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First record of the genus Latrodectus (Walckenaer, 1805) in the department of Oruro, Bolivia

Primer registro del género *Latrodectus* (Walckenaer, 1805) en el departamento de Oruro, Bolivia

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Abstract

The genus *Latrodectus* is of medical importance due to the release of venom through its chelicerae, causing clinical manifestations such as poisoning (called latrodectism). In Bolivia, specimens of this genus were reported in rural areas of 6 departments. In the present study, the distribution of the genus *Latrodectus* in the department of Oruro was determined by means of maps. Forty-one arachnid specimens from 18 different areas of Oruro were evaluated. For this purpose, a taxonomic characterization of the specimens was carried out. A database was prepared, as well as a map of the presence of the genus *Latrodectus*, showing that in the city of Oruro there were more individuals than in rural areas, mainly in peri-urban and urban areas. In addition, a map of the vegetation types of the department was made to understand the possible habitats where the arachnids could be located. In this way, the location of the arachnids pointed out their wide capacity of adaptation in different environments, considered as a synanthropic arachnid. Vegetation is an important factor in the establishment of *Latrodectus* individuals. In addition, there is a microhabitat conducive to its establishment. However, to avoid future mishaps due to the bite of this arachnid, it is necessary to know the nesting and reproduction sites

Resumen

El género *Latrodectus* es de importancia médica por la liberación de veneno a través de sus quelíceros, provocando manifestaciones clínicas como envenenamiento (denominado latrodectismo). En Bolivia, los ejemplares de este género fueron reportados en áreas rurales de 6 departamentos. En el presente estudio, se determinó la distribución del género *Latrodectus* en el departamento de Oruro mediante mapas. Se evaluaron 41 ejemplares de arácnidos provenientes de 18 zonas diferentes de Oruro. Con este motivo, se realizó una caracterización taxonómica de los ejemplares. Se elaboró una base de datos, además de un mapa de la presencia del género *Latrodectus*, señalándose que en la ciudad de Oruro hubo mayor cantidad de individuos en comparación de las zonas rurales, principalmente, en zonas periurbanas y urbanas. Además, se realizó un mapa de los tipos de vegetación del departamento para entender los posibles hábitats donde se podrían localizar los arácnidos. De esta manera, la ubicación de los arácnidos señalo su amplia capacidad de adaptación en diferentes entornos, considerado como un arácnido sinantrópico. La vegetación es un factor importante en el establecimiento de individuos de *Latrodectus*. Además, existe un micro hábitat propicio para su establecimiento. No obstante, para evitar futuros contratiempos por la mordedura de este arácnido, es necesario conocer los sitios de anidamiento y reproducción

Introduction

Arachnids are a large group of invertebrates and represent a megadiverse lineage of arthropods with more than 955000 described species, but an estimated 1 to 1.5 million species await naming[1-3], with a cosmopolitan distribution[4]. In the Americas, there are genera of arachnids that stand out for their medical importan

ce, *Loxosceles*, *Phoneutria* and *Latrodectus*[5]. In Bolivia, the genus *Latrodectus*, commonly known as "black widow". In some regions of the valleys known as "mico mico", while in the western part "huairuro"[6].

The genus *Latrodectus* is considered a public health problem due to its chelicerae bite[7]. This structure stores and releases a poison, highly harmful to human health, a toxin (α-latrotoxin) that causes the massive release of neurotransmitters[7,8], producing severe intoxication, generating different symptoms such as: severe inflammation, fever, intense pain, hallucinations, muscle stiffness, heart rhythm disorders, mainly paralysis of the nervous system[9,10].

Typical habitats for this type of arachnid vary from dark, damp, damp places to those with lots of vegetation[7]. However, as cities have grown in recent decades, ecosystems have changed, causing local species to adapt and broaden their preferences to use habitats near dwellings or other structures. Consequently, they could be considered as synanthropic arachnids, i.e. they tend to settle in urbanised areas[11], whose climatic conditions, food and environment play an important role for their stabilisation[12].

The presence of individuals of the genus *Latrodectus* from the year 2021 to date has been confirmed in different sectors of the department of Oruro. For this reason, the aim of the present study was to determine the presence of the genus *Latrodectus* in the Department of Oruro.

Materials and methods

Study area. The arachnids came from urban and rural areas of the department of Oruro, located in western Bolivia, at an altitude of 3800 m.a.s.l. between 17°18' 37" and 19°55' 46" South Latitude and 66°12' 12' 12" and 69°05' 05' 05" West Longitude (central altiplano). Bordering the departments of La Paz, Potosí, Cochabamba, and the Republic of Chile[13].

Semi-cold, semi-arid climate with dry winter, average temperature ranges from 8 to 18° C, precipitation varies between 190 to 570 mm per year, precipitation depends on the area of the department[13].

Specimen collection. Specimens of arachnids dating from the years 2021-2022 from different areas, which were sent by the Departmental Health Service (SEDES Oruro), were evaluated. The specimens were carefully captured by SEDES Oruro staff, using perforated plastic jars to avoid leakage. The samples were then sent to the National Institute of Health Laboratories (INLASA) for identification and recognition. In the case of dead specimens, they were preserved in 70% alcohol and sorted in the wet collection with their respective coding[6].

Dead specimens were analysed, a branded stereo microscope (Ken-α-Vision, 20X magnification) was used and dichotomous keys were consulted[6,10].

Databases. Using Microsoft Excel software, a data record was made for each of the samples used from the INLASA collection. The following information was obtained: a) code, b) sample c) department d) municipality e) place of capture and f) sample status.

Georeferencing. The samples from INLASA's wet collection did not have precise coordinates. Therefore, an approximate georeferencing was assigned to each of the collection points according to reference locations. Using the Google Earth Pro v. 7.1.8.3036 programme, obtaining latitude and longitude data[6].

With the coordinates obtained, the locations of the specimens were georeferenced and a map of the presence of the genus *Latrodectus* in the department of Oruro was drawn up with the Arc Gis v.10.3 computer program, using the WGS 1984 UTM Zone 19 S geographic coordinate system. In addition, the vegetation layer was used to obtain more references for each place, and the main square of 10 de Febrero was considered as the main point in the city of Oruro[13].

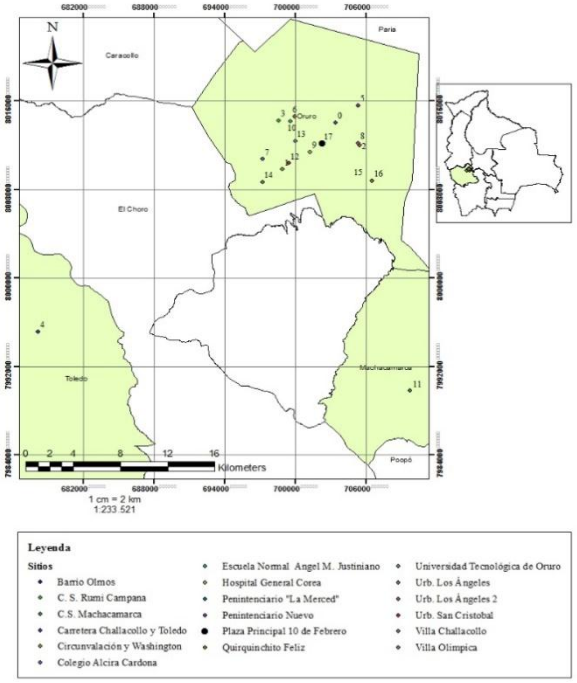
Results

Genus recognition. Forty-one specimens of the genus *Latrodectus* (Figure 1) were assessed for their morphological characteristics. Most were females (40 individuals) and 1 male.

Figure 1 Female specimen of genus *Latrodectus*

According to the dichotomous keys[10], the taxonomic evaluation criteria for specimens of the genus *Latrodectus* belong to the family Theridiidae. In their morphological characteristics it was recognised that they have black cephalothorax, abdomen and legs. Females had a larger body size than males, showing sexual dimorphism. They also have a prominent, globular abdomen, with a noticeable or reduced presence of the red hourglass pattern on the opisthosoma, which varies between individuals. The lateral eyes are separated. The chelicerae have no teeth. The fourth pair of legs has hairs arranged in a comb-like pattern[6,10]. The legs are medium-sized, with formula 1423[14].

Figure 2 Presence of the genus *Latrodectus* in the department of Oruro

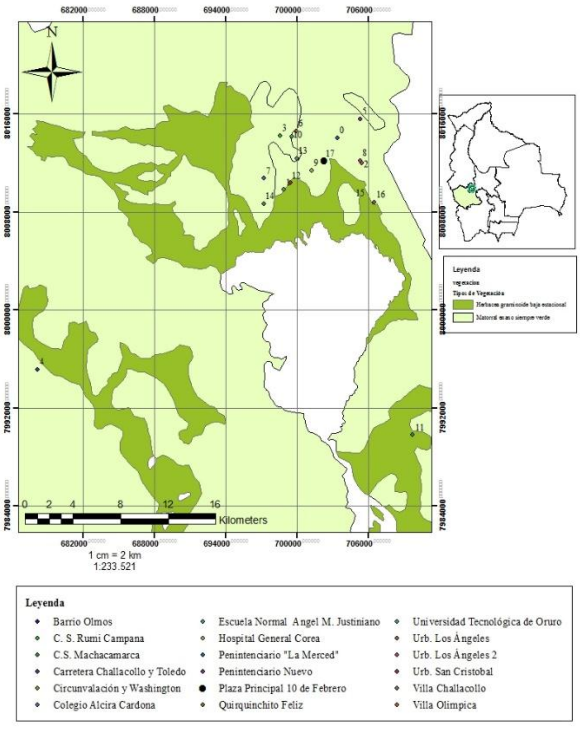


Georeferencing. The 41 specimens were captured in 3 municipalities in the department of Oruro. In the capital city, the largest number of records was captured, with the genus being found in 15 different locations. The remaining specimens were found in the municipality of Machacamarca and between the municipalities of Challacollo and Toledo (Figure 2). The greatest number of specimens of the genus were captured in the months of March, July and November.

The arachnids were found in different locations both outside and inside buildings in rural, peri-urban and urban areas, with a predominance of houses under construction, mainly open places, close to the pavement, with surrounding vegetation, with greater exposure to the environment. While the specimens from urban areas were mainly located in buildings with a higher number of people, schools, public universities, health centres and housing estates (Figure 2).

In addition, this genus was mostly located in predominantly dwarf evergreen scrub areas. With the exception of the Machacamarca Health Centre, which is close to seasonal low graminoid herbaceous vegetation (Figure 3).

Figure 3 Map of vegetation types in the department of Oruro



Discussion

In Bolivia, no dangerous arachnids have been recorded at higher altitudes (3000 m)[15,16]. However, through this study their presence and distribution at higher altitudes of the range (3735 m). Thus its presence in localities in 6 departments (La Paz, Cochabamba, Santa Cruz, Tarija, Potosí and Chuquisaca), but not in Oruro, which even extends its distribution to urban areas[6].

The specimens of the genus *Latrodectus* captured in the city of Oruro are classified as synanthropic arachnids, due to their ability to adapt to a variety of physical and biological conditions in urban ecosystems[17-19]. They take refuge in different types of cover and/or surfaces including: under stones, among debris, logs or holes, or close to vegetation[18,20].

Vegetation is an important factor for their presence[18,21], they manage to establish themselves and have food available[12,22,23]. Oruro has a predominant type of vegetation such as scrubland, which is an ideal habitat for these arachnids[23,24]. These environments are mostly found outside homes or buildings[24]. They can be categorised as seasonal synanthropic individuals, they can be in natural areas as well as in dwellings, but they do not plague spaces because they are not always found in the same place[11,23]. Therefore, it can be inferred that spiders choose a space that is not frequently disturbed to establish themselves[20].

Arachnids could enter and settle inside buildings using their dispersal modes known as "ballooning" or "rappelling", which allow them to move long distances from one place to another through their webs despite air currents[21]. Another way of entry would be by walking on surfaces such as the ground or walls to closer locations[25], or through anthropogenic activity such as the use of transport, transfer of materials and trade would help their dispersal to more disturbed and/or urbanised areas, increasing their distri-

bution to new sites[8,12,17]. This would explain the increase and expansion of the genus *Latrodectus* in urbanised areas.

Table 1 Examined material of the genus *Latrodectus* from the department of Oruro

Sample	Code	Date	Dpto.	Municipality	Place of capture	Simple status
1	ILS-A 261	10/11/2021	Oruro	Ciudad de Oruro	Universidad Técnica de Oruro	Sample in alcohol
2	ILS-A 262	10/11/2021	Oruro	Ciudad de Oruro	Universidad Técnica de Oruro	Sample in alcohol
3	ILS-A 263	26/11/2021	Oruro	Ciudad de Oruro	Penitenciario "La Merced"	Sample in alcohol
4	ILS-A 264	26/11/2021	Oruro	Ciudad de Oruro	Circunvalación y Washington	Sample in alcohol
5	ILS-A 270	11/01/2022	Oruro	Ciudad de Oruro	Urbanización los Ángeles	Sample in alcohol
6	ILS-A 271	22/02/2022	Oruro	Ciudad de Oruro	Centro de Salud "Rumi Campaña"	Sample in alcohol
7	ILS-A 272	23/02/2022	Oruro	Ciudad de Oruro	Carretera Challacollo y Toledo	Sample in alcohol
8	ILS-A 273	23/02/2022	Oruro	Ciudad de Oruro	Carretera Challacollo y Toledo	Sample in alcohol
9	ILS-A 274	23/02/2022	Oruro	Ciudad de Oruro	Carretera Challacollo y Toledo	Sample in alcohol
10	ILS-A 275	23/03/2022	Oruro	Ciudad de Oruro	Penitenciario Interno Oruro	Sample in alcohol
11	ILS-A 276	24/03/2022	Oruro	Ciudad de Oruro	Penitenciario Interno Oruro	Sample in alcohol
12	ILS-A 277	24/03/2022	Oruro	Ciudad de Oruro	Penitenciario Interno Oruro	Sample in alcohol
13	ILS-A 278	24/03/2022	Oruro	Ciudad de Oruro	Penitenciario Interno Oruro	Sample in alcohol
14	ILS-A 279	24/03/2022	Oruro	Ciudad de Oruro	Penitenciario Interno Oruro	Sample in alcohol
15	ILS-A 280	24/03/2022	Oruro	Ciudad de Oruro	Penitenciario Interno Oruro	Sample in alcohol
16	ILS-A 281	24/03/2022	Oruro	Ciudad de Oruro	Penitenciario Interno Oruro	Sample in alcohol
17	ILS-A 282	24/03/2022	Oruro	Ciudad de Oruro	Penitenciario Interno Oruro	Sample in alcohol
18	ILS-A 283	24/03/2022	Oruro	Ciudad de Oruro	Penitenciario Interno Oruro	Sample in alcohol
19	ILS-A 284	24/03/2022	Oruro	Ciudad de Oruro	Penitenciario Interno Oruro	Sample in alcohol
20	ILS-A 285	01/04/2022	Oruro	Ciudad de Oruro	Villa Olímpica	Sample in alcohol
21	ILS-A 286	14/04/2022	Oruro	Ciudad de Oruro	Colegio Alcira Cárdenas	Sample in alcohol
22	ILS-A 287	14/04/2022	Oruro	Ciudad de Oruro	Colegio Alcira Cárdenas	Sample in alcohol
23	ILS-A 288	21/04/2022	Oruro	Ciudad de Oruro	Urbanización Los Ángeles	Sample in alcohol
25	ILS-A 290	30/06/2022	Oruro	Ciudad de Oruro	Hospital General Corea	Sample in alcohol
26	ILS-A 291	08/07/2022	Oruro	Ciudad de Oruro	Escuela Normal Ángel M. Justiniano	Sample in alcohol
27	ILS-A 292	22/07/2022	Oruro	Ciudad de Oruro	Urbanización San Cristóbal	Sample in alcohol
28	ILS-A 293	22/07/2022	Oruro	Ciudad de Oruro	Urbanización San Cristóbal	Sample in alcohol
29	ILS-A 294	22/07/2022	Oruro	Ciudad de Oruro	Urbanización San Cristóbal	Sample in alcohol
30	ILS-A 295	22/07/2022	Oruro	Ciudad de Oruro	Urbanización San Cristóbal	Sample in alcohol
31	ILS-A 296	22/07/2022	Oruro	Ciudad de Oruro	Urbanización San Cristóbal	Sample in alcohol
32	ILS-A 297	03/08/2022	Oruro	Ciudad de Oruro	Centro de Salud de Machacamarca	Sample in alcohol
33	ILS-A 298	08/08/2022	Oruro	Ciudad de Oruro	Urbanización San Cristóbal Centro de Salud Machacamarca	Sample in alcohol
34	ILS-A 299	04/10/2022	Oruro	Ciudad de Oruro	6 Agosto y Hernando Siles	Sample in alcohol
35	ILS-A 305	4/10/2022	Oruro	Ciudad de Oruro	Villa Challacollo	Sample in alcohol
36	ILS-A 306	31/10/2022	Oruro	Ciudad de Oruro	Calle Olmos	Sample in alcohol
37	ILS-A 307	28/11/2022	Oruro	Ciudad de Oruro	Escuela de Fútbol Quirquincho Feliz	Sample in alcohol
38	ILS-A 308	28/11/2022	Oruro	Ciudad de Oruro	Escuela de Fútbol Quirquincho Feliz	Sample in alcohol
39	ILS-A 309	28/11/2022	Oruro	Ciudad de Oruro	Escuela de Fútbol Quirquincho Feliz	Sample in alcohol
40	ILS-A 310	28/11/2022	Oruro	Ciudad de Oruro	Escuela de Fútbol Quirquincho Feliz	Sample in alcohol
41	ILS-A 311	28/11/2022	Oruro	Ciudad de Oruro	Escuela de Fútbol Quirquincho Feliz	Sample in alcohol

Generally, inside buildings there are differences between the characteristics of each environment[26-28], in which temperature and humidity, food, the structure of the place, the concentration of people in the spaces, or the combination of these factors, make each site unique in its environment for arachnids[12,19,23,27].

In such spaces, they mainly settle down to shelter from low temperatures, which is why they would be qualified as strategic sites. In this way, each environ

ment would generate a microhabitat suitable for their settlement and therefore these sites would be more favourable for their survival and colonization[19,27,28].

Therefore, these arachnids are considered to be of great importance in the ecosystem, as they are predators, inhabiting places among leaf litter and low vegetation[29] to obtain food, benefiting humans as natural pest controllers[22,23,30]. However, it would be necessary and relevant to know the places where arachnid populations concentrate and reproduce. Mainly those places and/or establishments where a greater number of people congregate in a given place, as this would increase the risk of being bitten by the arachnid, which would represent a major medical problem[12].

Although these arachnids are not aggressive, it is important to educate the population about their morphological characteristics and their medical importance. They react when they feel attacked as a self-defence mechanism or if their nest is being disturbed[31]. Or if a person sits on or has close contact with the arachnid, they are more likely to receive a lethal bite, which can cause latrodectism[32,33].

The substance released by its chelicerae is more potent than the venom of the rattlesnake (*Crotalus durissus*) because it has more toxins present in the venom which is highly damaging to the nervous system, with symptoms such as irritability, hyperactivity, agitation, vomiting and muscle spasms beginning to appear within minutes[34].

So far, seven cases of black widow bites have been reported in the department of Oruro[35]. However, INLASA has the antivenom antilatrodectus (which efficiently neutralises the toxic effect caused by the venom) to deal with the emergency.

Urban areas have expanded massively, causing a noticeable change in the environment and fragmentation of natural sites. Hence, more studies on synanthropism in arachnids in Bolivia are needed. In terms of the diversity of urban spiders, the differences between spider communities, the effects of environmental conditions, among others. To understand the effect of urbanisation on spider populations with anthropogenic activity[18,36].

Therefore, in accordance with the above, it has been noted that specimens of the genus *Latrodectus* are highly adaptable to the environmental conditions of the city of Oruro. Due to the number of individuals evaluated and collected in a single department, in relation to Fernández & Castro[6], although they had a greater number of specimens examined, these were in different localities in 6 departments. In this study, 41 specimens were found close to each other in only one department.

The genus *Latrodectus* can establish itself in urban environments both outdoors and indoors, withstanding environmental changes, adapting to new microhabitats and possibly also being influenced by anthropogenic activities. It is therefore recommended to clean with extreme care, especially those places where there is worn material such as wood or leaf litter, to prevent spiders from establishing themselves in these areas. Maintenance should also be carried out between walls or corners in homes to avoid their establishment due to the danger they represent.

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Conflicts of interest

There were no conflicts of interest. Given that the samples granted by Sedes are now in the custody of INLASA.

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Ethical considerations

The greatest possible care was taken in the handling of the live samples from the collection. As well as the samples from the wet collection of the ¨Néstor Morales Villazón¨ Immunoglobulin Production Laboratory (INLASA).

Research limitations

Las limitaciones de la investigación fueron la falta de información del género *Latrodectus* en Bolivia. Además, la limitación de datos precisos en cuanto a coordenadas geográficas se refiere.

Authors' contribution

Yandira Bertha Bustillos García, carried out the studies required for the article and the writing of the article, with the aim of contributing to the knowledge of the genus Latrodectus in Bolivia. *Ciro Humboldt Paputsachis*, assisted in the recognition of the specimens and in the revision of the article.

Cited literature

1. Zhang Z-Q. Phylum Arthropoda. Zootaxa 2013; 3703(1):17-26. DOI: https://doi.org/10.11646/zootaxa.3703.1.6
2. Krantz G, Walter DE, editors. A manual of acarology. Texas: Tech University Press; 2009.
3. Walter DE, Proctor H. Mites: Ecology, evolution & behavior. life at a microscale [Internet]. Dordrecht: Springer Dordrecht; 2013. 470 p. DOI: https://doi.org/10.1007/978-94-007-7164-2
4. Canals Lambarri M. Generalidades de arañas ponzoñosas. Parasitol Latinoam [Internet]. 2021 [citado 5 de marzo de 2023];70(2):103-13. Recuperado a partir de: https://sociedadchilenaparasitologia.cl/wp-content/uploads/2019/10/RPLA_Ara%C3%B1as_DEFINITIVA_vf-1.pdf
5. Cloudsley-Thompson JL. Spiders and scorpions (Araneae and Scorpiones). In: Lane RP, Crosskey RW, editors. Medical Insects and Arachnids. Dordrecht: Springer; 1993. p. 659-82. DOI: https://doi.org/10.1007/978-94-011-1554-4_19
6. Fernández G, Castro M. El género Latrodectus Walckenaer, 1805 en Bolivia (Araneae: Theridiidae). J Selva Andina Res Soc 2013;4(2):57-63. DOI: https://doi.org/10.36610/j.jsars.2013.040200057
7. Gómez-Cardona JP, Gómez-Cabal C. Arañas de importancia clínica-epidemiológica en Colombia. Biosalud 2019;18(1):108-29. DOI: https://doi.org/10.17151/biosa.2019.18.1.9
8. Garb JE, González A, Gillespie RG. The black widow spider genus Latrodectus (Araneae:

Theridiidae): phylogeny, biogeography, and invasion history. Mol Phylogenet Evol 2004;31(3): 1127-42. DOI: https://doi.org/10.1016/j.ympev.2003.10.012

9. Moises Asbun JA, González Figueroa D, Díaz Carmona R. Picadura de arácnidos en la ciudad de Cochabamba. Estudio de Casos. Rev Inv e Info Salud 2010;5(12):33-47.
10. Aguilera MA, D'Elía G, Casanueva ME. Revaluation of *Latrodectus thoracicus* Nicolet, 1849 (Araneae: Theridiidae): biological and phylogenetic antecedents. Gayana (Concepc.) 2009;73(2): 161-71. DOI: https://doi.org/10.4067/S0717-65382009000200001
11. Durán-Barrón CG, Francke OF, Pérez-Ortiz TM. Diversidad de arañas (Arachnida: Araneae) asociadas con viviendas de la ciudad de México (Zona Metropolitana). Rev Mex Biodiv 2009;80 (1):55-69.
12. Cabrera-Espinosa LA, Valdez-Mondragón A. Distribución y modelaje de nicho ecológico, comentarios biogeográficos y taxonómicos del género de arañas Latrodectus (Araneae: Theridiidae) de México. Rev Mex Biodiv 2021;92:e923665. DOI: https://doi.org/10.22201/ib.20078706e.2021.92.3665
13. Gobierno Autónomo Departamental de Oruro. Plan territorial de desarrollo integral de Oruro [Internet]. Oruro: Gobierno Autónomo Departamental de Oruro; 2020 [citado 22 de octubre de 2022]. 342 p. Recuperado a partir de: https://www.oruro.gob.bo/planificacion/
14. Anyphaenidae Bertkau, 1878 [Internet]. Grupo Ibérico de Aracnología. 2023 [citado 5 de marzo de 2023]. Recuperado a partir de: https://sea-entomologia.org/gia/familia_anyphaenidae.html
15. Janzen D, Ataroff M, Farinas M, Reyes S, Rincon N, Soler A, et al. Changes in the arthropod community along an elevational transect in the Venezuelan Andes. Biotropica 1976;8(3):193-203. https://doi.org/10.2307/2989685
16. McCoy ED. The distribution of insects along elevational gradients. Oikos 1990;58(3):313-22. https://doi.org/10.2307/3545222
17. Kaslin Ulloa RJ. Distribución actual y potencial de las poblaciones del género Latrodectus (Araneae: Theridiidae) en Ecuador [tesis licenciatura]. [Quito]: Pontificia Universidad Católica del Ecuador; 2013 [citado 26 de octubre de 2022]. Recuperado a partir de: https://repositorio.puce.edu.ec/handle/22000/5717
18. Rodríguez-Rodríguez SE, Solís-Catalán KP, Valdez-Mondragón A. Diversity and seasonal abundance of anthropogenic spiders (Arachnida: Araneae) in different urban zones of the city of Chilpancingo, Guerrero, Mexico. Rev Mex Biodiv 2015;86(4):962-71. DOI: https://doi.org/10.1016/j.rmb.2015.09.002
19. Wener C, Puissant A. Biological diversity and cities: a review and bibliography [Internet]. Bonn-Bad Godesberg: Bundesamt für Naturschutz; 2009 [cited October 22, 2022]. 134 p. Retrieved from: https://www.bfn.de/sites/default/files/BfN/service/Dokumente/skripten/skript245.pdf
20. Durán-Barrón CG. El sinantrópismo en arañas. En: Durán-Barrón CG, editor. Memorias del VI Congreso Latinoamericano de Entomología y XLII Congreso Nacional de Entomología: 17 al 21

de junio 2007. Universidad Nacional Autónoma de México [Internet]. Acapulco: Universidad Nacional Autónoma de México; Instituto de Biología; 2007 [citado 3 de mayo de 2023]. p. 9-13.

21. Argañaraz CI, Rubio GD. Gleiser RM Comunidades de arañas en parches verdes urbanos y su relación con las características locales y paisajísticas. Biodivers Conserv 2018;27(4):981-1009. DOI: https://doi.org/10.1007/s10531-017-1476-8
22. Lowe EC, Threlfall CG, Wilder SM, Hochuli DF. Environmental drivers of spider community composition at multiple scales along an urban gradient. Biodivers Conserv 2018;27(4):829-52. DOI: https://doi.org/10.1007/s10531-017-1466-x
23. Desales-Lara MA, Francke OF, Sánchez-Nava P. Diversidad de arañas (Arachnida: Araneae) en hábitats antropogénicos. Rev Mex Biodiv 2013;84 (1):291-305. DOI: https://doi.org/10.7550/rmb.31708
24. Durán-Barrón CG, Francke OF, Pérez-Ortiz TM. Diversidad de arañas (Arachnida: Araneae) asociadas con viviendas de la ciudad de México (Zona Metropolitana). Rev Mex Biodiv 2009;80 (1):55-69. DOI: https://doi.org/10.22201/ib.20078706e.2009.001.584
25. Desales-Lara MA, Francke OF, Sánchez Nava P. Arañas (Arachnida: Araneae) asociadas a diferentes grados de urbanización. En: Cruz Miranda SG, Tello Flores J, Mendoza Estrada A, Morales Moreno A, editores. Entomología Mexicana. Memorias del XLVI Congreso Nacional de Entomología [Internet]. México; 2011 [citado 3 de mayo de 2023]. p. 69-73.
26. Zolotarev MP, Belskaya EA. Ground-dwelling invertebrates in a large industrial city: Differentiation of recreation and urbanization effects. Contemp Probl Ecol 2015;8(1):83-90. DOI: https://doi.org/10.1134/S1995425515010163
27. Maldonado-Carriles J, Quijano-Ravell A, Gúzman-García CE, Ponce-Saavedra J. Arañas (Araneae: Araneomorphae) antrópicas de Morelia, Michoacán, México. Entomología Mexicana 2018;5: 22-8.
28. Salazar-Olivo CA, Solís-Rojas C. Araneofauna urbana (Arachnida: Araneae) de Ciudad Victoria, Tamaulipas, México. Acta Zool Mex 2015;31(1): 55-66. DOI: https://doi.org/10.21829/azm.2015.311505
29. Orozco-Gil M, Desales-Lara MA. Las arañas (Arachnida: Araneae) del estado de Hidalgo, México: contribución al conocimiento de su biodiversidad. Acta Zool Mex 2021;37:e3712362. DOI: https://doi.org/10.21829/azm.2021.3712362
30. Maldonado-Carrizales J, Ponce-Saavedra J, Valdez-Mondragón A. Diversidad de arañas (Arachnida, Araneae) sinantrópicas de la ciudad de Morelia, Michoacán, México, ¿qué tanto influye el tiempo de construcción de las viviendas en la comunidad de arañas?. Rev Soc Entomol Argent 2021:80(4):67-80. DOI: https://doi.org/10.25085/rsea.800403
31. Ortuño Lazarte PE, Ortiz Samur NP. Latrodectismo. Rev Cient Cienc Méd 2009;12(1):25-8.
32. Zúñiga-Carrasco IR, Caro-Lozano J. Aspectos clínicos y epidemiológicos de las mordeduras de araña en México. Hosp Med Clin Manag 2018;

11:191-203. https://doi.org/10.24875/HMCM.18000161

33. Sotelo-Cruz N, Gómez Rivera N. Neurotoxic manifestations of black widow spider envenomation in paediatric patients. Neurología 2016; 31(4):215-22. DOI: https://doi.org/10.1016/j.nrl.2015.05.007

34. Castañeda-Gómez J, Salceda-Sánchez B, Huerta H, Villegas-Trego A. Primer registro de la viuda café *Latrodectus geometricus* en Sonora, México. Biomédica 2020; 31(3):139-43. DOI: https://doi.org/10.32776/revbiomed.v31i3.788

35. Capturan seis arañas viudas negras en instalaciones del centro AIDA [Internet]. Instituto Nacional de Laboratorios de Salud-Ministerio de Salud y Deportes. 2022 [citado 2 de marzo de 2023]. Recuperado a partir de: https://www.inlasa.gob.bo/2022/12/capturan-seis-aranas-viudas-negras-en-instalaciones-del-centro-aida/

36. Taucare-Rios A. Las arañas sinantrópicas peligrosas de Chile. Rev Med Chile 2012;140(9):1228-9. DOI: https://doi.org/10.4067/S003498872012000900019