Laboratory culture techniques for the Goliath tarantula *Theraphosa blondi* (Latreille, 1804) and the Mexican red knee tarantula, *Brachypelma smithi* (Araneae: Theraphosidae)

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Introduction

Tarantulas (Araneae) belonging to the sub-order Orthognatha (formerly Mygalomorphae) family Theraphosidae are perhaps the most common invertebrate displayed in zoos today. This is because of their large size, notorious reputation, name-recognition by the public, simple dietary requirements, ease of care for many species and availability through the commercial pet trade and breeders. Eighty-eight species are reportedly kept in captivity in zoos, museums, universities and private individual members of the American Tarantula Society. The Arachnid Specialist Group of the Terrestrial Invertebrate Taxon Advisory group would like to encourage the zoological and museum community to establish breeding programs for several species of theraphosids due to the increasing collection pressure on some of these species and the need for detailed life history and reproduction data on many species commonly kept in exhibits but poorly known, scientifically speaking.

According to a recent report (Calloway, 1995), to date only one zoological institution in North America has bred the Mexican redknee tarantula, *Brachypelma smithi*, the Metropolitan Toronto Zoo. In addition, eight private individuals in the U. S. have also bred *B. smithi*. However other species of tarantula have been bred, and indeed there is an active commercial breeder group and hobbyist group in the United States. In Calloway's survey 44% of 165 institutions responding to the survey expressed an interest in cooperating in captive breeding programs for tarantulas. Zoos in England have already initiated a captive breeding project for the Mexican redknee. This is the favored species for educational programming due to its extremely docile nature, ease of basic maintenance and thirty-year life span in captivity. However, this species is now legally protected from being collected in the wild for commercial purposes and is more difficult to breed than some other species of tarantula. Hence, due to the conservation needs of this species and the educational needs of institutions that exhibit invertebrates, this would be the ideal time to begin in earnest to propagate this species and perhaps several others that are in high demand and possibly in need of conservation attention. This paper represents a report of our progress with two species of great interest to zoos, the Goliath tarantula, *Theraphosa blondi* and the Mexican redknee tarantula, *Brachypelma smithi*.

The Goliath (bird-eating) tarantula, *Theraphosa blondi*

Theraphosa blondi is most probably the largest tarantula in the world. Since most of their natural diet is probably comprised of invertebrates and some small ground dwelling vertebrates (lizards, etc.), I propose that the "bird eater" part of the common name be dropped and in the interest of education, the common name be changed to simply "Goliath

tarantula." *Theraphosa blondi's* natural range includes undisturbed rainforests in southeastern Venezuela, Guyana, and northeastern Brazil.

The Insect Zoo obtained a wild collected *Theraphosa blondi* female approximately 65 grams in weight and centimeters in length on September 1, 1993. She was fed a single "pinkie" (small newborn mouse) once a week. Occasionally, a cricket was substituted for the mouse. She was maintained at 85 degrees Fahrenheit and 80-90% relative humidity, in a 30-gallon terrarium. On 25 June1994 she laid eggs and enclosed them in a silken egg sac approximately nine months after she arrived at the Insect Zoo. She was kept off exhibit for several weeks when egg laying occurred. During the incubation period she guarded the egg sac aggressively and moved it around, presumably turning it to maintain the eggs properly. She was observed removing hairs from both sides of her abdomen and depositing them on the outer side of her egg case. Arachnologists hypothesize that these hairs protect the eggs from dipteran parasites. On 27 July 1994 she tore open the silk egg sac. The eggs began hatching on 1 August 1994, 33 to 39 days after being laid, and a total of 45 spiders were produced. Two died within the first two molts and were preserved in alcohol. The 43 remaining were successfully reared and then the majority of those were donated to other zoological institutions.

The first stage or instar at emergence is non-ambulatory. The technical term for this first stage is bald deutova or larvae sensu. We referred to them as egglings. They molted several days latter, looking more like typical spiderlings and were ambulatory at this stage. Working with a sample size of fifteen, the following ranges of weights were obtained:

Date	**Range of weight (grams)**
August 8, 1994	0.1223 - 0.1521 g
September 8, 1994	0.1218 - 0.1612 g
September 16, 1994	0.1556 - 0.1837 g
May 10, 1996	23.7 – 29.0 grams
n = 15	

Our spiders at one year and 9 months ranged in weight from 25-29 grams.
Between August 9-10, 1994 38 spiderlings had molted into their second instar and were ambulatory. By the third instar they became gray-black in color but with a superficially hairless appearance. The fourth instar took on a hairy appearance, more typical of what one might expect from a tarantula. As of May 15, 1996, one year and 10 months from hatching, sexual maturation had not been reached. Marshall and Uetz (1993) reported that there are 9 instars for the males and 10 instars for the females, requiring two years to reach sexual maturity. Of a sample size of 12, all twelve molted into the ambulatory phase on August 12, 1994. To date, including the first molt on August 12, 1994, one has molted 6 times, three have molted 7 times, three have molted 8 times, one has molted 9 times and four have molted 10 times. Hence, we have observed considerable variation in the rate of growth. Several factors affect their rate of maturation and the size at maturation including nutrition, total number of eggs produced, egg size and perhaps temperature.

Stage	**Date**	**# animals**	**# days**
Eggs laid	June 25, 1994		
Hatch (deutova)	August 1, 1994	45	33-39
1st molt (ambulatory)	August 9-10, 1994	38	42-49
1st molt	August 12, 1994	12	45-51

In Marshall and Uetz's study a total of 3 males and one female were reared to sexual maturity. Currently we are rearing a total of fifteen of the original 45 hatchlings. The

remaining animals have been donated to other educational exhibits in the United States, Canada and New Zealand.

Some species of ground dwelling tarantulas native to North America mature in 8-10 years exhibiting a much slower growth rate than the Goliath tarantula, *T. blondi*. A figure of 14 to 17 instars has been reported for some species (Marshall and Uetz, 1993; Stradling 1978, and Baerg 1963).

The Mexican redknee tarantula, *Brachypelma smithi*

The entire genus *Brachypelma* (formally *Eualthus*) is now listed as a CITIES Appendix II. Life span is notable, these species reportedly live from 25 up to 30 years in captivity. We have estimated that some of our specimens have lived for 28 years. The courtship and mating of *Brachypelma* has been described by McKee (1984) so will not be repeated here.

As of May 1996, we successfully raised 18 of the 20 spiderling specimens received from the Metropolitan Toronto Zoo on December 8, 1994. Two died within the second molt. As with the *T. blondi* spiderlings, the early instars were maintained in commercial drosophila vials (Carolina Biological Supply) with a substrate of vermiculite. The spiderlings were moved into larger plastic containers as needed. In our sample size of ten, during the period from 8 December 1994 to 15 May 1996, one has molted 7 times, four have molted 6 times, two have molted 5 times and three have been recorded as molting 4 times. As of 15 May1996, the spiders are ~3 centimeters in length. *Brachypelma* species can take from 3-4 months to incubate (Hodge, 1992) and the egg sac can be separated from the female and incubated artificially (McKee, 1986).

Summary of Husbandry Techniques

The key elements to successful laboratory culture of *T. blondi* are temperature, humidity, hygiene, frequency of feeding and quality of food item. Sterilize the containers frequently!

Substrates

We currently use vermiculite as the primary substrate for rearing young spiders. Vermiculite is inert, has a neutral pH and is less ideal harborage for pathogens and other unwanted microorganisms. Vermiculite also holds water, so by moistening it, one can increase the humidity in the container. For exhibit enclosures however, we use natural materials such as sand, soil, moss, In addition, rocks, bark pieces are placed to provide burrow structure and places where the tarantulas can molt properly. We also include appropriate live and dead plant material to visually enhance the exhibit and to simulate the natural ecosystem of the species to add educational depth to the exhibit. Each off-exhibit spider enclosure is filled with from 2-3.5 inches of vermiculite. The depth is varied relative to the size of the spider. Ample depth is given to provide room for burrowing. *B. smithi* spiders are active burrowers, some individuals showing more inclination to burrow than others.

Hygiene

This section is separated due to its importance in the successful rearing and maintenance of spiders and other invertebrates. The second most important parameter after humidity is hygiene. If the vermiculite or the cotton in the water dish shows any signs of discoloration, the container is emptied and sterilized before replacing the tarantula inside. The water dish is also sterilized with 5% Clorox (bleach) solution and the cotton is replaced with a fresh piece. White sterilized cotton is an ideal substance for water dishes off-exhibit since any

bacterial or fungal growth can be detected quickly by watching for a change in color in the cotton. All utensils are also sterilized with bleach at the end of each day, or frequently during the day when changing over soiled containers.

Soil is an excellent medium for harboring bacterial and fungal microorganisms. If a specimen dies, the enclosure should not be reused until everything in the enclosure is replaced or sterilized and incinerated. We generally use 5% sodium hypo-chlorite (Clorox) for sterilizing containers. We sterilize soil and other substrates by baking them in a conventional oven at 400-500 degrees for 2 hours or by micro-waving them.

Containers and Enclosures

We use a variety of types and sizes of plastic container some are made of a hard clear plastic and some of softer, flexible, translucent plastic. The type of plastic container is less important than the floor size, the height and the amount of ventilation provided in the lid. As the spiders grew larger we switched to an unbreakable plastic container with a snap down lid made by Cambro, Inc. This type of container is commonly used for restaurant food storage and can be usually purchased at wholesale restaurant supply outlets at a cost of about $7.00 per container. As with the culture of many species of invertebrate, humidity is key to success. Young spiderlings are very susceptible to desiccation. A layer of silkscreen material (BioQuip) is used to cover openings larger than three millimeters in diameter. In addition, for *T. blondi*, there is a second layer of silkscreen between the opening and the lid(but not attached to the lid, to provide extra security when removing the lid to add water and food. These tarantulas are extremely fast and aggressive.

Diet

Both species were started on a diet of very small, pin head size or slightly larger, domestic crickets (*Acheta domesticus*). They graduate to larger cricket sizes as they grow. Only one cricket at a time is placed in the rearing enclosure. Other food items have been used by others such as waxworms (*Galleria*), fly maggots (*Musca domestica*). *Theraphosa blondi*, when they attained a length of 5-7 inches, were offered Madagascan hissing cockroach (*Gromphordorhina protentosa*) nymphs (one inch in length) and occasionally pinkies (newborn mice). The young spiders were offered food every other day. *Theraphosa blondi* specimens usually ate all food offered. If the crickets were not eaten within a few minutes they were removed to prevent problems for the tarantulas during molts. It is extremely important to remove uneaten or dead food items. During the molting process they are very vulnerable to predation.

Handling

The hairs of most tarantulas are urticating, and *T. blondi's* hairs are highly urticating and can cause allergic responses quite quickly. For that reason, our handling protocol includes the wearing of a facial dust mask and latex surgical gloves when moving tarantulas and cleaning their enclosures. In addition, this species is highly aggressive and will strike at the slightest provocation. Hence, we do not recommend this species for new facilities unless the personnel have had experience with some of the more tractable and less fragile species. *Bracypelma smithi* is quite tractable as they grow large enough to be handled, however, when they are young they move quite quickly and are less sedentary than the adult females. We avoided manual handling to avoid damaging the early instars.

Husbandry

As I mentioned earlier, the two most important factors in raising young spiders is humidity and hygiene. For the goliath tarantula, the optimum temperature is 85 degrees Fahrenheit and 80-90% relative humidity. For the Mexican redknee the humidity requirements are lower except for molting periods. Small thermometers and hygrometers are used inside the containers to monitor temperature and humidity. These can be purchase from Carolina

Biological Supply or other scientific supply companies (such as Radio Shack). All species of tarantula are kept individually. The *T. blondi* spiderlings were separated from the female a day after she tore open the egg sac. All specimens are provided with a water dish containing white cotton. The young spiders are checked every other day for moisture. The containers with a more ventilated lid (older spiders) are misted with distilled water twice a day, once in the morning and once at the end of the day.

Regulations and Permits

Due to the ever-changing status of wildlife in nature, it is best to check with the U. S. Fish and Wildlife Service on the classification of a specific species before deciding on the importation and acquisition of any invertebrate. I also recommend checking with state and federal departments of agriculture to inquire whether a courtesy permit should be requested. Local health regulations in some cities and counties may restrict the importation of venomous animals without permission.

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