

## Guardians of the Underworld: Cave Scorpions.

By Rodrigo Monjaraz-Ruedas, published originally online in Spanish language in August 2017 as part of a blog series dedicated to explaining scientific articles to the general public. Blog name: “Arac’nota”. Outreach Activities of the “Aracnidos” group (<https://aracnidomex.wixsite.com/aracnidos>).

Original Spanish post:

<https://aracnidomex.wixsite.com/aracnidos/single-post/2017/08/14/guardianes-del-inframundo-los-alacranes-cavern%C3%ADcolas>

### English translation:

POW! BAM! scorpions emerge from the bowels of the Earth! With a surprising 20 species of scorpions that inhabit the caves of Mexico, but only three of these live in one of the deepest cave systems in the world, the Huautla Cave System, located in the Sierra Madre Oriental in the states of Oaxaca and Puebla. Species of the genus *Alacran* Francke, 1982 have been found at depths between 700 and 900 meters, with *Alacran tartarus* Francke, 1982 being the one that inhabits the deepest in the world. These scorpions present many modifications due to the cave life, such as the total loss of their eyes, the elongation of their legs, pincers and tails (telson), as well as the loss of coloration, which are adaptations to the lack of light, that helps them explore their environment and survive in these extreme environments.

Recently, cave exploration has brought to the light the discovery of new species that inhabit these environments, including a new species of genus *Alacran*, and along with this species the intriguing question of how is it that these animals have managed to colonize the caves? A really challenging question given that they live in such a deep cave. Fortunately, we can postulate geographic hypotheses based on the morphology and DNA of the species, given that these areas evolve along with the species inhabit them.

Since the three known species of the genus *Alacran* are found in three isolated caves in the Sierra Negra in Puebla, in the Sierra Mazateca and in the Sierra de Juárez in Oaxaca, all converging in the Sierra Madre del Sur region, they present a distribution relatively close to each other but not interconnected (disjunct), however, these three regions are divided by the presence of large canyons formed by the Santo Domingo river and the Petlapa river, which serve as natural physical barriers that delimit the current distribution of the genus *Alacran*. It is believed that there was a primitive system of caves which extended from Northwest to Southeast through the original Sierra Madre del Sur, in which the ancestor of the current species of the genus *Alacran* ventured in search of refuge and food, finding a favorable environment in where to live, however, with the passage of time, these organisms adapted to this extreme life, which prevented them from returning to the surface.

The following geological events that affected the Sierra Madre del Sur, such as erosion and the formation of mountains, shaped the current Oaxacan landscape, in this way, the Santo Domingo and Petlapa rivers created canyons with the passage of time, which fragmented the original cave system, giving rise to three independent cave systems, dividing the ancestral populations of *Alacran* into three new species. This is a classic example of allopatric speciation produced by a vicariance event, although this example was made with morphological evidence, the implementation of DNA sequences would help to assign geological times that could give more support to this hypothesis.

Cave scorpions currently represent an enigma for arachnologists and the world in general, since little is known about their behavior, or the importance of their venom, which makes them extremely important and a target in current genomic and poison research. There is no doubt that they will remain guarding the entrance to the underworld, as good guardians of what the caves hide for all of us.

If you are interested in reading more about it, do not hesitate to look for the work dedicated to these specimens.

### Reference:

Santibáñez-López, C.E., Francke, O. and Prendini, L. 2014. Shining a light into the world’s deepest caves: phylogenetic systematics of the troglobiotic scorpion genus *Alacran* Francke, 1982 (Typhlochactidae : Alacraninae). *Invertebrate Systematics*, 28, 643–664.