultry manure to improve the soil (3.4%); in contrast, no terraces are laid out on the land (93.2%), nor are surface water detour canals built (94.9%). It was observed that few people carry out some practices to conserve their land for culture in the municipality of Tecpatán, Chiapas, which could be improved through organization, training, and technical assistance.

Technological impact

According to the opinion of the respondents, the results of the improved seed were good (35.6%), regular (32.2%), and bad (10.2%). There was no timely pest control (72.9%), the crops are not in better condition (88.1%), the support did not allow changing cultivation techniques (79.7%), the crops are not more uniform (83.1%), and the quality of the corn produced (84.7%), the facilities (91.5%), and the equipment (94.9%) did not improve. In general, it can be seen that producers have not improved their culture because they have no guidance or training, as well as no commercial interest in their crop. Only 18.6% of those surveyed acquired some tools to use in their work, such as backpack pumps and machetes. The 42.4% said that they need to acquire a series of tools, especially backpack pumps, machetes, hoes, and wheelbarrows, which they plan to acquire when they have money (18.6%), or there is some government support (15.3%), and 8.5% do not know how or when to acquire them.

Factors that influenced the impact

Concerning the variables that influenced the technological impact, the respondents indicated that they cooperate in common tasks (76.3%) and were not prepared to receive the support (55.9%), there was no training before the delivery of the support since the support arrived the technician does not show up to train them (86.4%), the suppliers have not complied with the requested material (81.4%), and there was no advice in the care of the support (91.5%). The 76.3% of producers who cooperate in the common tasks of the population stand out, however, they do not do it for other tasks related to their culture, and such community cooperation could also be used to initiate the organization that allows the better development of their main source of income.

Now, the highest frequency (45.8%) of respondents indicated having had losses in their culture, between 20 and 100% due to strong winds, likewise, 15.3% between 30 and 75% due to strong rains and winds, 13.6% between 50 and 100% due to drought and heat, although 30.5% denied having had losses. The effect of environmental factors cannot be controlled, but they can be prevented with better management of the cultures, for example, varying planting dates, planting early, intermediate or late varieties, depending on the case, with different plant heights, respectively, among others (León-Velasco, 2016).

Complementary service needs

Once the objectives of this research have been raised to the respondents, it has awakened in them the need to include the use of technical assistance as one more working tool in the production systems, in this way, there was an average of 85.2% who are willing to receive technical assistance for the activities carried out in their culture, but only 33.9% of that amount are willing to pay for it, as long as there is a guarantee of higher production, as also expressed by the Chiapas producers of Villacorzo 68% (Domínguez *et al*., 2001), Tapachula 71.8% (Ruiz *et al*., 2001), San Fernando 25.4% (Sánchez & Sánchez, 2013), Copainalá 14.4% (Posada & Domínguez, 2014), Ocotepec 12%, (Grajales, 2015), Mezcalapa 22%, (León & León, 2015), Coapilla 11.9%, (Pérez & Hernández, 2016) and Francisco León 6.1%, (Sánchez & López, 2016).

Of the 61.0% of Tecpatán producers who are not willing to pay for these services, some said that: the service is expensive, it does not work, they do not have enough money to pay, they are of low resources, and finally others because they consider that the government should provide them for free.

CONCLUSIONS

In the municipality of Tecpatán, Chiapas, 79.7% of the farmers are between 41 and 70 years old. 54.2% finished elementary school, 16.9% between 1st and 3rd grade, 10.2% finished middle school, 1.7% finished high school, 1.7% have a degree, and 15.3% are illiterate. 42.4% farm 1 ha, 10.2% 1.5 ha, 25.4% 2 ha and 10.2% between 2.5 and 5 ha. The source of income is agriculture (54.2%), and 40.7% is obtained from agriculture and livestock. 93.2% own *ejido* land, 5.1% private land, and 1.7% rented land. 100% of them manually plant *criollo* corn in rainfed conditions, and 25% of them also plant in residual humidity. 91.5% sow at 100 cm between furrows and between points, with four seeds per point. 39% controlled pre-emergent weeds, 44% controlled post-emergent weeds separately, and 10% did it manually. There was an attack of codling moth (85%) and, separately, blind chicken worm (56%). 48% of producers apply between 15 and 200 kg ha^{-1} of urea.

36% of growers indicated that the culture is profitable. 85% use the grain for self-consumption. 58% have eroded soil and do not analyze it (97%) nor improve it (68%), and 31% leave the stubble. The production systems in the municipality are: monoculture corn (31%) and associated with beans (66%). Respondents cooperate in common tasks (76.3%) and were not prepared to receive support (55.9%), there was no training before the delivery of support (79.7%) since the support arrived the technician does not show up to train them (86.4%) and suppliers do not comply with the requested material (81.4%).

Finally, 85% of producers are interested in receiving technical assistance for all the activities of the culture, but only 34% of them are willing to pay for these services.

RECOMMENDATIONS

With the information presented, it is recommended to continue this research, which consists of elaborating an Integral Technical Assistance System for corn producers in the municipality of Tecpatán, Chiapas. It is necessary to apply this Integral Technical Assistance System in an interinstitutional and multidisciplinary way. It is suggested to update (at least biannually) the institutional lists of corn producers in the municipality of Tecpatán, Chiapas.

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OXYGEN-TEMPERATURE IN THE INCIDENCE OF STREPTOCOCCUS SPP., IN FLOATING CAGES OF TILAPIA (OREOCHROMIS NILOTICUS) IN MALPASO, CHIAPAS

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— Abstract—

The present work describes the existing relationship of two environmental components in the presence of Streptococcosis in tilapia, which reports high mortality rates in open systems. For this reason, the oxygen and temperature of 10 tilapia aquaculture production units from floating cage systems and the relationship with the isolation of *Streptococcus spp*. were studied, in one of the main hydroelectric dams known as Malpaso located in Chiapas, one of the main tilapia-producing states in Mexico. Organ sampling was carried out to identify the bacteria, and at the same time oxygen and water temperature readings were taken, as well as reports of mortality and clinical signs. 80% of the units were positive for *Streptococcus spp*., With a mortality of 50% and clinical signs in 60% of the production units. The mean oxygen and temperature parameters were located at 5.5mg / l and 30.7° C, respectively. The relationship of oxygen to the incidence of *Streptococcus spp*. was found at a concentration of 5-6.5 mg / l and a temperature> 31° C. Therefore it is concluded that the environmental conditions of the floating cage systems for the production of tilapia represents a risk to the appearance of infectious diseases, due to the dynamics of the variation of biological components that puts the integrity of the fish at risk and predisposes the habitat for various pathogens such as *Streptococcus spp*.

Keywords

Mojarra; environment; mortality.

Tilapia (*Oreochromis spp.*) is one of the main species used in aquaculture production. Its ability to adapt to changing and extreme environmental conditions (Schmitter, 2006) has allowed it to be distributed in various regions of the world, at the same time, the high production efficiency and intensification of aquaculture systems have greatly favored the growth of this sector. FAO statistics show the productive increase of tilapia with annual reports ranging from 2657.7 t in 2010 to 4525.4 t in 2018, representing 8.3 % of aquaculture production worldwide. Closely matching the intensification is the demand for the product, which in *per capita* values increased from 9.0 kg (live weight) in 1961 to 20.3 kg in 2017, at an average rate of 1.5 % per year, while total meat consumption grew by 1.1 % per year in the same period (FAO, 2020).

In this sense, the intensification and expansion of aquaculture activities increase the probability of new, emerging, and re-emerging diseases (Delphino, *et al*., 2018), as well as anthropogenic activities that arise around production units, which can be associated as a cause of contamination, by physical, chemical or biological waste that alter water conditions (Soto, 2020). Therefore, it is important to differentiate the causes of disease or identify those factors that predispose to high mortality rates.

One of the most vulnerable systems is the culture of tilapia in floating cages that develops alongside the conditions of its environment, where control is practically impossible, considering currents, water level fluctuations, and quality concerning suspended substances (SADER, 2011), which compromises the adaptive capacity and survival of tilapia, due to the environmental risks that accompany it and represent a real challenge during the productive cycle (Arámbul, *et al*., 2018).

The main environmental exposures in fish are often related to spatial and temporal variation in temperature that affects physiological traits, due to their poikilothermic characteristics that compromise host resistance and to a large extent affect the colonization capacity of bacteria (Tavares, 2018).

Temperature and oxygen, together with rainy and dry periods, are considered the main climate-related risks in floating cages, as high temperatures predispose stress and susceptibility to diseases (Bahri, 2012; Lebel, 2016).

Oxygen concentrations in the water are one of the essential elements for the culture, its absence does not allow the development of tilapia, and low levels predispose a constant problem during the production cycle because at higher temperatures there is an increase in fish metabolism and higher oxygen consumption (Tomalá, *et al*., 2014).

Biological interaction also influences the incidence of facultative or opportunistic pathogens that cause mortalities ranging from 20% to 90% (García, 2020). In tilapia, *Streptococcus spp* is reported as one of the main pathogens related to water temperature and is common in intensive culture areas, especially in cage culture systems, which depend on the quality of tap

water (Kannika, 2017), this gram-positive bacterium mostly causes granulomatous infections (García, 2020), unilateral or bilateral exophthalmia, ocular opacity, hemorrhage at the base of the fins, darkening of the skin, ascites and cerebral congestion (Suanyuk, 2010) that prevent the commercialization of the product. The disease has a systemic course, reaching from 10-50% mortality in days for severely acute infections and in periods of one month, it is reported between 50-60% (Kayansamruaj, 2014; El-sayed, 2019).

In Mexico, the state of Chiapas is one of the main tilapia producers, which concentrates its production in several water bodies such as Peñitas, Malpaso, and La Angostura (Campos, 2018), however, the information available on the dynamics of various bacterial pathogens present in tilapia cultures in Chiapas is very limited. Therefore, the present study aims to identify one of the main pathogens in tilapia and its interaction with two environmental components.

MATERIALS AND METHODS

Study area

The present work was carried out in the Malpaso dam, formally called Netzahualcóyotl dam, located in the Grijalva riverbed between the municipalities of Copainalá, Tecpatán, and Ocozocoautla de Espinosa, located 2. 5 km downstream of the confluence of the La Venta and Grijalva rivers, approximately 125 km southwest of the city of Villahermosa, Tabasco, and 328 km upstream of the mouth into the Gulf of Mexico (CONAPESCA, 2015).

Isolation and identification of Streptococcus spp

The win Epi program, for aquatic organisms available online, was used to determine the minimum sample size necessary to detect disease, with a 95% confidence level of 76 production units, considering at least one infected individual, assuming a minimum expected prevalence of 0.26%, with a sample size of 10 tilapia production units in floating cage systems.

Biological material was collected from tilapia organs, including liver, spleen, brain, heart, and kidney from fattening animals weighing 250g. Dissolved oxygen (DO) and water temperature parameters were measured with the water quality tester multifunction device, and finally, mortality and presence of clinical signs were considered in each of the farms.

Sample collection

For sampling, the fish were slaughtered following NOM-033-ZOO-1995, Humane slaughter of domestic and wild animals. For this purpose, a physical

slaughter method was used, the fish were desensitized by cutting the spinal cord caudal to the skull and the upper margin of the opercula.

For the identification of *Streptococcus spp*. 25 samples were collected per production unit, corresponding to organs, which were taken by bacteriological loop and sown in an enriched medium for microorganisms, brain heart infusion (BHI), in 1.5 ml Eppendorf tubes, leaving incubation in agitation at 37 °C for 24 h, then sowing in a solid medium of 5% ram blood agar, incubating for 24 h. Colonies with *Streptococcus spp*. morphology (white colonies with beta-hemolysis halo) were identified and isolated, gram staining, CAMP, and catalase tests were performed.

Data analysis

Descriptive statistics were performed to determine the frequency and detection of *Streptococcus spp*. and correspondence analysis to identify the relationship between variables. The statistical program R version 4.0 was used.

RESULTS AND DISCUSSION

According to the evaluation of 10 aquaculture production units, an incidence of *Streptococcus spp*. of 80% was found, with 50% mortality and 60% with clinical signs. In 50% of the units, the pathogen was isolated from the liver, brain, heart, kidney, and 40% from the spleen. Table 1 shows the values found in each production unit. On average, 5.5 mg/l of oxygen and 30.7 °C of temperature were found.

Table 1
Values found in the floating cage aquaculture farms

Number of organs infected	Oxygen (mg / l)	Temperature (°C)	Mortality	Clinical signs
5	4.5	30.5	+	+
1	4	30.5	-	-
0	5	31	-	-
1	5.7	30.9	-	+
2	5	31.5	-	+
5	5.5	31.5	+	+
5	6.5	30.5	+	-
0	7	30	+	+
4	6	31	+	-
1	6	30	-	+

Source: Own elaboration

The body of water where the tilapia production units are located is one of the main hydroelectric dams that are part of the middle hydrological basin of the Grijalva, one of the most important basins in Mexico and the second most abundant in the country, with an approximate area of 58,000 km², which concentrates 42 of the 92 continental fish species (Anzueto, *et al*., 2016).

During 2015, the Management and Carrying Capacity Plan of the dam was carried out, in which some environmental parameters including temperature were evaluated. At that time a range of 23.1 °C to 28.0 °C was found, with little variation between the surface layer and a decrease at 10 and 20 m. (CONAPESCA, 2015). This data is placed below what was found (30.7° C), which suggests one of the most notable and significant modifications associated with climate change, the gradual increase in temperatures; given this, it could be necessary that in the tropics cage cultures are planned according to the region since otherwise they would no longer be feasible (Bahri, 2012).

The temperature range found (30 - 31.5° C) is in the range for *Streptococcus spp*. growth, since it only requires a temperature above 27 ° C, to activate the genetic modulation involved in its metabolism, adaptation, and pathogenicity (Tavares, 2018; Abraham, 2019), the above implies that temperature influenced the isolation of *Streptococcus spp*, in 80% of the aquaculture units.

Kayansamruaj (2014) mentions that bacterial virulence is also influenced by temperature, and in response, the tilapia exhibits massive inflammation leading to death, therefore, the higher the temperature the higher the mortality and injury rate.

Unlike temperature, oxygen was presented in a higher range, between 4 - 7 mg/l, on the other hand, this does not have such a strong effect on the bacteria, because most members of the *Streptococcus* genus are facultative anaerobes, which means that they can grow in conditions of absent or limited oxygen; they are catalase-negative with different nutritional requirements, which reflects the adaptation as a commensal (Schmitter, 2006).

Despite the success of tilapia for culture, environmental changes challenge their survival and disease resistance. Phuoc (2020) suggests that the severity and geographic range of streptococcosis outbreaks in tilapia may increase as water conditions change due to global warming, environmental pollution, and river acidification. These characteristics describe production conditions, which develop in floating cage systems, where fish are at the expense of environmental conditions. Niu (2020) found that the pathogen-positive samples corresponded entirely to cages in isolates of *Streptococcus spp*. from tilapia in floating cage and pond systems. This emphasizes the instability of this type of system, due to environmental exposure, which represents a risk for the culture and economic losses for the producer.

The unpredictability of the aquatic environment causes product losses that include production costs and biosecurity measures for the control and management of infections; on the other hand, these losses are ignored and/or not reported, due to the general acceptance of the producer who considers it within the normal in the culture, accepting margins of loss in production (Shinn, 2020).

The correlation coefficient analysis found a moderate positive correlation to the presence of *Streptococcus spp*. in temperature and oxygen, as shown in the following table.

Table 2

Correlation to the presence of Streptococcus spp

Variables	Range	*Streptococcus spp., positive*
Oxygen (mg / l)	6-6.5	0.3273
	5-5.7	0.4082
Temperature (°C)	31-31.5	0.4082

Source: Own elaboration

Assuming an effect of oxygen and temperature on the incidence of *Streptococcus spp*., we can identify that an oxygen range of 5-5.7 mg/l predisposes to the presence of the pathogen, although a range of 6-6.5 mg/l is also related, consequently we can attribute the presence of *Streptococcus spp*. to a range of 5-6.5 mg/l, since this pathogen grows in facultative anaerobic conditions, i.e., it can grow in optimal oxygen conditions or limited or even absent conditions (Schmitter, 2006). On the other hand, we observed that a temperature > 31° C predisposes to the presence of *Streptococcus spp*.

Finally, we can mention that oxygen at a concentration of 5-6.5 mg/l and a temperature > 31° C affects the incidence of *Streptococcus spp*. of tilapia cultured in floating cages. Rodkhum (2011) reports that at a temperature range of 30 - 33° C there is higher mortality due to *Streptococcus spp*. than at 25° C, on the other hand, Amal & Zamri, (2011) and Abraham (2019) mention that at a temperature > 31° C, it predisposes tilapia to outbreaks of *Streptococcus spp*. infection.

The main lesions observed in positive cases of streptococcosis in Malpaso were exophthalmia, ascites, and granulomas at the base of the tail with pus accumulations.

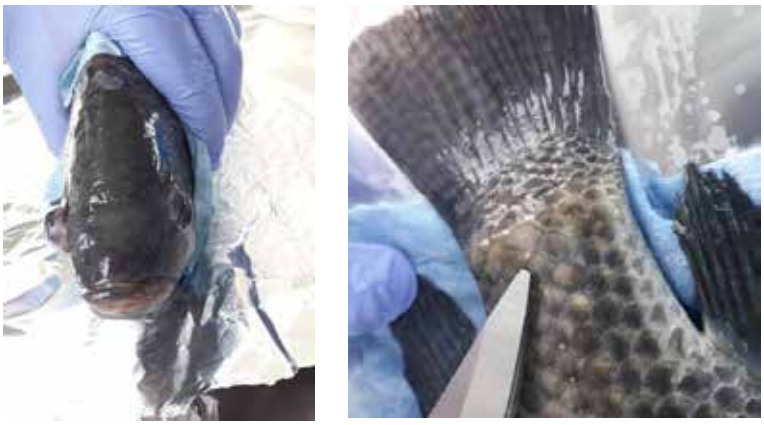

Image 1. External lesions. Unilateral exophthalmia and granuloma with purulent content

The most evident clinical signs in tilapia due to *Streptococcus spp*. from the Malpaso dam are the appearance of granulomas on the surface of the skin, on the base of the tail, which upon pressure releases a thick fluid, for this reason, it is not a product suitable for sale. Likewise, the appearance of the eye outside the orbital cavity gives an unpleasant and unhealthy appearance.

CONCLUSIONS

The average temperature found in the Malpaso dam was 30.7° C and it was found that >31°C influences the development of *Streptococcus spp*. Likewise, the oxygen level was 5.52 mg/l and at a range of 5-6.5 mg/l, it was related to the incidence of the bacteria. Thus, we can mention that the environmental conditions of floating cage systems for tilapia production represent a risk for the appearance of infectious diseases, due to the dynamics of variation that puts the integrity of the fish at risk and predisposes the habitat for diverse pathogenic and opportunistic agents.

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A C A D E M I C S
P A P E R S

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THE POETRY OF JOSÉ ALFREDO JIMÉNEZ

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— Abstract—

This work aims to show the popular elements and literary values present in the songs written by the iconic Guanajuato composer José Alfredo Jiménez, including the moral, religious, philosophical, and symbolic aspects that have allowed them to settle in the likes not only of contemporary Mexicans of the author of "El Rey" but also of current generations.

Keywords:

Song; culture; popular; tradition; composition.

José Alfredo Jiménez composed his songs based on the feelings of his marginalized countrymen, which he achieved largely through knowledge of popular culture. The themes of his songs are based on his identification with the lower classes; in "La que se fue" and in "El hijo del pueblo", as well as in "Gracias", his farewell song, there is an emotional bond with Mexicans who have traveled the paths of poverty. In the prologue to the *Cancionero* by José Alfredo Jiménez (2007), Carlos Monsiváis said "that he was the ideologist of the masses" (16).

Interestingly, Rock & Roll and the songs of the Guanajuato author march along parallel tracks; while the first was inspired by the young people of the middle class, in his idea of less conventional and stagnant society, freer, in the case of José Alfredo, the *humus* from which his song sprang was the vindication of the humble, full of hardships and, nevertheless, heirs of a heroic past, descendants of Cuauhtémoc; heroism worthy of being vindicated and even revered. It is an urban art of rural inspiration[1]. It was the beginning of television. José Alfredo maintained the charro attire and the air of stoicism characteristic of the films of the Mexican Gold Cinema cycle, such as the inaugural *Allá en el Rancho Grande*, while another era intersected with films such as *Rebelde sin causa* and the mambo, el cha-cha, the *Big Bands* and Bill Haley and His Comets, which started *Rock & Roll*. There was public for everything[2].

City versus province, wealth versus poverty, the composer of Dolores Hidalgo leans towards the peasants and the proletarians: vileness does not live within the humble, but in the high social spheres where the corrupting power of money turns its members into hypocrites, agreeable and, finally, unhappy, surrounded by women whose "bought affection does not know how to love us nor can it be faithful." On the contrary, the dispossessed show themselves without falsehoods, full of illusions. José Alfredo shares with them the pain, the misfortunes, and the shortages, he assumes poverty as his origin, a space from which he was exiled: “Yo conocí la pobreza / y

1 In the mid-fifties, at the height of their songs, interpreters appeared dressed in stylized country outfits of charro and Adelita, in strange coexistence with the musical avant-garde that began in those years, enthroned by Elvis Presley, his leather jackets and his Vaseline glittering fringe. It is agreed that Rock in Mexico began in 1956, in curious contrast to the image of José Alfredo Jiménez, and it was not only the appearance: on the one hand there was the conservatism of traditional values and folklore; on the other, the youth in search of a horizon that found its model in North American culture. Cfr. "El proceso de las artes (1910-1970)", *Historia general de México*, by Jorge Alberto Manrique (2000:945), and also *Estremécete y rueda: loco por el Rock & Roll. Un relato de la historia del rock en México correspondiente al periodo 1956-1976* de Federico Rubli (2007).

2 It was the six-year term of Adolfo Ruiz Cortines (1952-1958) with his sober, conservative bias, in opposition to the German excesses of modernization, corruption, and frivolity.

allá entre los pobres jamás lloré" (2002: 175)[3]. His songs were born essentially dedicated to the people, in homage to their original homeland[4]:

> Es por eso que es mi orgullo
> ser del barrio más humilde,
> alejado del bullicio
> de la falsa sociedad.
> Yo compongo mis canciones
> pa´ que el pueblo me las cante,
> y el día que el pueblo me falle,
> ese día voy a llorar. (121)

The people did not fail him, of course; its torn and drunken heart sing his lyrics since they shaped what pierces the depths of his soul; they are protest songs, therapeutic because when the disturbing does not go through the word, it is expressed in the most violent way[5]. José Alfredo becomes a catharsis. In "Gracias" he bowed to the faithfulness of the people; he was sure that his art was already embedded in the soul of his countrymen; hence his gratefulness; the Mexican scene was the ideal place for his pieces to set the emotions on fire:

> Yo no quiero saber
> qué se siente tener
> millones y millones;
> si tuviera con qué,
> compraría para mí
> otros dos corazones
> para hacerlos vibrar
> y llenar otra vez
> sus almas de ilusiones
> y poderles pagar
> que me quieran a mi
> y a todas mis canciones. (148)

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3 The quotes referring to the lyrics of José Alfredo's songs are taken from the book Cancionero Completo (2002), published under the Ocean / Turner publishing label, with a foreword by Carlos Monsiváis and an epilogue by Manuel Arroyo-Stephen.

4 On the contrary, the rock boom arose from the middle class in an eminently urban and North American context.

5 Lev Semenovich Vygotsky (1999: 261) points out that "The delay in external manifestation is the distinctive feature of an artistic emotion and the reason for its extraordinary power. We can show that art is a central emotion, an emotion in the cerebral cortex. The emotions that art arouses are intelligent. Instead of attacks or trembling fists, they tend to release themselves in images of fantasy."

José Alfredo wished at the end of his life two hearts that would let him compose and make those who listen to him vibrate. In the light of this reflection, his famous – and enigmatic, although it may not seem so– song "El rey" makes sense: he knew that he was about to be "left out" of life, but he was also the one who had left so many lights on. His compositions are traces dormant in the depths of Mexicans, such as the thought of the Nahua Tlamatinimes, the Marian cult, and other original elements that structure the syncretism of our history.

Among the elements that make up the extraordinary congruence of José Alfredo's art is combining the norm with slang. In other words, it is built with traditional molds but using rural and popular speech, which gives greater credibility to its themes and environments: some voices and speeches that appear repeatedly are, among others, "*rumbo*" in the place of direction, "*montón*" instead of a lot, "*ora*" instead of now, "*aluego*" instead of later, "*a ver*" to indicate disbelief or challenge; "*al cabo*" indicating an end. Expressions such as "*mero*" are also found to qualify a place or a precise moment: "El mero día de la boda / más de la cuenta tomó" (277); "de plano" para afirmar seguridad: "pa´ quitarme de plano la vida / sólo falta que tú me abandones" (275). There are a lot *pa', pos, nomás*; expressions such as "*ya no hay remedio*", "*estar parejos", "me dio la corazonada", "me lleva la tristeza", "no voltiés pa´ atrás, "tú trais la baraja*"; as well as a large number of diminutives: *"orita", "juntitos", "cositas", "grandecita", "despacito", "cariñitos*".

Likewise, the exaggeration of events is another of the distinctive features of these compositions. The lover claims to reach, driven by the power of love, beyond his human limits: "Y yo te buscaré / por cielos y por mares" (225); "Me sentí superior a cualquiera / y un puño de estrellas te quise bajar" (224). The feelings appear overwhelmed, expressed at their highest levels; to the lyrical subject, love does not fit in the body.

A STRANGE WORLD

Mexicans lack certainty about their origins; they usually identify with the defeated but glorious pre-Hispanic world. The ancients believed they came from wonderful places located in inaccessible regions and beyond history: Aztlán (Place of the white herons), Chicomoztoc (Seven caves) Vucub Zuyua (Seven caves or Seven ravines), paradisiacal places, free of uncertainties and regrets. Memories of these mythical spaces are found in certain towns whose hills with caves are considered ancient depositories of lost goods.

The indigenous past is so enigmatic that it continues to cause perplexities in current Mexicans, descendants of ancient cultures that they almost completely ignore, but to which they attribute great traits: they believe

they come from "a strange world", mythical, from which they were expelled and have had to travel through ungrateful paths; they think they are linked to a past that still grants dignity and comfort. For example, “De un mundo raro”, an emblematic song of popular Hispanic poetry, is stained of that mythical and heroic sphere, taken away by the European presence:

> Y si quieren saber de mi pasado,
> es preciso decir otra mentira:
> les diré que llegué de un mundo raro,
> que no sé del dolor, que triunfé en el amor,
> y que nunca he llorado. (101)

The songs of José Alfredo Jiménez are structured on a background of orphanhood, human penalties, and expiration; the protagonists are presented in the transit towards their disappearance, marked by the catastrophe. The destiny of men is to lose life, love, youth. Actions are carried out within a path of impairment. Men are endangered torches or love birds, but their transience is often a spur for action:

> Y como alguien me dijo
> que la vida es muy corta,
> esta vez para siempre
> ha venido por ti” (291).

The pre-Hispanic people knew that they had borrowed the land they walked on, where no one had to stay for a long time, the man was like a flower that briefly opened the petals and then surrendered to oblivion and mist; life like a painting fades; his place, his true home, was perhaps in the region of the dead; the land was the place of the orphan and a path of hardships as seen in a song from Tlaxcala:

> ¿Es quizá nuestra casa en la tierra?
> ¡Sólo lugar de pena, lugar de congoja es donde vivimos!
> [...]
> ¿Mi madre y mi padre vendrán a darme
> su canto y su palabra que busco?
> Nadie yace allí: nos dejaron huérfanos en la tierra (Garibay, 1987:199).

However, for the Nahua poets, there were palliatives such as song and friendship[6]; the song was a garment of the soul, beautiful and true; it also meant a way to transcend, to fix the being in the memory of those who are to come, as can be seen in the following verses recorded and translated by Ángel María Garibay (1987):

> ¿Se irá tan solo mi corazón
> como las flores que fueron pereciendo?
> ¿Nada de mi nombre será algún día?
> ¿Nada será mi fama será en la tierra?
> ¡Al menos flores, al menos cantos!
> ¿Cómo lo hará mi corazón?
> ¡Hay, en vano pasamos por la tierra! (176)

José Alfredo's songs are born from the pain of existing; but also of the need to alleviate sorrows, to clear the abyss to which great loves and great losses condemn. “Ella”, “La noche de mi mal”, “A los quince o veinte tragos”, “Haz de pagar”, “Soy el arrepentido”, “Amor de pobre”, among others, express this tear. The protagonists of his songs walk on a path that leads to death. The Mexican easily ends his life "due to a misunderstanding", he gambles his life for a married woman, on the street, in the cantina, or on the line with his rooster.

THE CERRO DEL CUBILETE

In José Alfredo's songs, there are allusions to Christ and the cross, to the rites and various elements of Catholic orthodoxy, mixed with pagan aspects. Christ and the cross, symbols of love and martyrdom, appear close to men. The cross is metaphorically represented as a burden and shelter in “La cruz del amor” and “La cruz del cielo”. In “Caminos de Guanajuato”, the sacred and the profane meet: Christ has his place on a hill whose name symbolizes an object seen as evil by Catholicism: the hazardous cup. The song picks up an aspect of the life of Guanajuato, their intense passion for the temple at the top and for the fair where "life is wagered and the winner is respected."

God appears as the supreme force that dictates the limits of the human; his will is beyond all comprehension and imposes a destiny on each man,

6 Singing as a consolation in the face of human tragedies is a topic that also appears in Martín Fierro by José Hernández (1983: 29): “Aquí me pongo a cantar / al compás de la vigüela; / que al hombre que lo desvela / una pena extraordinaria, / como la ave solitaria / con el cantar se consuela”, as well as in many other compositions that are rooted in popular tradition.

“but God is the one who marks paths”, even if the poet does not understand his purposes and experiences them as misfortunes: “quién sabe Dios / por qué te puso en mi camino” (200). Sometimes they are gifts that balance the scale: “sólo Dios que me vio en mi amargura / supo darme consuelo en tu amor” (102).

The patron saints that are worshiped in the towns, such as the Virgin of Zapopan, emerge as icons of relief; the hermitage, the church, prayers, the priest, Christmas, glory, sin, guilt, the soul, and hell are central aspects of the Catholic man and run through the lyrics of José Alfredo.

WHEN THE AFTERNOON DIES

Love ends even if you have loved each other deeply; his birth contains the germ of destruction; sunrise and sunset; the lyrical subject usually relates the love affair and its inner drama with the passing of the day.

> Si encuentras un amor que te comprenda
> y sientes que te quiere más que nadie,
> entonces yo daré la media vuelta
> y me iré con el sol cuando muera la tarde. (168)

The happiness of lovers ends in a painful farewell. The songs are organized from the emotional destruction caused by "the withdrawal"; the protagonists try to delay the outcome: “Ella quiso quedarse / cuando vio mi tristeza” (136), or to speed it up: “Acaba de una vez, de un solo golpe” (50).

To love is to lose the ground, to walk on quicksand, to live in risk, to place oneself in the hands of the other, who is equally unstable. Affection presents itself as heaven and hell at the same time: it saves and condemns, delights, and hurts. José Alfredo sings the erotic offense, the frustrated illusion. The unbearable truth of heartbreak is lived as an exile; it means descending to the underworld and settling, as Saint John of the Cross said, in the "dark night of the soul":

> No quiero ni volver a oír tu nombre;
> no quiero ni saber a dónde vas,
> así me lo dijiste aquella noche,
> aquella negra noche de mi mal. (173)

The fear of being forgotten, of being out of the heart of the other, forces us to appeal to the memory: “Te dije adiós y pediste que nunca, / que nunca te olvidara” (183). However, love saves when it fills the road with wine and

roses, buries the past, clarifies the vision of things, consoles, calms pain, and puts lovers "close to God"; then it becomes a source of new worlds:

> Y te voy a enseñar a querer,
> porque tú no has querido:
> ya verás lo que vas a aprender
> cuando vivas conmigo. (87)

Lovers take root in life through the realization of passion and pass from one state to another: “Si algo en mí cambió / te lo debo a ti” (237); at that moment, even tears spring from so much happiness: “Poco a poco me voy acercando a ti, / poco a poco se me llenan los ojos de llanto” (287).

Men's fragility, with their drama on their backs, is contrasted by the grandeur and beauty of the celestial vault; in "La noche de mi mal", the poetic subject claims to have walked "under a sky more than blue"; the protagonist of "El jinete" rides singing "under the light of the stars" and, "although the night is very beautiful", he is inhabited by the wound of hopelessly lost love. Nature is not only the setting for the actions, it usually participates in the adventures of the protagonists: to the white horse, "the Yaqui Valley gave its tenderness"; the sea dialogues with the Seven Seas: “Y las olas me contestan / ya no llores, marinero” (129); a stone on the road reveals the destiny of the poet.

FOUR ROADS

Canteens, drinks, bottles, glasses, liquor, become allegorical keys when moving to other areas. Drunkenness is not exclusive to those who get drunk with liquor, but rather it becomes a condition of love ecstasy:

> Nadie sabe ni puede decir
> las cosas de amores
> porque todos se entregan
> borrachos de amor en el mundo. (166)

The liquor settles on the lips of the beloved. Love becomes alcoholic and alcohol becomes erotic: “me emborraché de verte” (58), it is said in "Bola negra"; there the protagonist receives "tequila kisses" and "glasses of kisses" and walks drunk with so much love. Love is communion, although fleeting: “Tómate esta botella conmigo/ y en el último trago nos vamos” (139), or as it is said in “Cuatro copas”:

Quién sabe cuántos años han pasado,
la vida nos dejó las almas rotas,
y estamos recordando nuestra historia
nomás mientras tomamos cuatro copas. (92)

There is not a single way for everyone; each one walks on his own, predetermined and random at the same time. Destiny and chance come together in the songs of José Alfredo. Life is a gamble like playing cards, but the cards are marked. Luck was cast from the beginning:

No cabe duda,
yo nací con el santo de espaldas,
no cabe duda,
la pobreza la traigo en el alma. (44)

The roads intersect for a few moments; later, each one "takes his course"; on the way there are brief intersections that diminish loneliness; however, the fullness of lovers remains on the threshold:

Y estuve a punto, y estuve a punto
de cambiar tu mundo,
de cambiar tu mundo
por el mundo mío. (183)

The trails are not linear, they fork. Options appear on the horizon, some more uncertain than others, and you can choose "the worst road." The choice brings insecurity, unease; the protagonist finds himself at a crossroads faced with the obligation to choose: “Cuatro caminos hay en mi vida, / ¿cuál de los cuatro será el mejor?” (91).

Paul Westheim (1985), referring to Tezcatlipoca, the Aztec god of misfortunes, says that "crossroads [are] the place of uncertainty, where the traveler doubts which way to go; [for this] stone seats were erected [...] so that he could rest from wandering” (14).

The protagonists twins of the Popol Vuh (1984), a sacred book of the Quiche Maya of Guatemala, travel to the underworld and take the path of the talking black road, which tells them: “Yo soy el que debéis tomar porque yo soy el camino del Señor” (121). And also in the novel by Juan Rulfo (2004), Pedro Páramo, Juan Preciado says that he had "run into" the muleteer Abundio in "The encounters, where several roads cross," they went down one of them "after upsetting the hills. “Habíamos dejado el aire caliente allá arriba y nos íbamos hundiendo en el puro calor sin aire” (67).

In José Alfredo's songs, the best path is not always chosen; frequently, the characters take the one that offers deadly pleasures: “Que se me acabe la vida / frente a una copa de vino” (241).

EVERYWHERE I GO, I SEE YOU

Reason is not the instrument that supports decisions; irrational forces dominate, dark impulses; the heart speaks, whose language challenges those who "are in their right mind" and confronts the world of conventions: “Si ando en mi juicio, no estoy contento, / si ando borracho, pa´ qué te cuento” (91).

Love is beyond comprehension, it moves along the abyss; there lies the source of the best songs by José Alfredo; language has a magical value because it connects and energizes with experiences that do not fit into words: “No te puedo decir lo que siento” (258); “y me querías decir no sé qué cosas” (49); “Despacito, muy despacito, / me dijo cosas que nunca oí” (102); “Nadie sabe ni puede decir / las cosas de amores” (166). Love is "the strange force" that imposes itself:

> “Te vi llegar y sentí la presencia
> de un ser desconocido;
> te vi llegar y sentí lo que nunca
> jamás había sentido” (183).

The language of love and heartbreak is not always verbal, the eyes are its main means of expression:

> Este adiós, corazón,
> te lo exijo mirando tu cara
> y si ya no hay amor en tus ojos
> me voy de tu vida. (210)

Sometimes the message is sent by intuition: “No creas que alguien me lo dijo: / me dio la corazonada” (265). Love is not a matter of the will, it is governed by laws in which even the criminal can, with justice, plead innocent. There is no relationship between the laws of love and the conventional ones, they are different territories. The seat of passion has no name:

> Sucedió lejos de aquí
> en una tierra sin nombre,
> donde la ley nada puede
> contra el cariño de un hombre. (276)

Certain moral imperatives disappear in these pieces, such as male fidelity, since for men fidelity to women is an interior matter: “por donde quiera que voy te miro; / y ando con otra y por ti suspiro” (91).

José Alfredo abhorred the barriers imposed by social classes: “Si nos dejan, / nos vamos a vivir a un mundo nuevo” (259); the protagonists are the marginalized, the usual losers, the persecuted, dipsomaniacs, prostitutes, incarcerated, poor peasants, men who overshadow themselves without a trace, removed from the modernizing development they experience in the form of prisons, far from a satisfactory life; they yearn to be outside those laws, to achieve, even in the imaginary plane, security and rest:

> Vámonos, donde nadie nos juzgue,
> donde nadie nos diga que hacemos mal;
> vámonos, alejados del mundo, donde no haya justicia
> ni leyes ni nada, nomás nuestro amor. (291)

The humble and impoverished Mexican gives what he does not have; his life is worth nothing, he begins crying "and thus crying ends", it is a passion that is drawn in the sand. The actions of the characters are generally carried out in twilight and foggy environments, or at night, because the world of shadows is conducive to the revelation of men’s deep side.

WHITE HORSE

An ethical base is observed in the compositions of José Alfredo; Christian, chivalric, enlightened, and indigenous morals appear here, conjugated or in a certain state of purity. Freedom is a central value and appears suggested; it is the base of "The white horse." From the philological perspective, it does not matter that to create that corrido José Alfredo has based himself on a trip in his car during a long party: the white horse is the protagonist who represents aspects of men; his trip is an act of freedom, of decision, even though his life depends on it: “y no quiso echarse hasta ver Ensenada” (107). During the trip, he suffers injuries and bruises. His career is slowing down, to such a degree that "near Mexicali he felt he was dying." Finally, he lay down when he saw Ensenada. It represents the passing from youth to old age. White horse’s river of life, like that of all of us, flowed into the sea of death. Jorge Manrique (2016:48) wrote “Nuestras vidas son los ríos / que van a dar en la mar, / que es el morir”.

The songs of José Alfredo raise respect for the will of others. The union of a couple, for example, must correspond to a free choice: “Pero quiero que sepas que no te obligo / que si vienes conmigo es por amor” (291). The white horse decided to leave and the rider respected his decision: “Su noble

jinete, le quitó la rienda, / le quitó la silla y se fue a puro pelo" (107). Even in songs of accentuated machismo, freedom is respected when she decides to leave because the lack of love is not claimed but betrayal, deception, bad faith.

Beyond money and power, José Alfredo privileged feelings; the value of a man lies in his authenticity, in his promise, in the quality of his friendship. Having a heart means being true and this is not related to power or the possession of material wealth: "Yo no entiendo esas cosas de las clases sociales, / sólo sé que me quieres y que te quiero yo" (291).

PLAYING FAIR

For Mijail Bajtin (1999), the carnival offers a vision of the world, of men, and human relationships deliberately outside the norm; it implies the transitory liberation based on the flight from the ordinary life with which one is sorely governed. The carnival also carries with it the idea that human beings are not separated from the world, but entangled with it, confused with animals and things.

Certain carnival elements are present in José Alfredo's songs, for example, the union of the new with the old: "Cuando vivas conmigo"; from birth to death: "Caminos de Guanajuato"; human qualities with those of animals: "El coyote", "La araña", "Los gavilanes", "El tigre", "El borrego", and others who participate in the fairs and "their plays "with drunkenness, chance, excesses.

ACROSS THE BRIDGE

José Alfredo uses different tropes and figures for the elaboration of his compositions; feelings come into analogy with nature; the plants, the animals, the clouds, the stars are in the process of a sentimental relationship: "Nuestro amor es lo mismo que el mar / cristalino y profundo" (166). There are times when the elements compared lie within the subject:

> yo sentí que mi vida
> perdía en un abismo
> profundo y negro
> como mi suerte. (135)

Or the comparison occurs at the level of intertextuality, that is, the song quotes what happens in another song:

> Como al caballo blanco
> le solté la rienda,
> a ti también te suelto
> y te me vas ahorita. (273)

As for the metaphors, the substitutes are usually elements taken from nature: the woman is a dove, a flower, and a star, while scratching, but also a prison; her lips are glasses of liquor; her kisses, syrup or poison; the eyes, stars; love, thorn, prison, sweet bond.

In the game of synecdoche and synesthesia, fortunate literary effects are achieved: the light of the moon becomes the light of the sky; the night bathes with the moon and enters into communion with the couple, thereby intensifying the fullness of love. The cantina extends to the world, the roads of Guanajuato to the roads of life, the woman's smile on her lips: “a ver si al cabo del tiempo / tus labios se siguen riendo” (241).

On the other hand, the irony is not so frequent, but some pieces are structured based on this figure, as in several moments of "El perro negro", "La media vuelta", and "Cuatro copas", which on the other hand is symbolically united to "Cuatro caminos", and where the opposite of what is going to happen is said: to reach the fourth cup is to arrive at lost borders:

> Me invitas una copa o te la invito,
> tenemos que brindar por nuestras cosas,
> no vamos a llegar a emborracharnos,
> nomás nos tomaremos cuatro copas. (92)

The poetry of José Alfredo Jiménez especially dominates the technique of suggestion, which consists in approaching a fact without mentioning it; perhaps it is self-censorship regarding the naming of erotic pleasure, or perhaps it is the restrictive elegance imposed by the time. The point is that sex does not usually appear explicitly, only the situations are outlined; for example, in "Amanecí en tus brazos", the lovers’ nakedness is not mentioned, but it is implicit.

Now, to observe the workmanship of José Alfredo we must refer to the structure of Castilian verse. The symmetry of these songs, their impeccable rhythmic scaffolding, in which verses and traditional forms[7] abound, have been seen in the parts cited.

José Alfredo Jiménez made simple songs; its lexicon is limited; the images are scarce, but with few resources, it drags remote echoes that move the most intimate fibers of the listener. One of the secrets of his aesthetic fortune consists in mastering the technique, in the timing and harmonization

7 José Alfredo's songs frequently combine verses of 7 and 11 syllables, as in the lyre, whose rhyming structure in a B ab B, mixes short and long periods that achieve a singular harmonization and musicality. It was devised by the Italian Bernardo Tasso (1534) and introduced in Spain by Garcilaso de la Vega in the famous "Canción a la flor de Guido", from whose first verse the term lira was taken: "si de mi baja lira". Cfr. Fernando Lázaro Carreter (1984).

of his rhymes, in the appropriate combination of short and long lines, as seen in "Amarga Navidad", where he gathers periods of seven and eleven syllables, this time in a single stanza and with single imperfect assonance in the words "fear" and "remedy" that makes it more subtle:

> Y ya después que pasen muchas cosas,
> que estés arrepentida,
> que tengas mucho miedo,
> vas a saber que aquello que dejaste
> fue lo que más quisiste
> pero ya no hay remedio. (50)

It is not unintentional that some of José Alfredo's emblematic songs have the structure of traditional romance. Before citing an example and its variants, typical of the Mexican corrido, we must define this tradition. The romance is a more or less broad poem, without stanzas, or with a single stanza – most likely that is where it got its name: "corrido" –, composed of eight syllables whose even verses have assonance rhymes, and the odd ones do not rhyme. Its remote origin and typology have been widely studied[8]; these poems constitute the most recurrent literary genre in Hispanic culture, both in popular and bookish art since romances have been composed, sung, and recast in the most different places and times. One of the reasons for this breadth and durability is its clarity and simplicity since it is enough to pay attention and let yourself be enveloped by that almost natural form of the language[9].

It must be said that this adaptation of the romance that we call corrido presents some peculiarities, such as the incorporation of verses in consonance and not maintaining the same rhyme throughout the text, while it is twinned with its predecessor due to its scarce adjectives and its narrative nature, which even includes dialogues in the actions, using an always emotional, indiscreet, disturbing and dramatic tone, as seen in José Alfredo Jiménez's corrido "El perro negro", wherein fifty-two octosyllables the tragic story of

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8 For example, in the classic books of Ramón Menéndez Pidal (1983): *Flor nueva de romances viejos,* and from Manuel Alvar (1979): *Romancero Viejo y tradicional*. In Mexico, the studies on the subject by Mercedes Díaz Roig (1987): *El romancero viejo*, and by Margit Frenk Alatorre (1984): *Entre folclor y literatura* are very important.

9 "A song is a multisemiotic form of discourse that transmits, in words and music, contents whose meanings, classes, and ways of saying, are just beginning to be systematically studied. The content of a song can represent the ideology of a society, so its written dimension is of interest to the theory of literature, since it has features that make its aesthetic analysis impossible, such as resonance, tone or melody, intensity or rhythm, to which is added the style and theme, a system of signs and their respective meaning, which represent a specific genre and which, as Robert Hodge points out, constitute what Barthes calls the soul of the song, a quality of singing that is not necessarily individual, but can belong to a whole culture" (Altúzar Constantino, 2009. "Vigencia del corrido en Chiapas", *Crates. Revista de estudios literarios*, No. 5. pp. 11-26.

a dispute or love triangle. The predominant rhyme is consonant and occurs in sharp words:

> Al otro lado del puente
> de La Piedad, Michoacán,
> vivía Gilberto, el valiente,
> nacido en Apatzingán,
> siempre con un perro negro
> que era su noble guardián. (126)

From the beginning, rhymes are incorporated into the odd verses: “puente”, “valiente”, thereby breaking a rule mentioned above: even verses rhyme and odd verses are loose; likewise, at the end of the corrido another one appears: "dueño", "negro", to close with the rhyme that runs through the entire text:

> Así murió el perro negro,
> aquel enorme guardián,
> que quiso mucho a Gilberto
> y dio muerte a don Julián.

The most hidden essence and grace of the old romancero are present here, as when it is said with sarcasm: Gilberto estaba dormido, / ya no volvió a despertar”; the hero of the story must pay with his life for his wish, because

> Quería vivir con la Lupe
> la novia de don Julián,
> hombre de mucho dinero
> acostumbrado a mandar.

Tables remain: Don Julián kills Gilberto, and the black dog kills Don Julián; Lupe becomes Lupita and is doubly widowed; she chooses the most beautiful flowers "as to make an altar" and at the end, she resignedly goes “hasta una tumba / del panteón municipal”.

In general, the popular song has several artistic merits that literary studies cannot ignore. José Alfredo Jiménez is in communion with the depths of the language. The daily scenes, the drama, the heroism, and the realism that his songs show are the manifestation of the social and cultural context in which they arose, they constitute a testimony of popular sentiment, not only because of the complexity of symbols that his language evokes but also for the brilliant simplicity of the contents and forms.

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RELIGIOUS DIVERSITY AND POLITICAL SYSTEMS IN LATIN AMERICA (2000-2015)

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RESUMEN

The objective of this manuscript is to share the emergence and appearance of non-Catholic religious creeds in Latin American territory from 2000 to 2015. In the absence of studies on the subject, a general outline of a project is drawn up to be developed in the future. The main research question defines the process of establishment in countries with political systems of the right, of the left, or with systems of social democracy. An important aspect refers to the fact that the increasing presence of new creeds has influenced the re-constitution of the notions of culture and religion.

Keywords:

Religion; Diversity; Latin America.

POLITICAL SYSTEMS IN LATIN AMERICA. A SHORT WALK, 2000-2015

This document presents a brief historical analysis around the panorama of religious diversity and the condition in which it develops in countries with political origins of different spheres: Left, Right, social-democratic, center-left, center-right, among others, during this century and the previous century and since the 1950s at least.

Historically, transcendental documentary contributions have been constituted that dictate that Latin America, including Mexico, is undergoing a re-configuration of the religious panorama characterized by the increasingly strong presence of a population not ascribed to Catholicism, but to other denominations that over time have captured the sympathy of the population. Over the past fifty years, the Catholic religion has experienced a considerable loss of parishioners, in addition to solid increases in non-Catholic associations.

This is demonstrated by the research of the *Pew Research Center* taken up by Berdejo (2014) for whom, in 2014, the non-Catholic population figures had increased significantly. It indicates the following:

> ...that until 1960, 90 percent of Latin Americans considered themselves Catholic, however, this percentage has decreased. Currently, in 2014, even though 84 percent of adults grew up in a Catholic home, only 69 percent say they continue to belong to the Church. Of the entire region, Colombia has the highest percentage of Catholics who converted to Protestantism (74 percent), and Panama the lowest with 15 percent. In contrast, Protestants increased from 9 to 19 percent, and "unaffiliated" (agnostics, atheists, etc.) increased from 4 to 8 percent. In Uruguay, the latter sector is made up of 37 percent of the population.

The rates of decline in the Catholic population are striking. According to the *Pew Research Center* (2014: 10), "the scale of this exodus is roughly on par with that of several Latin American countries that have also suffered sharp declines in the proportion of adults who identify as Catholic, among which are Nicaragua (25 percentage points less), Uruguay (22 points less), Brazil (20 less) and El Salvador (19 less)".

In Mexico, at least at the municipal level, according to the text of *La diversidad religiosa en México*, whose author is INEGI (2005), argues that:

> Pentecostalism was registered in 2,213 of the 2,443 municipalities in the country. Its presence is significant (more than 20%) in 18 municipalities of Oaxaca and in 2 of Veracruz de Ignacio de la Llave; in one of them (San Juan Bautista Tlacoatzintepec, Oaxaca), little more than 52% of its population declared to

profess this doctrine; of the 94 municipalities where the percentage fluctuates between 10% and 20%, 70 belong to Oaxaca, Chiapas and Veracruz de Ignacio de la Llave.

It is vital to put the aforementioned figures in context. The growth of non-Catholic religious groups in the country is a real question and not an anecdote. It is assumed - as a hypothesis - that the type of political system that prevails in each country is vital to understand the rise of various (non-Catholic) creeds. Therefore, the following question has been generated that throughout the investigation is intended to answer: What factors explain the growth of the ecclesial supply in Latin America with diverse political systems? In this sense, Norberto Bobbio (cited in Rovira Kaltwasser, 2014) establishes that each of the political tendencies has a particular meaning. The right conceives that inequalities are natural and difficult to eradicate; the left assumes that inequalities are socially constructed and, therefore, are the result of scenarios that must be reconstituted. Right-wing political systems such as Mexico, Chile, and Colombia, among others, in the vision of Mudde (2007), would define inequalities as natural, difficult to eradicate by the State, while in the case of left-wing countries such as Bolivia, Venezuela, and Ecuador would assume the inequalities as artificial, and therefore, solvable through the application of national policies.

According to Flavia Freidenberg (2003), the characteristics of the current left-wing populisms refer to the forms of inclusion and political mobilization, which are seen as part of the types of democracy that in the attempt are erected as expressions of opposition against the demonstrations of the governments that carry out programs that imply damage to the institutionality and that incur radical versions of democracy.

The premiere of governments of a social-democratic type in Brazil and Uruguay provides Jorge Lanzarote (2008) with the opportunity to coin a concept of *social democracy* based on the political nature of each government, operating in relatively institutionalized plural party systems, under an effective competition regime with organized opposition. The list of governments considered right-wing includes Chile, Colombia, El Salvador, Honduras, Mexico, and Panama. By 2008, eleven of the eighteen Latin American countries were ruled by center-left or left-wing presidents (Stokes, 2009).

Given the diversity of political systems and their acquired hegemony, it is considered that the growth of non-Catholic creeds, the evolution of the concept of culture, and the structure of national policies vary according to political and governmental practices and discourses; product largely of the evident religious diversity evident in the region and that the agendas of the different governments must analyze.

The importance of this manuscript lies in the fact that it describes a social phenomenon that has a global impact and that is little analyzed in terms of research projects, at least in Mexico it has been barely studied. The central reflection that is intended to be discussed is to account for why it is essential to analyze the establishment, evolution, and development of non-Catholic groups in Latin American territory, with research projects according to the themes, which allow elucidating their various features in the face of the condition and structure of each political system in each country, this is fundamental.

The main objective of this manuscript

It is shared that the primary objective is to share an argument that makes it possible to elucidate and imagine the particularities of the process of establishing non-Catholic creeds in Latin America, with the specificities of countries with governments of the left versus countries with governments of a political stamp of the right and one of social democracy such as Brazil and its comparative axis with Mexico.

Given this possibility, it is necessary to understand the conditions for the establishment of non-Catholic religious groups in countries with governments of the left versus countries with governments of the right and one of social democracy. It is interesting to think about how governments rescue the issue of the proliferation of non-Catholic groups as a topic that can become part of the public policy structure and form part of national policies. Thus, one must also reflect on the role of non-Catholic groups in shaping culture.

The object of study

A possible object of study for other projects would refer to elucidating the characteristics of religious diversification on Latin American soil in comparison with Mexico and the process of building a *Latin American culture* in the face of the presence of political systems of various origins.

Hypothetically

The hypothesis is that the evolution of culture in Latin America and Mexico is largely due to the massive establishment and constant development of non-Catholic creeds, as well as to the different norms and constitutional principles of the countries, which result in modalities of diverse political systems and the very cultural and political conjunctures that the creeds settled on Latin soil have faced. The conformation of the culture depends to

a large extent on the legal reforms made by the Latin states and on how non-Catholic groups with their ministers of worship and regional parishioners mobilize to appropriate public spaces and to be included in the configuration of new cultural concepts.

The historical framework of the phenomenon: religious dynamics in Latin America and the supply growth

Over the past fifty years, in the case of Mexico, the establishment of non-Catholic creeds has been accelerated. It is explained by various issues: 1) A very important one is because non-Catholic groups in Mexico emerged with the liberal Juarista State, but their presence began to acquire statistical visibility in the middle of the 20th century (Bastián, 1983; Blancarte, 2003).

It is worth mentioning that Catholicism prevailed in more than 90% of the population until before the 1990s. By the year 2000, non-Catholic affiliations made considerable progress. Casillas (2007: 138) calls this growth evolution of religious preferences in the country, located by states and municipalities. The author emphasizes that at the state level the predominant religion throughout history has been Catholic.

The dynamics of non-Catholic religious groups have been complex, as was said, very broad and problematic. In this line, when establishing the dynamics of the religious population in Latin America, the perspective of *Pew Research* (2014: 3), a survey that collects data on the religious condition of the inhabitants of Latin America, which is very much in line with Stoll (2002: 15-23), emphasizes that the tendency to increase in non-Catholic creeds is real and not anecdotal, to the detriment of diocesan Catholicism itself, and even of traditional Catholicism.

> Some of the lowest percentages of the evangelical population were found in the Andean countries: Venezuela (1 to 3%), Colombia (1 to 4%), Ecuador (2 to 4%), Peru (3 to 5%), and Bolivia (2 to 8%), in which Protestantism got off to a slow and difficult start. Yet since 1960 evangelical churches have grown rapidly, with one of the highest rates in the region. Expectations are also high in Paraguay (2-4%), another country where evangelicals had not thrived until recently. Evangelicals in the Caribbean are growing rapidly in other traditionally Catholic countries such as the Dominican Republic (2 to 7%), Haiti (15 to 20%), and Puerto Rico (7 to 30%).
>
> In Latin America, the two most evangelical countries from 2010 onwards are Brazil, where Protestants claim to reach up to 18% of the population, and Chile, where they claim to have up to 25%, and in the same words of the author, twenty-two million evangelicals in Brazil account for three out of every five evangelicals in Latin America and the Caribbean. Together with the population in

> Chile, they reach two out of three. The rapid growth of the Protestant population is observed, in general, in Chile, the growth rate has decreased, but in Brazil, according to the International Evangelistic Crusade, the evangelical growth has been 77%; from 1970 to 1980 it was 155%.

According to the page NoticiaCristiana.com (2008), in 1900 there were about 50,000 Protestants throughout Latin America; one million in 1930, 5 million 20 years later, 10 million in 1960, 20 million in 1970, 50 million a decade later. It was estimated that in 2000 Protestants/Evangelicals numbered around 100 million. During the first decade of the 21st century, Latin America and the Caribbean approached 600 million inhabitants, 20 percent of whom would be evangelicals.

Just as they were initially perceived by other Protestants and/or Evangelicals in Europe and the United States, Pentecostals in Latin America have gone from being considered outsiders, and even contrary to the Protestant family, to become its main aspect. Indeed, according to the perspective of Jean Pierre Bastián (1990; 1997), since 1950 the Latin American religious field has been transformed in the face of the appearance of a multiplicity of religious associations, among which the Evangelicals, Pentecostals, and Presbyterians stand out, which has greatly influenced the cultural (and even political) transformation itself (Mendes, 2013).

From the perspective of Camargo Martínez (2019: 1), 2) the growing presence of other religious offerings was established as part of a "process of religious conversion and mobility with implications for the social structure of the countries." This entails another element. 3) The growth of the ecclesial offer has occurred due to the constant mobility of people from one religious association to another, which has affected the way of thinking, relating to others, and the way of social mobilization.

Concerning journalistic texts, especially, the Latinobarómetro report argues that the tendency of people to be in associations other than Catholicism is real and not anecdotal. Evangelical Christianity has grown in the last eighteen years in Latin America as Catholicism has steadily declined. This reference denotes that in total, Catholicism has lost 13 percentage points in terms of believers throughout the continent, going from 80 percent of the population in 1995 to 67 percent until 2013 (Latinobarómetro, 2014).

The decline in Catholic believers has been marked in countries such as Nicaragua and Honduras, where they lose presence close to 30 percent. There are also significant decreases, of 20 percent, in Costa Rica, Uruguay, Chile, Panama, and Brazil. The decline is milder, between 13 and 5 percent, in El Salvador, Peru, Colombia, Argentina, Venezuela, Ecuador, Bolivia, Guatemala, and Paraguay. Only one country shows an increase in the number of Catholic believers as a percentage, it is the Dominican Republic, 1 percent (Ibídem).

For Mallimaci (2017: 4), 4) the appearance of a greater ecclesial offer has occurred because religious beliefs and affiliations have "mutated", "pluralized" or "recomposed", which is an unequivocal symptom that it has a break in the Catholic monopoly of previous centuries made its appearance, relative deregulation of what has been called the field, arena or religious sphere; it has fewer ascriptions compared to some fifty or sixty years ago that it presented, say in 1940, one hundred percent of the affiliations, all of which have configured, in a similar way to the religious scene, the environment or the cultural scene.

More and more evidence: The modification of the concept of culture and the appearance of more non-Catholic creeds

The appearance of innumerable non-Catholic creeds is also explained by the following aspects. Ochoa (2012) points out that the idea of culture that has undergone readjustments over time has been very important concerning cultural heritage, to the protection of tradition in situations of religious conflict, together with all the expressions that are of an immaterial and ritual nature, elements that allow us to better understand the emergence of different creeds.

6) A fundamental aspect is the introduction of the linguistic element that performs a differentiation function. They construct discourses that distinguish between what is not "Christian", "Evangelical", "Pentecostal" or "Presbyterian" and what is. This is following what Grimson (2008) deduces about the differentiation between the so-called “educated” versus the “uneducated” people, emphasizing the set of knowledge, traditions, and customs that they possess when belonging to a society, a field, or any religious field.

With the inclusion of non-Catholic creeds in urban contexts, following the analysis of Barrera Luna (2013: 22), 7) culture has achieved a certain evolution of the ecclesial offer thanks to the search for shared meaning, it is in the unity of culture and religion that new religious and common meanings are constructed, almost in the style that Harris, Geertz, and Lévi-Strauss himself would have liked, in the sense of achieving an adequate interpretation of the ascription of people to a scene in that identity is built by feeling that they belong, in this case, to the ecclesial sphere.

Religious associations with their processes of ascription to ecclesial activities promote the feeling of belonging among people of different congregations. For Molano (2007), the same appearance of other religious associations other than the Catholic one produced an almost inseparable link with the cultural heritage and with the irremediable territorial affiliation.

Due to the very cultural characteristics of the Latin region, religion exerts a special influence on all cultures. For example, Harvey (1990), when

constructing his idea of culture, tried to look at the construction of cultural policies, which are in the sights of the reconfigurations that creeds make with their discourses and practices. The idea of Najenson (1982) is very suggestive about culture as a civilization or as a metaphor that describes the levels of socio-economic development that also provide life and legitimacy to non-Catholic creeds in the different existing contexts.

Buildings such as national libraries, national museums, national theaters, churches, and archives would have a fundamental place in the conceptual logic of author Najenson. For his part, for Stavenhagen (1986), in his effort, together with other thinkers, to construct the concepts of *culture* and *identity* for Latin America, he has held a debate regarding the notion of national culture and that in reality has not given credit to the existence of native cultures, or others of a religious nature, or that if they exist, they have little to do with national culture. Therefore, the same idea or notion of Latin America must contain the affirmation of indigenous cultures and ecclesiastical diversity with multiple non-Catholic creeds, especially their material and spiritual development.

Faced with this insufficient concept of *culture* for the Latin American region, we take up what Restrepo (s/f) dictates regarding the fact that the idea of "Latin Americanism" must be distinguished from the place that cultural studies occupy when it comes to defining the own concept. Cultural identity for the author is a project that contains the specificity of the Latin American peoples with everything and their multiple ecclesiastical meanings, in the way that Stuart Hall himself pointed out for some time (quoted from Restrepo, nd), with the conceptual tools and the resources that people will have at their disposal to understand the world of life around them.

From a cultural category and the perspective of the context of the Latin American region, styles of doing and speaking derived from many ecclesial cultures are shared, and as part of the exercise and civic discourse that is ascribed to a set of non-Catholic creeds. Perhaps the greater presence of religious creeds can be seen and reviewed as part of a social policy of the masses and the public, perhaps as a cultural activity or as part of a political culture that vindicates the ways of dressing, ways of being, or ways of speak since when conducting himself before other nations he would even be referring to a national culture of a religious nature.

Per the above, the phenomenon is interesting as part of an analysis of the knowledge of the Latin reality, in the social, cultural, and religious lines, in the area of the Latin American ecclesial views in comparison with the leftist governments of the south of the continent such as Ecuador, Venezuela, and Bolivia, right-wing neoliberal governments such as Mexico, Chile and Colombia, and one of a social-democratic type such as Brazil with the phenomenon of the emergence of non-Catholic denominations,

say Pentecostals and denominations of a historical nature such as Baptists, Presbyterians, Methodists, and Nazarenas, to understand the establishment, development and comparative evolution of the religious field comparably with the development of culture and the socio-political field itself.

METHODOLOGY AND THEORY

Executing an analysis of a socio-religious nature such as the one that can be read and intended to elucidate in this document in the previous sections has required considering a qualitative analysis methodology based on the construction of timelines in which the periods in which non-Catholic creeds arrived at each country are analyzed. This part of the investigation is not explained in this document. However, certain elements are exposed that could be part of a theoretical-methodological axis that accounts, more broadly, for the phenomenon seen here.

In a project that seeks to carry out an analysis of a phenomenon similar to the one explained in this document, essential aspects and the same main actors involved in inclusion in the Latin American context would be highlighted, as well as all their impact on the transformation of the concept of *culture*. Through longitudinal analysis, the dynamics of the establishment of non-Catholic creeds would be observed in different decades (1970 to date) and, of course, in different contexts. The similarities and differences would be established, as well as the aspects of continuity and rupture in the national context of Mexico with the Latin contexts. Through the analysis of the timelines, it would be observed how the notion of *culture* has been modified and how the perception of the population around its ascription would be captured as a fundamental aspect.

The theoretical construct that would be the guiding axis of the project is the theory of the social actor that exposes the tension between the notion of structure, the conception of the social subject, and the aspect of the social agent (Bourdieu, P. & JD Wacquant, 1995; Giddens, 1991; Bourdieu, 1985). From the perspective of Touraine (1994), while the sociological concept of agent presents the individual rather as a reproducer of practices, the concept of actor broadens the margins of his decision and action, that is, of his autonomy. In this way, he is conceived as someone capable of becoming a creator in the field of his action. n the words of Geoffrey Pleyers "actors can direct the social organization as a whole, fight for cultural challenges seeking deep transformations of society and control of progress and society" (2006: 737).

The agent, according to Bourdieu (1988), as a transforming subject of culture and society, would develop practices that are largely consistent with the position he occupies in the social space. The social actor, on the

other hand, is recognized above all for the actions he decides to carry out. Touraine's position is contrary to Bourdieu's theoretical conception of *social reproduction*, which is akin to Poulantzas and Foucault who focused on "the present domination in all aspects of social life, in which the reproduction of society or the omnipresence of power leaves no space or autonomy to the actors and denies their ability to construct themselves as such" (Pleyers, 2006: 738).

In this sense, the theory of the actor would be chosen instead of a theory of the subject or of the social structure (Touraine, 1984, Melucci, 1996, 1999, Giménez, 2006) because the first postulate the capacity of the individual as the motor of all action. The *theory of the social actor* proposed by Touraine (1984, 1995b) is a conceptual proposal that would make it possible to observe religious groups as transformers of cultural reality. Religious groups, political and governmental groups can be conceived as actors with collective roots that, through the social action deployed, transform part of the circumstances of the region's population, due to the economic resources obtained and the political power achieved.

Non-Catholic religious groups and government entities are conceived and would be conceived, as collective actors with defined objectives, missions, and visions. The logic of Giménez (1997) establishes that they can be recognized as groups with social and ecclesial organizational structures that actively intervene in political, cultural, and social development processes (Touraine 1995a; 1995b).

Logistically, it is expected that the information would be collected from oral testimonies, participant observations, and semi-structured and open interviews. To complement the methodology, the collection of information, and the corresponding analysis, it is thought that it could be carried out at intervals of at least two months per country, four months maximum, during the first five years, foreseeing that the total period to complete the investigation is indefinite or maybe ten years at the most. As part of the results of this project, it is thought that it would begin to give results with a specialized article, an international congress, a specialized colloquium or seminar, and so on, as established by the research process itself.

It is worth mentioning that the compilation of the oral testimonies would be carried out in three ways: 1) The first refers to the capture of the recorded arguments through interviews, the main characters involved in the phenomenon will provide the information. 2) The second consists of recording information with notes in a notebook, noting down the details that would be considered outstanding.

Finally, the third form refers to the realization of informal talks, in many cases delimited, surely, by a couple of coffees and a cordial approach that would mean the beginning of a close approach to the main actors which

would also symbolize the beginning of friendships enduring that until the end of the periods of each fieldwork will provide us with greater access to much important information.

Oral testimonies would be obtained through exploratory interviews that would allow investigating basic aspects of the object of study. Interviews would be conducted to monitor and describe the evolution of religious groups and analyze the relationships between actors and ministers of worship, intra and extra-ecclesial forms of life, and the trajectory of creeds to identify the characteristics of the settlements. In-depth interviews would be used to gather the information that would be difficult to obtain in the first instance, to elucidate the idea of culture and religion possessed by the region's population.

MANUSCRIPT CONTRIBUTIONS

This document has had the purpose of contributing at least briefly to the knowledge of the evolution of the socio-religious and cultural field in Mexico and to compare it with Latin America. At least briefly on what underlying the settlements of non-Catholic creeds, Pentecostal and Presbyterian congregations, in the different territories and give an account of the evolution of the cultural sphere. It is contributed that to explain the main object of analysis that is studied here, oral testimonies will be obtained through a network scheme that would reveal the connections between various actors such as ecclesial, economic, political, cultural actors, among others. It is expected that this research will contribute to the understanding of the diversification of the religious offer in Latin America in terms of the process that different churches have had for their settlement, and the different problems, tensions, strengths, public efforts, among others, as well as the influence they have had on the culture of each region.

FINAL COMMENTS

To conclude with this manuscript, it is argued that it is necessary to analyze the dynamics of certain churches in the following countries, to round off the research: The Universal Church of the Kingdom of God (IURD), in Brazil, led by the apostle Edir Macedo. It is one of the most popular churches in Brazil and the world with about eight million parishioners. It supports 9,600 pastors, 4,700 temples installed in 172 countries. The Center for Faith, Hope, and Love (CFEA) with a presence throughout Mexico, in 26 states of the republic, and with more than 40,000 followers, spreading a social and liberation gospel that has influenced the social and cultural activities of the Mexican population.

The International Christian Church of Santiago (ICIS), in Chile, is part of a World Movement of Disciples (MMD) with the mission of evangelizing the population of Latin America. Also the Church Casa de Oración Bolivia (ICOB), of Evangelical Apostolic and Prophetic nomination (EAP), which until a couple of years ago had 5,000 parishioners only in its central headquarters and that increases the number if one takes into account that it has various venues, for example, Casa de Oración Tropical Church (ICOT), Obra Misionera "Sumuque" (OMS), Obra Misionera "Trinidad" (OMT), among others. The Iglesia Misión Carismática de Colombia (IMCC), of a Pentecostal nature, with 200 thousand members in the city of Bogotá and with more than 160 branches worldwide. Finally, the Iglesia Pentecostal Unida Internacional de Ecuador (IPUIE), in Ecuador, registering with great force in Guayaquil and Quito, in addition to having an interesting editorial ministry, in which approximately 1200 leaders make up the ministerial body of the church.

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