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Spatial Distribution Of The Michino (Manilkara Bidentata (A. DC) A. Chevalier), District Of Huarango, Province Of San Ignacio, Cajamarca, Peru

Flores Flores, Leiwer[1], Herrera Aguinaga, Jose Imer[2], Becerra Montalvo, Vitoly[3], Delgado Soto, Jorge Antonio[4], Aguirre De Los Ríos, Francisco Fernando[5], Pérez Hurtado, Germán[6]
[1]Universidad Nacional de Cajamarca, Perú, lflores@unc.edu.pe, ORCID: https://orcid.org/0000-0001-9260-7894
[2]Universidad Nacional de Cajamarca, Perú, joseimerha@yahoo.com, ORCID: https://orcid.org/0000-0002-6441-120X
[3]Universidad Nacional de Cajamarca, Perú, vbecerra@unc.edu.pe, ORCID: https://orcid.org/0000-0001-9595-4170
[4]Universidad Nacional de Cajamarca, Perú, jdelgado@unc.edu.pe, ORCID: https://orcid.org/0000-0003-2275-8608
[5]Universidad Nacional de Cajamarca, Perú, faguirred@unc.edu.pe, ORCID: https://orcid.org/0000-0003-3289-1859
[6]Universidad Nacional de Cajamarca, Perú, gperez@unc.edu.pe, ORCID: https://orcid.org/0000-0003-3289-1859

Abstract
The objective of this research was to evaluate the spatial distribution of the michino (Manilkara bidentata (A. DC) A. Chevalier) in the district of Huarango, San Ignacio, Cajamarca, Peru. The field work was carried out in nine sectors: Sábanas, El Acerillo, La Playa, Caña Brava, El Triunfo, La Laguna, El Derrumbo, Naranjos Chaca and La Totora, an inventory of the individuals was carried out, georeferencing, recording data such as CAP, HF, HT, shape and condition of the stem, crown shape and phenology; In addition, he collected samples for identification. The results were: 1144 individuals located in an altitudinal range between 700 - 1225 m s. n. m., the largest amount was found in the Sabanas sector with 309 individuals and in La Totora the lowest amount with 17 individuals. The registered diameters oscillated between 10 - 150 cm, the largest number of individuals were between 31 - 40 cm with 291 (26 %), followed by 269 individuals (23.5 %) between a range of 21 to 30 cm DAP, Likewise, the total height was recorded, where the largest number was found between 11 to 15 m with 561 individuals (49 %). Regarding its phenology, 30,16 % was found in flowering and 7,78 % in fruiting. The species was described, recording information on vegetative and reproductive organs, and the uses they give it in the study area.
Keywords: *Spatial distribution, Manilkara bidentata, Huarango district.*

INTRODUCTION

MINAM (2019) states that Peru is considered a forest country because its territory has more than 60% forests, it ranks tenth in forest cover in the world and second in Latin America, after Brazil. However, despite having a great diversity of forest species, there is a minority group of timber species that are traded nationally and internationally (SERFOR, 2017). On the other hand, humanity has been transforming ecosystems which are intervened on a large scale, trying to immediately solve the growing demands such as food, wood, fiber, fuel, among others; considered net benefits for human well-being, economic development, and massive land colonization (Roe et al., 2007).

OSINFOR (2021) points out that it is essential to have knowledge about the distribution of forest species for the development of management plans, conservation and research development, as well as for the decision-making of local actors related to the management and administration of forest resources at the national level, contributing to the sustainable use of forest resources. Likewise, Maciel-Mata et al. (2015), cited by OSINFOR (2021), argue that knowledge of the biological, ecological, biogeographical, and anthropic factors that define the distribution of species and their ecological affinities are important in the development and planning of conservation plans.In the forests of northeastern Peru, there is a need for ecological studies, which, in fact, results from the spatial distribution of different species of importance for the use of the inhabitants of the area of the district of Huarango - Cajamarca; one of the species that is very necessary to study and above all to know its spatial distribution is the species Manilkara bidentata

(A. DC) A. Chevalier, known in the area as michino, a species that in the past has been widely used by the settlers, because it is a very resistant species of wood; however, due to anthropic activities, this species is at risk of disappearing, so it is very important to carry out research that allows us to know the spatial distribution, in order to provide the necessary information for development projects, and State institutions, oriented to conservation, to formulate the silvicultural management plan. seeking propagation and repopulation, in the same place where the species develops or outside it. That is why it is proposed to carry out an analysis on the spatial distribution of the michino, to contribute, raise awareness, possess and provide information, so that the district can make the right decisions when using natural resources. With this study, it is intended that other professionals continue with the research work in the area, through evaluations of the spatial distribution of tree species that the district of Huarango provides us.

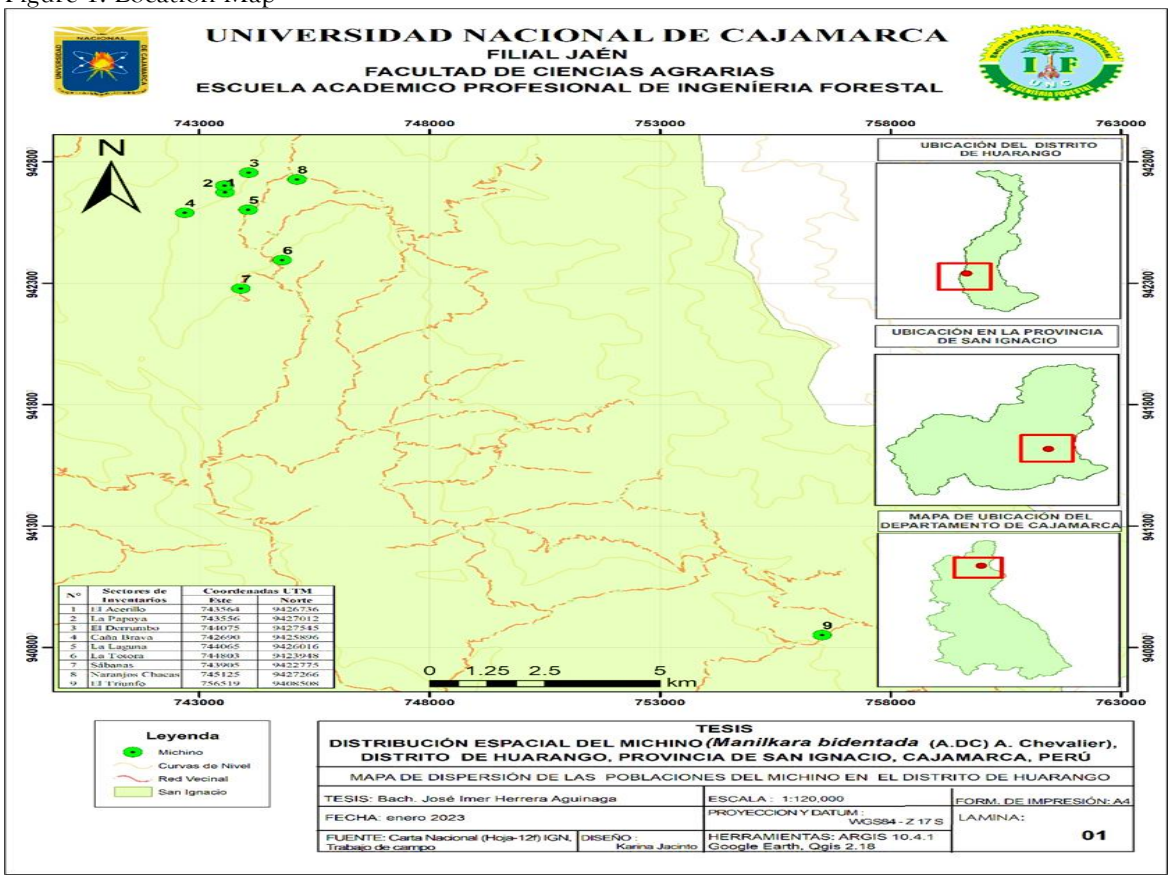
In this context, taking into account the problematic relationship of the research, it was proposed to develop the present research with the general objective of evaluating the spatial distribution of the michino (Manilkara bidentata (A. DC) A. Chevalier) in the district of Huarango, province of San Ignacio, Cajamarca, Peru. The specific objectives were: a) To characterize morphologically the michino (Manilkara bidentata (A. DC) A. Chevalier). b) To prepare the spatial distribution map of the michino in the district of Huarango.

MATERIALS AND METHODS

The present research was carried out in the remnants of forests in the jurisdiction of the hamlets and population centers of the district of Huarango, province of San Ignacio, Cajamarca. Located on the left bank of the Chinchipe River at 785 m a.s.l.

To carry out the fieldwork, the inhabitants of the different communities of the district were identified, who had knowledge of areas where michino existed, with whom an interview was established, referring to the exact places of the presence of this species, obtaining this information, the recognition of the areas was carried out, later the registration of all the individuals found was carried out taking data as CAP, whip and total height and using a GPS each of the individuals was georeferenced, noting information such as their coordinates and altitude. Likewise, each individual was coded sequentially.

Figure 1. Location Map



N°	Sectores de Inventarios	Coordenadas UTM Este	Norte
1	El Acerillo	743564	9426736
2	La Pagoya	743556	9427012
3	El Derrumbo	744075	9427545
4	Caña Brava	742690	9425896
5	La Laguna	744065	9426016
6	La Totora	744803	9423948
7	Sábanas	743905	9422775
8	Naranjos Chacas	745125	9427266
9	El Triunfo	756519	9408508

The collection of michino samples was carried out in all the areas studied, taking the terminal twigs containing leaves, flowers and fruits (Rodríguez and Rojas 2002). Later they were conditioned in newspaper, in such a way that it is visualized in a beam as the underside of the sample, arranging them one on top of the other forming a package, this procedure was repeated with all the samples collected, for the preservation an antidefoliant solution was prepared with 96° alcohol and water in a proportion of 50% of each, then they were put in a thick plastic bag and transferred to the city of Jaén, where drying and identification were carried out, which was carried out using the methodology of consultation with the specialist, classifying it according to the taxonomic classification system APG IV of 2016.

RESULTS

Phenological stage of the inventoried individuals

Figure 2. Phenological state of individuals. In original Spanish language

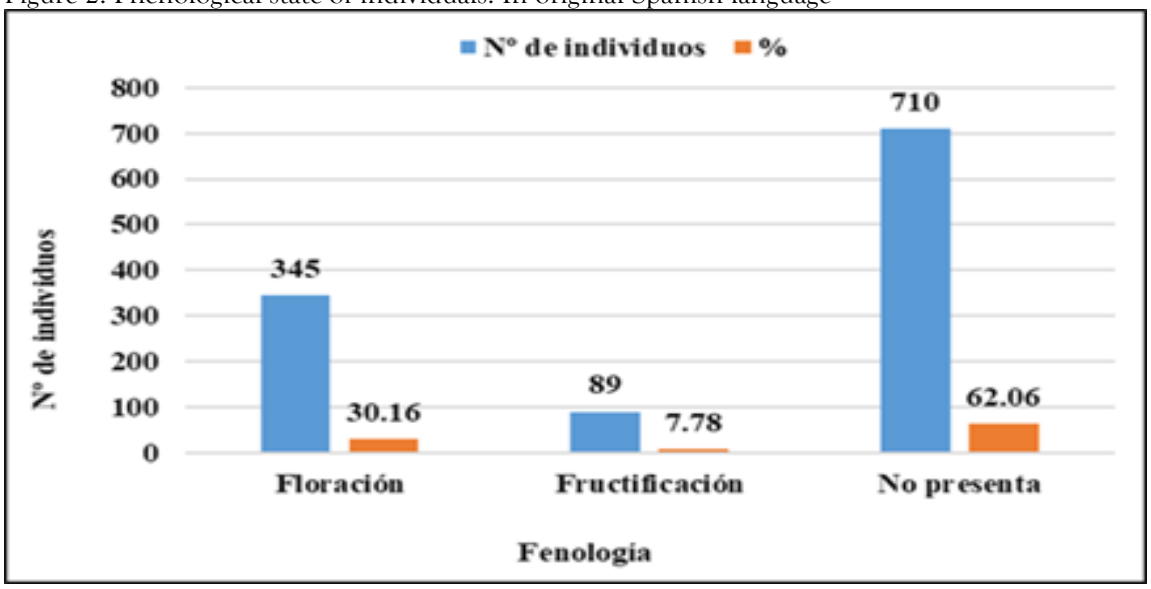


Figure 2 shows the phenological status of the individuals inventoried at the time of evaluation, registering 345 in flowering (30.16 %9), 89 individuals in fruiting (7.78 %) and finally 710 individuals that were not in the phenological stage (62.06 %).

Figure 3. Distribution of DAP from individuals. In original Spanish language

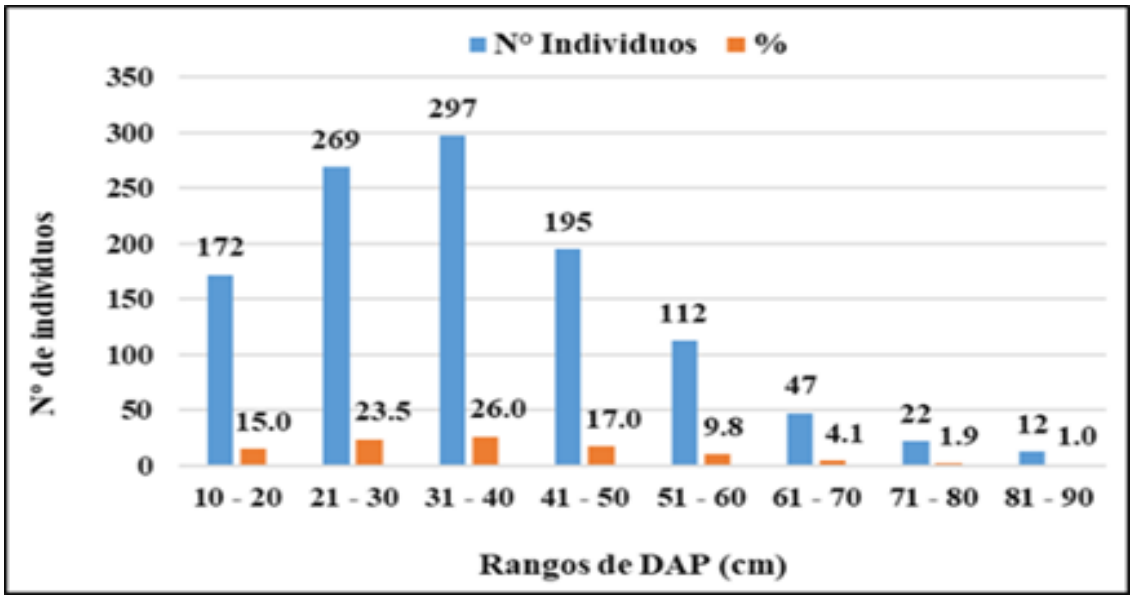


Figure 3 shows the distribution ranges of DAP of the inventoried individuals; the largest number are between 31 and 40. cm of DAP, registering 297 individuals (26%), followed by 269 individuals (23.5%) who were found 21 to 30 cm of DAP, 195 individuals have a range between 41 to 50 cm (17%), between

the ranges 10 to 20 cm of DAP 172 individuals (15%) were found between the range of 51 to 60 cm of DAP 115 individuals (9.8%) were found, between 71 and 80 cm of DAP are 22 individuals (1.9 %) and finally 12 individuals are between 81 and 90 cm of DAP (1 %).

Figure 4. Stem height distribution of individuals. In original Spanish language

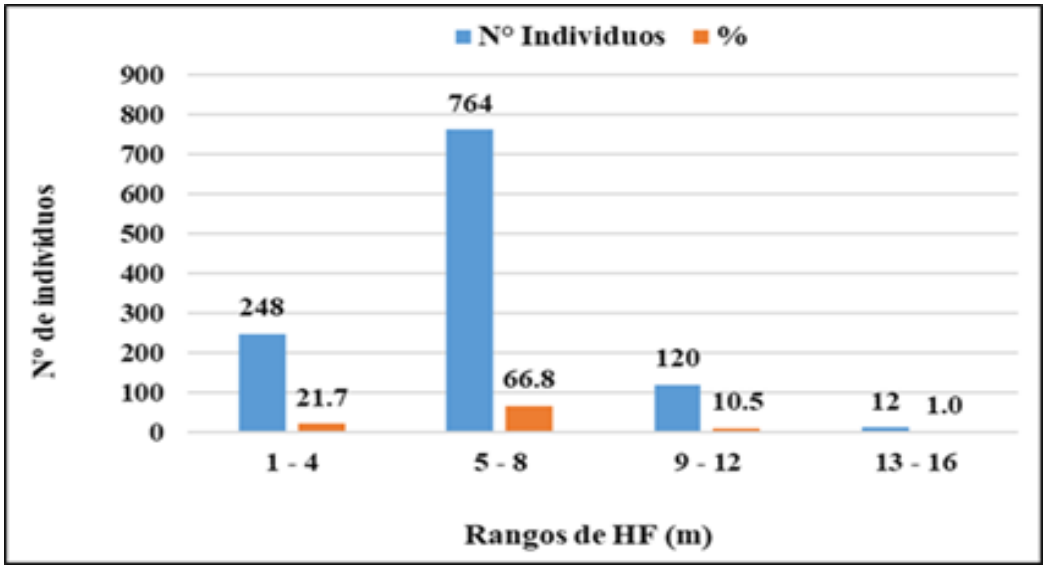


Figure 4 shows the ranges of stem height distribution of the individuals inventoried in the evaluated sectors, the largest number of individuals are in a range between 5 to 8 m with 764 individuals (66.8 %), followed by the range between 1 to 4 m of stem height with 248 individuals (21.7 %), between 9 and 12 m of stem height is found at 120 individuals (10.5 %) and finally between 13 and 16 m of stem height is found in the same area. They registered 12 individuals (1%).

Figure 5. Distribution and percentage of total height of individuals. In original Spanish language

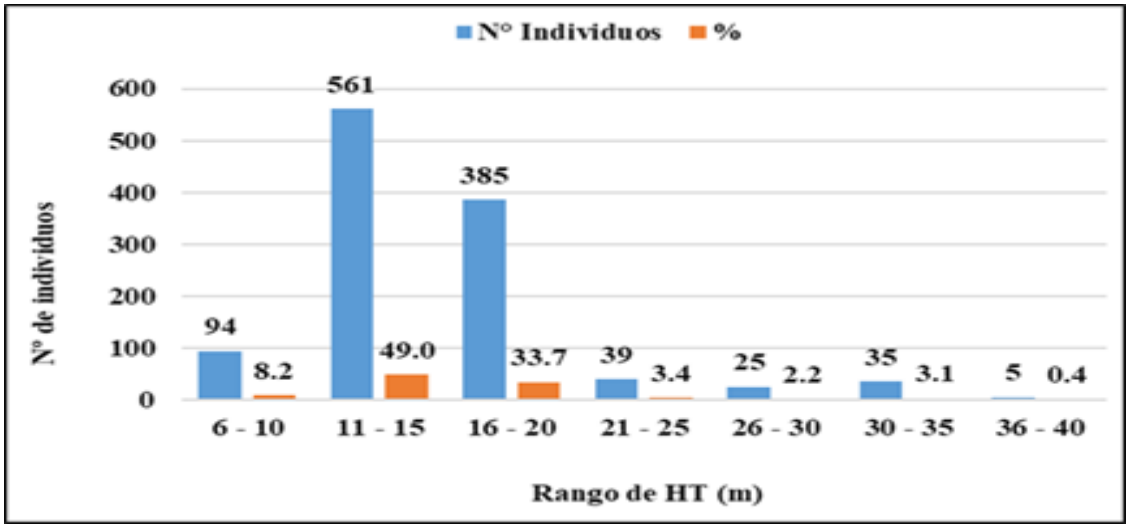


Figure 5 shows the total height distribution ranges of the inventoried individuals, the largest number of individuals is in a range of between 11 to 15 m with 561 individuals (49.%), followed by the range between 16 to 20 m with 385 individuals (33.7%), 94 individuals are between 6 – 10 m (8.2%), between the range 21 to 25 there are 39 individuals (3.4%), between the range 30 to 35 m of total height, 35 individuals (3.1%) were registered, between the range 26 to 30 m of total height there are 25 individuals (2.2%) and finally 5 individuals have between 36 to 40 m of total height (0.4%) of representativeness.

Figure 6. Altitudinal distribution of individuals. In original Spanish language

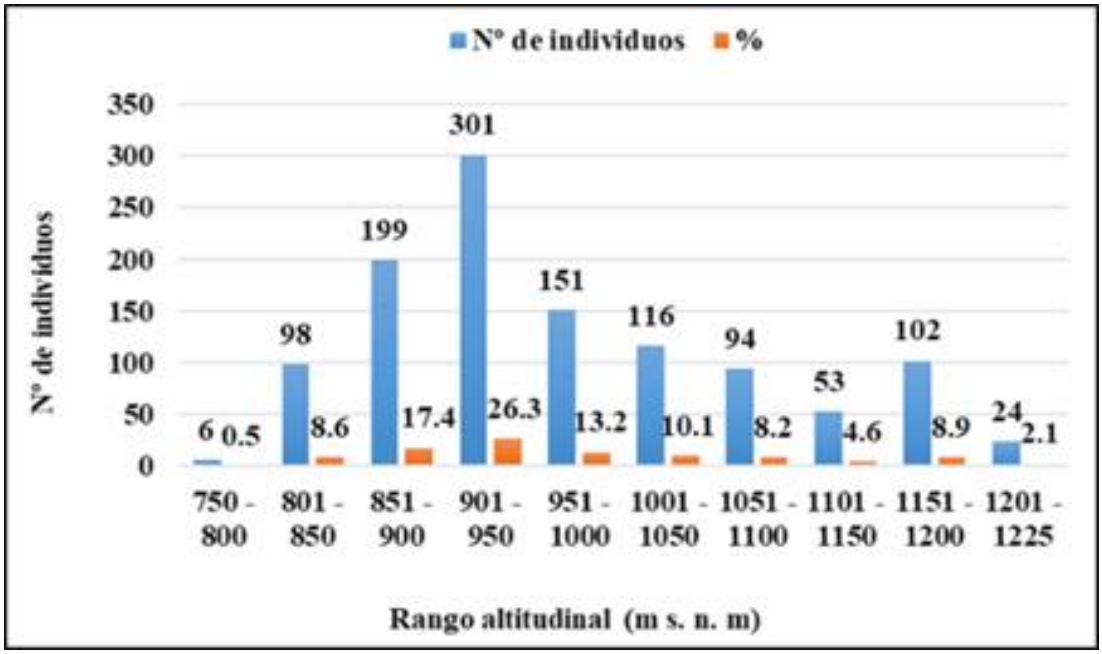


Figure 6 shows the altitudinal ranges of the individuals in the evaluated sectors, the largest number of individuals were located in the range of 901 - 950 m a.s.l. (26%), followed by 199 individuals that were located between 851 - 90 m a.s.l. (17.4%), 151 individuals were located in the range of 951 - 1000 m a.s.l. (13.2%), between 1001 - 1050 m a.s.l. 116 individuals (10.1 %) were found, between 1151 - 120 m a.s.l. 102 individuals (8.9 %) were found, between 801 - 850 m a.s.l. 98 individuals (8.6 %) were found, at an altitude of 1050 to 1100 m a.s.l. 94 individuals (8.2 %) were recorded, between a range of 1101 - 1150 m a.s.l. 53 individuals (4.6 %) were located, 24 individuals were found at an altitude of 1201 - 1225 m a.s.l. (2.1 %), finally 6 individuals were located between 150 and 800 m a.s.l. (0.5 %).

Figure 7. Stage of the inventoried individuals. In original Spanish language

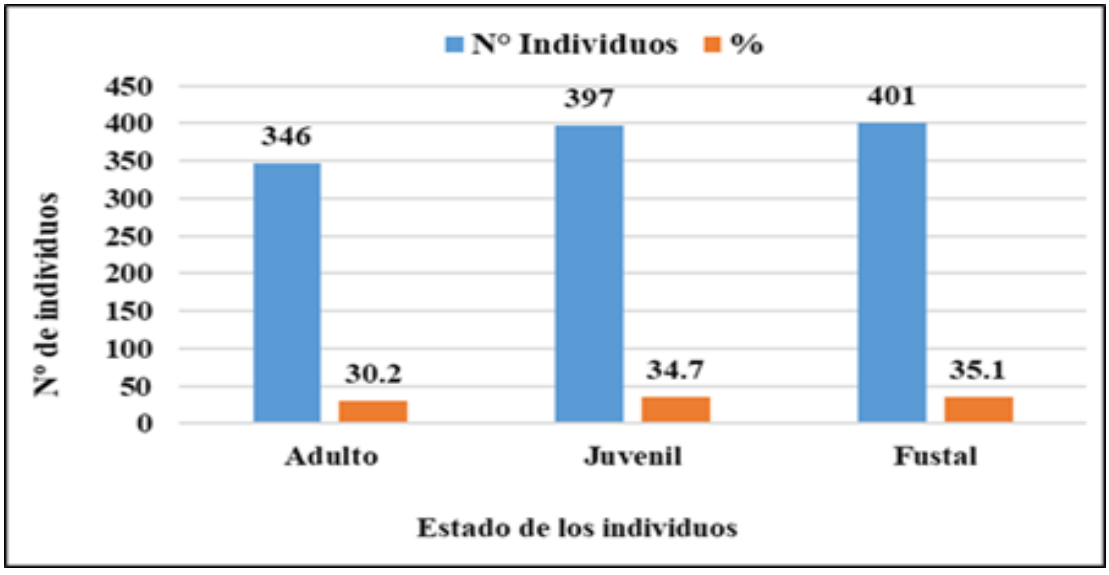


Figure 7 shows the stage of the individuals inventoried in the sectors evaluated; The largest number of individuals are in a stem stage with 401 individuals (35.1 %), followed by 397 individuals who were in the juvenile stage (34.7 %) and finally in the adult stage 346 individuals (30.2 %) were found.
Figure 8. Shaft forms of individuals. In original Spanish language

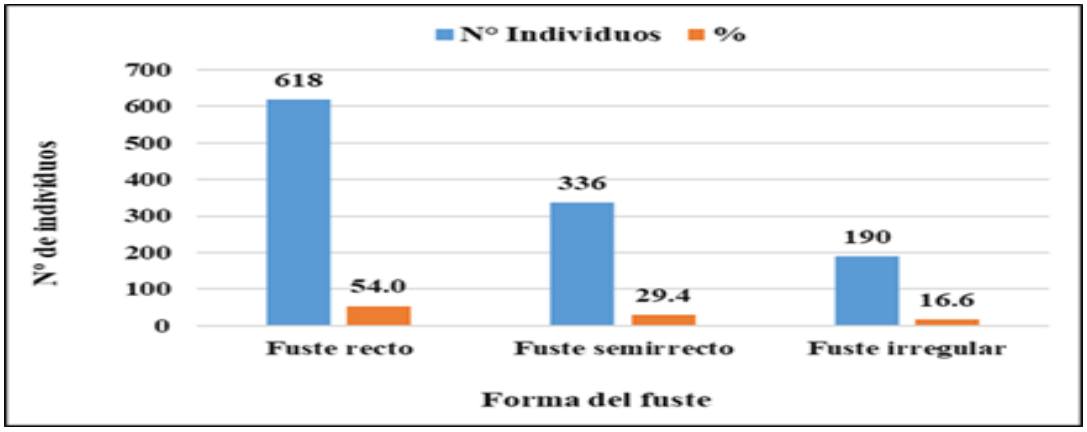


Figure 8 shows the shape of the shaft of the individuals inventoried, the largest number had a straight shaft, registering 618 individuals (54%), followed by 336 individuals who had a semi-straight stem (29.4%) and 190 individuals had an irregular stem (16.6%).

Figure 9. Condition of the stem of individuals. In original Spanish language

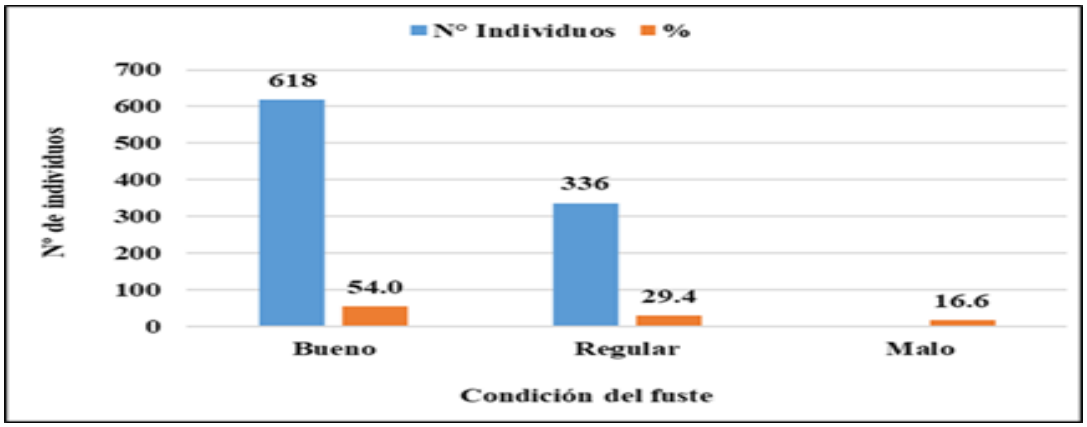


Figure 9 shows the distribution of individuals by their stem condition, the largest number of individuals had a good stem with 618 individuals (54%), followed by 336 individuals who had a regular stem (29.4%) and finally 190 individuals with a bad stem (16.6%).

Figure 10. Distribution by the shape of your crown. In original Spanish language

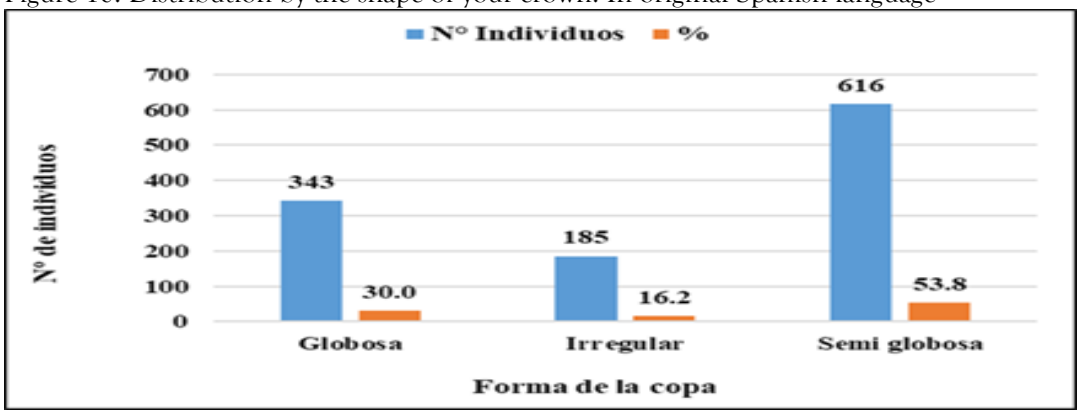


Figure 10 shows the distribution of individuals by their cup shape, 616 individuals had a semiglobose cup (53.8%), followed by 343 individuals with a globose cup (30%) and 185 with an irregular cup (16.2%).
The characteristics of the terminal twig where the leaves and fruits are seen (Figure 11)
Figure 11. Manilkara bidentata (A. DC) A. Chevalier

Distribution of the number of individuals by sector

Figure 12. Distribution of the number of individuals by sector. In original Spanish language

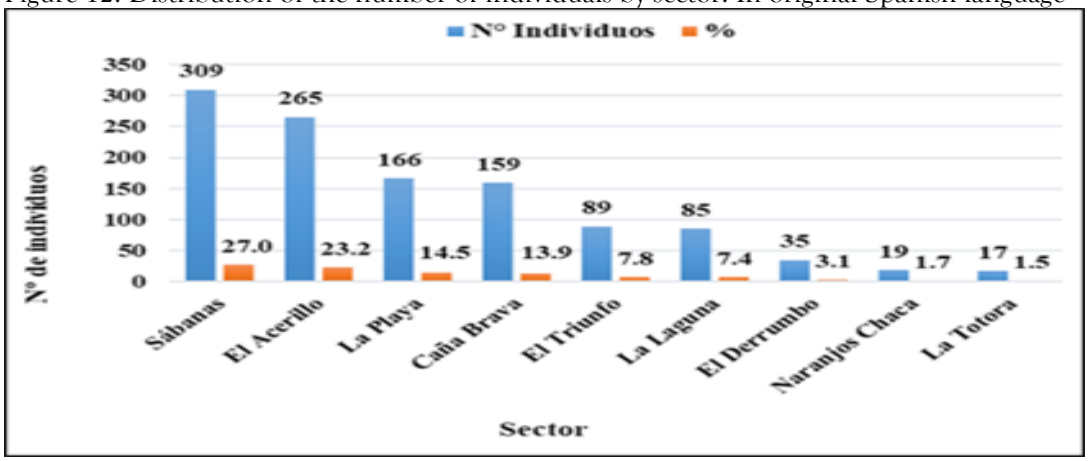


Figure 12 shows the distribution of michino individuals in the sectors studied, The largest number were found in the Sábanas sector with 309 (27%), followed by the El Acerillo sector with 265 individuals (23.2%), the Playa sector has 166 individuals (14.5%), Caña Brava with 159 individuals (13.9%), the Triunfo 89 individuals (7.8%), in La Laguna 85 individuals (7.4%), in El Derrumbo 35 individuals (3.1%) were located, in Naranjos Chaca 19 individuals (1.7%) were located and in the La Totora sector 17 individuals (1.5%). only in two sectors (Sabanas and El Acerillo) were more than 50% of michino individuals found.

DISCUSSION

In this study, the spatial distribution of the michino (Manilkara bidentata (A. DC) A. Chevalier is addressed), this species is being widely used by the inhabitants of the area under study because it has very resistant wood, however, due to excessive use, this species is currently in danger of disappearing (Aguirre, 2015 and Maldonado, 2012), so there is an urgent need to take actions to conserve and restore this species, for this it is essential to have information on the development and behavior of the species and its environmental conditions within a given ecosystem where they develop; that is why this study of spatial distribution will provide us with information, which will help us to know the dynamics of the species, to take protection and conservation measures. Saboya (2013) states that knowledge of the spatial distribution of tree species in tropical forests is fundamental in the development of forest resource management plans. On the other hand, Aguirre (2015) argues that the species in question found in the province of San Ignacio-Cajamarca, is in the category of Critically Endangered (CR), facing a high risk of extinction in its wild form in the immediate future, especially in the last relict forests, in which it still survives.

The present study was developed in nine areas located within the district of Huarango, where it was possible to verify that they are places that are highly intervened by the anthropic activities that man has been developing since ancient times to the present, where the forests have been transformed to establish crops and pasture areas for cattle raising. these activities becoming the only source of subsistence for their families, resulting in the vulnerability or loss of species of commercial value such as the species under

study. Alvis-Gordo (2009) points out that natural forests located in areas close to urban centers and areas of future urban expansion are considered ecosystems of environmental and ecological importance, due to the innumerable benefits they provide to the inhabitants of cities and towns. The knowledge and evaluation of its structural characteristics and its dynamics are a fundamental factor in determining the possibilities of use, whether in aspects of production, conservation or regulation.

For the present study, areas where there is a greater concentration of the michino species were selected, information obtained from the inhabitants of the area, managing to inventory 1144 individuals distributed in nine communities of the district of Huarango, these individuals were located between 700 and 1225 m a.s.l. the largest number of individuals were found in the Sabanas Sector with 309 individuals, coinciding with Aguirre (2015) who determines in his study that, the species Minalkara bidentata is distributed within the province of San Ignacio between 550-1892 m a.s.l., where the highest concentration was found in the district of Huarango 12-15 individuals/ha and the lowest in Namballe, Tabaconas with 2-4 individuals/ha. Knowledge of these ecosystems, which are so valuable for urban life, implies the design of mechanisms that allow for adequate management and conservation of their potentialities, which requires greater dedication and awareness of the importance of these natural spaces for the well-being of current and future populations. Understanding its different ecological and structural aspects will allow us to guide more effectively the successful management of this type of forest (Alvis-Gordo, 2009).

Saboya (2013) points out that having information on the spatial distribution of tree species in tropical forests is essential to implement forest resource management plans. Tree spatial patterns are important indicators of forest history and dynamics. They provide useful information that can be used in the development of restoration plans for degraded forests (Silva, 2014).

CONCLUSIONS

The individuals recorded presented a diameter at chest height between the ranges of 10 – 150 cm, where the largest number of individuals are in a range of between 31 and 40. cm of DBH, registering 297 individuals (26%), followed by 269 individuals (23.5%) who were found between 21 and 30 cm of DBH. In the same way, the total height was recorded, where the largest number are between 11 and 15 m of total height with 561 individuals (49%), followed by the range between 16 to 20 m of total height with 385 individuals (33.7%).

The characterization and description of the species of michino (Manilkara bidentata (A. DC) A. Chevalier) was carried out, describing its characteristics of the vegetative and reproductive organs, also its common name and the uses given to it in the study area were recorded, which are for construction, beams, living fences, posts, among others, identifying that this species is highly requested by the settlers.

The species Manilkara bidentata (A. DC) A. Chevalier, which was raised in the research project and described as such in the resolution approving the thesis project, has been identified as Manilkara bidentata subsp. Surinamesis (Miq.) T. D. Penn, by the botany specialist in botanical identification certification.

In the present study, 1144 individuals of michino (Manilkara bidentata (A. DC) A. Chevalier) were inventoried), finding that its spatial distribution is in nine sectors of the district of Huarango, located at an altitude of between 700 – 1225 m a.s.l., where the largest number of individuals were located in the Sabanas sector with 309 michino individuals and in the La Totora sector it has the least amount with 17 individuals. Likewise, 30.16 % were in the flowering stage, 7.78 % in fruiting.

Thanks

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