Troglobitic Spiders of Research Cave 6N-327

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During the SRGWA Nullarbor Expedition of 1992-93, Max Meth (CEGSA) took me to one of several karst features on the Hampton Tableland of Mundrabilla Station for the purpose of attaching identification numbers. The feature 6N-327 was a shallow cliffline adjacent to a small rock pavement amongst scattered trees approximately 1.5km north of the scarp. While I was preparing the number and attaching it to a suitable location, Max, in his own inimitable style, was conducting a preliminary dig, armed in his usual way with a shovel (mine), crowbar and bucket. Within a few minutes, a small 30mm hole suddenly appeared with air rushing out. Max almost seemed disappointed as he laconically stated that the feature was now another cave. A few minutes later, we placed a small rock over the hole and left to number other features.

During another SRGWA expedition, on January 1, 1997, with the numbers, attitude and implements, we were back for a dig. The day was not really conducive for digging, it quickly became hot and cloudless. Digging was enthusiastic as it was the coolest place to be, the only downside being the dust-laden gale howling out from the depths. Sweaty arms, faces and necks quickly became darkened due to successive layers of adhering dust - which at least gave some protection from sunburn. After about 3 hours digging, and at the bottom of a 2 x 1m trench, a hole big enough for most people to crawl through appeared, we had our cave. We cleaned the dust from our eyes, washed our hands, and immediately retreated to the shade of a nearby tree for lunch.

Max was the first to succumb to curiosity, finished eating, strode across to the trench and crawled headfirst through the hole, which was still blowing a gale. Everyone else entered feet first to be confronted by one of our greatest surprises - a seemingly sealed eco-system! The first *Tartarus* spider was encountered less than 10m into the cave. It did not take long to conclude that we had a major biological discovery on our hands that needed protection. Over the next two days when the two main arms of the cave were partially explored and route-marked during the course of a “stick survey” more than 24 spiders were encountered of all age groups and both sexes. This was the highest population of spiders discovered to date - even egg sacs were found, presumably associated with the *Tartarus* spider. Negotiations immediately commenced with the Station owners, Lucy and Bob Eglinton, to declare the cave a research site and restrict entry. One year later, with financial support from the Speleological Research Group Western Australia (SRGWA) and Australian Geographic Society, the cave entrance was covered by an environmental gate. The partially pre-fabricated gate was assembled and cemented into place by members of the Canberra Speleological Society and SRGWA.

During the year from the time the cave was opened to when the gate was fitted, the spiders had retreated from the entrance region possibly due to a combination of air turbulence and surface predators even though every effort had been made to re-seal the entrance. Data loggers (obtained with the aid of a Gordon Reid Foundation grant) placed in the entrance zone and deeper into the cave during the gate construction period showed a dramatic climatic effect as soon as the gate was closed (Figure 1) and observation has since shown that the spiders soon re-colonized the entrance region.

One major outcome of the initial discovery was being able to witness for the first time what appeared to be the preliminaries of the *Tartarus* courtship ritual which gave every indication of being a long drawn-out affair. Since that time it has been discovered that the cave's troglobitic ecosystem also includes the spider *Troglodiplura lowryi* (the first recorded live sighting in WA), cockroach, isopod, beetle, mites associated with root material and a suspected flying insect. Micro-karst connections to the surface allow the inflow of water, tree roots, water with vegetable debris and intrusion of surface fauna which has included a small rodent-like creature suspected of being a dunnart (Poulter 2002).

A major survey of the cave began at the beginning of 2002, revealing that the entrance rockfall region is more extensive than first thought. The cave is essentially two chambers with at least two side extensions although the lower, major chamber is divided into “multiple chambers” by either the

ceiling or extensive ceiling (calcite) decoration dipping down to meet the sediment floor. In this way, almost one kilometre of “passage” has been mapped with more visible. Surveying has been conducted so as to cause the minimum of disturbance to the soil floors and web structures - movement through the cave is deliberately slow as spiders periodically change location and once unobstructed pathways can become blocked by web support lines. One essential survey tool is an 8m retractable builder's tape which allows side distances to walls and other features to be plotted without leaving an established track. Ultrasonic or laser distance measuring instruments may also be used in forthcoming work. Once mapping is completed in most regions, redundant trails are blocked off and rehabilitated while preferred trails are more substantially track-marked where possible. When spider webs are located close to a main trail, their position is marked so as to avoid future web damage should the spider remain “on station”.

At the close of surveying in 2002, some 90 *Tartarus* spiders of all age groups and sexes had been plotted. This is the highest population density ever recorded in a single cave. There has been only one confirmed sighting of a live *Troglodiplura lowryi* (1998) although a fungus-covered body was recovered and an unconfirmed live sighting made in 2002. Observation indicates that when the female *Tartarus* spider moves her web site, she may re-ingest the majority of her web as an energy-saving measure.

The lower chamber is further divided into two distinct sectors with the conveniently and centrally located Main Drag acting as a border. The region to the west is drier and slightly elevated, contains the majority of the calcite decoration (mostly dead) and it is possible to stand up most of the time which is particularly welcome. Some of the floor deposit could include intermixed “coffee and cream” material fretted from the ceiling. Few female spiders were found in this area, although in 1997, many spiders were discovered in the vicinity of Logger Junction (Stn. 37a). By stark contrast, the sparsely explored and surveyed eastern sector is mainly sedimentary floodplain, largely devoid of decoration but with a high population of spiders which has made movement slow and extremely difficult to avoid damaging inter-woven web structures. Sitting up in this region is a luxury to be relished. There are also occasional though extensive deposits of exudated shards.

A north-easterly extension with extensive dry and broken calcite decoration found to contain spiders, tree roots and egg sacs has been entered twice, but as yet, only received a rudimentary survey. A suspected dunnart has been seen in this area too, possibly entering via a micro-karst passage.

Tree roots that penetrate the cave appear to obtain nutrients from two sources, either directly from the cave's humid atmosphere in which case it is not uncommon to encounter large tufts of fragile, dark coloured rootlet clusters along fault lines or, consolidated taproots and associated rootlets penetrating the cave's floor soil and rock structures. Tree roots in turn, provide nutrients for the cave's troglobitic fauna. Cockroaches of all age groups can be seen foraging amongst the rootlets either cropping the roots themselves or possibly feeding on the microscopic mites and fungi. Newly hatched female *Tartarus* spiders have also been found to set their webs close to some root systems.

The female *Tartarus* spiders can be found living a solitary existence or in moderately scattered social groups although this could also indicate abundance or lack of food. In the case of the male *Tartarus* spider, some credence must be given to the possibility of territorial range. Encountering more than one mature male in close proximity to a cluster of females is rare. The mature male spider is nomadic, searching out prey and suitable females with which to mate. Males have been seen moving towards females either following or laying a single silken thread. Careful examination of cave ceilings reveal a small network of these silken highways.

Credence also needs to be given to the possibility that the female may also be cannibalistic in relation to courting males, borne out by the drawn-out and hesitant behaviour exhibited by the male during the only mating ritual observed in 1997 and web-entangled husks periodically encountered in this and other fauna-rich caves. Admittedly, web-entanglement of husks that has been seen may have occurred during a spider's moulting maneuvers. Cannibalism is exhibited by other spider groups, eg. the female redback spider will eat her much smaller mate if he does not perform to her liking. In a presumably nutrient-poor cave environment, cannibalism of the numerically smaller population of male spiders seems on the one hand, unlikely - while on the other, advantageous to the continued survival of the species. Only long-term and detailed observation in the remarkable underground laboratories provided by 6N-327 and its companion 6N-1327 will yield answers to this and other questions about the unique spiders of the Nullarbor caves.

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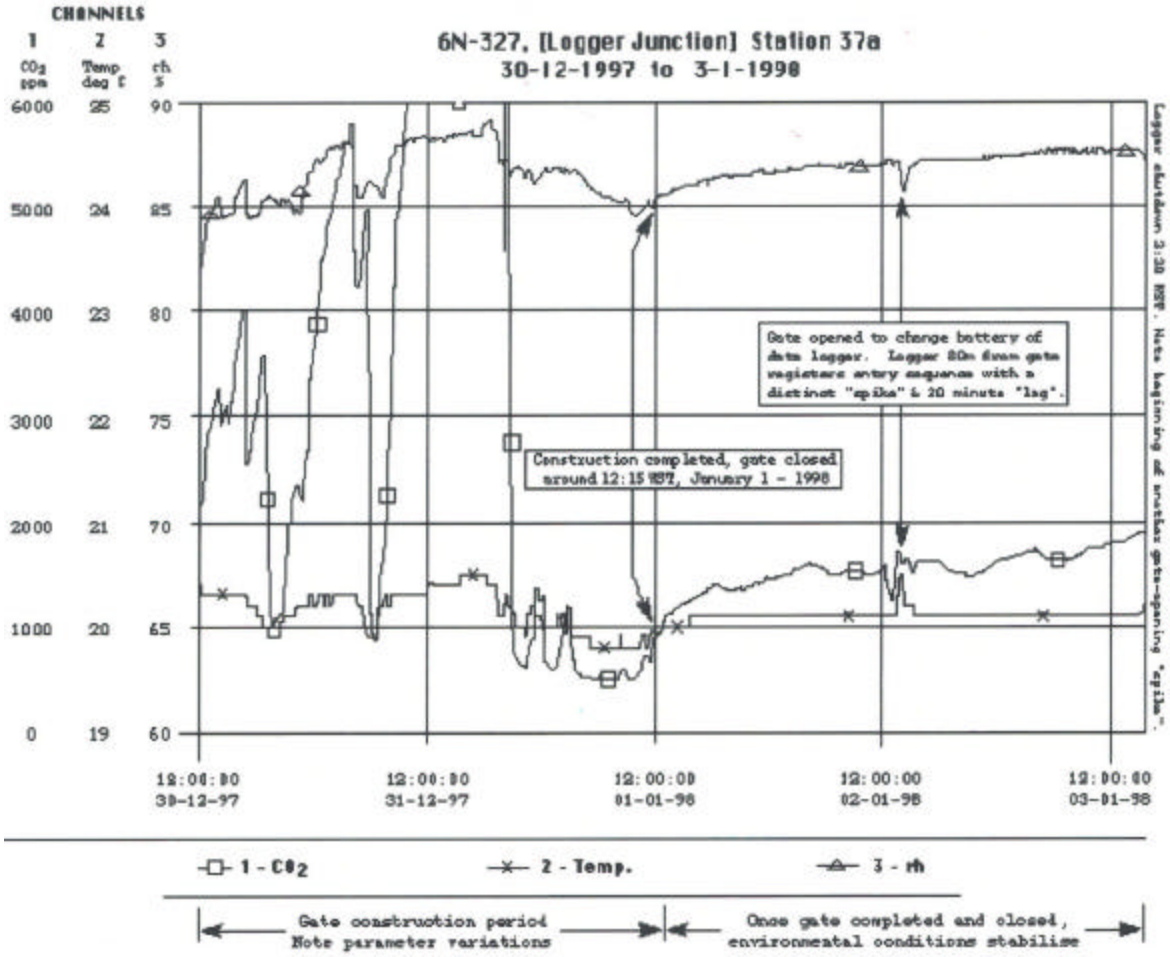

Figure 1 – 6N-327 (Logger Junction) Station 37a