Troubleshooting *Extatosoma tiaratum* population decline

Devin Krafka
Keeper, Butterflies & Insects, Omaha's Henry Doorly Zoo & Aquarium
Traci Clevenger
Supervisor, Berniece Grewcock Butterfly & Insect Pavilion
3701 South 10th Street, Omaha, NE 68107, USA

INTRODUCTION:

In the spring of 2015, we noticed a major decline in our giant prickly stick insect, *Extatosoma tiaratum,* population. Babies were hatching but dying right before or right after their first molt. In addition, the adults were discolored and had droopy abdomens. Historically, this was an easy stick to breed and the population was relatively healthy. This paper explores husbandry, veterinary and collaboration efforts while addressing *Extatosoma tiratum* population decline.

Before I begin, I want to mention this wasn't necessarily a linear process for us. Some of the things I describe were happening simultaneously and over several months.

TROUBLESHOOTING: husbandry

Since the population decline was an isolated issue (i.e. no other stick insect populations were suffering), environment was considered to be a contributing factor even though their environment remained unchanged. *Extatosoma tiaratum* were kept in a permitted room, which remains around 24˚ C (75˚ F). This meets the preferred temperature range of 18˚- 25˚ C (64˚- 77˚ F) (Brock, 2000). Their diet consisted of bramble and, when available, rose and eucalyptus.

Figure 1. Original adult/juvenile mesh enclosure with shower curtain surround.

The stick insects were housed in a 90 x 35 x 66 cm black mesh cage with a shower curtain surround (Fig. 1). Their cage contained a mister head which misted daily for five minutes every hour beginning at 7:00 a.m. and ending at 7:00 p.m. One compact fluorescent light bulb sat on top of the mesh. The cage is near an outside wall with windows on either side.

Since temperature most likely wasn't the issue, there were other variables to consider such as humidity and ventilation. *A Complete Guide to Breeding Stick and Leaf Insects* states the

preferred conditions varied. Some facilities have successfully bred in extremely wet and humid conditions while others keep their populations well ventilated and mist only once a week (Brock PD 2000).

To better control ventilation and humidity, the shower curtain was removed immediately (Fig. 2) from the adults and nymphs were placed into 3 trial groups. A handful of nymphs landed in a 10 gallon (18.9 L) tank with a shower curtain on the lid, a 10 gallon (18.9 L) tank without shower curtain on the lid and deli cups with a ventilated lid (Fig 3). Each trial was fed the same diet as before but the leaves were manually cut for the babies to begin feeding. Ultimately, these options seemed too wet.

Figure 2. Original adult/juvenile mesh enclosure without shower curtain surround.

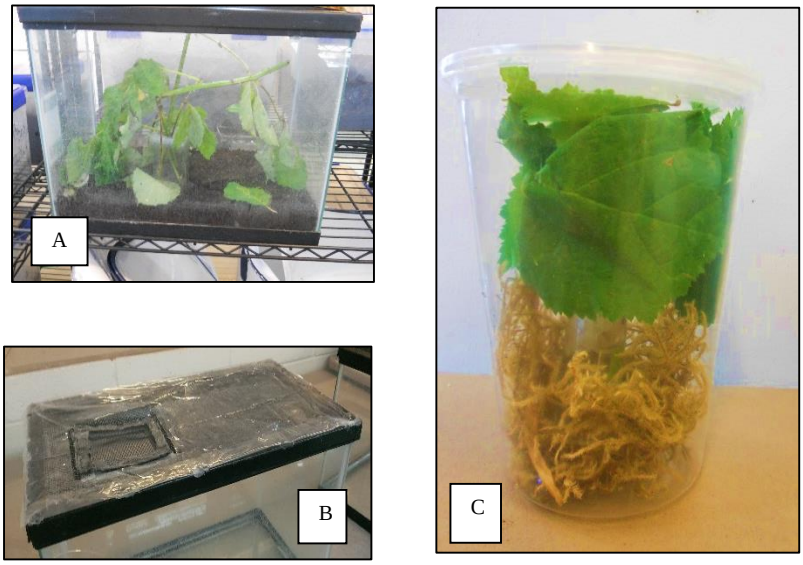

Figure 3. Juvenile trials. A) 10 gallon tank set-up with coco fiber bottom for moisture retention and blackberry bramble as the food source. B) The shower curtain lid with Velcro hatch to place juveniles in the tank without lifting the lid. C) An example of the deli cup enclosure.

The remaining group was moved to 35.6 x 35.6 x 61 cm white mesh pop-up caterpillar castles with an easy clean white cotton cage liner and magentas (6.4 x 6.4 x 9.7 cm clear plastic containers with a lid) to hold browse (Fig. 4). After every browse change, the magenta, cage and liner were placed in a 5 gallon (18.9 L) bucket with a 10% bleach solution (Fig. 5) and soaked for 15- 20 minutes. New browse were rinsed and then placed inside one of these pop-ups (Fig. 6).

Figure 5. The white mesh pop-up caterpillar castle, cage liner and magenta soaking for 15- 20 minutes.

Figure 4. The interior of the white mesh pop-up caterpillar castle.

Figure 6. Browse placed in the sink for washing.

TROUBLESHOOTING: veterinary practices

Subsequently, while the environmental manipulation was taking place two histopathological examinations were sent to Dr. Michael M. Garner of Northwest ZooPath.

Dr. Garner found the following (email from M. Garner to Omaha's Veterinary Care Staff, personal communication, 2015):

> *"No morphologic abnormalities are noted in the examined section, but most of the coelomic viscera are not represented in the section. Some deeper levels are being processed, and an addendum will follow*. ***Microscopic examination of multiple deeper levels identifies no abnormalities in the integument, central nervous system, alimentary tract, adipose tissue, heart, breathing tubes, or gonad (female). The cause for the losses noted in the history could not be determined from the submitted animal. It may be necessary to submit an animal that is morbid or freshly dead. This walking stick was in excellent nutritional status and had food in the alimentary tract.***
> *Culture: Aspergillosis, rare bacillus, rare branching gram positive rods"*

Omaha's veterinary staff didn't think the histopathological exam was conclusive since the Aspergillosis was only found on the outside of the animal. Two treatment groups were recommended to address the infectious agents (fungal and bacterial), and one group to address possible underlying nutritional causes:

> **Treatment group one**: Dextrose (100 mg/mL) was sprayed on leaves once daily as empiric treatment for increased juvenile mortality. This treatment was based off the video *Sticky* (Rose) to address any possible nutritional cause.

Treatment group two: Oxytetracycline (0.2 mg/mL) was sprayed on leaves once daily as empiric antibiotic treatment for increased juvenile mortality.
Treatment group three: Voriconazole (0.2 mg/mL) sprayed on leaves once daily as empiric antifungal treatment for increased juvenile mortality.

It should be noted that Dr. Garner's second exam came back with the following note:

> *"Multiple additional deeper levels identify the entire brain and various peripheral nerves. Mild to moderate vacuolar change is in the gray matter of the brain with occasional edema and rare glial cell necrosis. Glial cell necrosis and edema are also detected in some of the peripheral nerves. I believe this animal may have been intoxicated, perhaps with organophosphates or carbamates. Evaluation of husbandry is recommended in the regard."*

The second exam was rendered moot since a browse rinse was already included in our new husbandry practice; however, the results reinforced the importance of rinsing all browse before adding them to any stick enclosure. Furthermore, the results prompted a conversation with Blackberry Bramble (our supplier) about bramble collection practices.

TROUBLESHOOTING: collaboration

While applying treatments, other institutions were contacted. Knowing their husbandry and veterinary practices would help combat the population issues and help find speedy solutions. UV lights were added to the *Extatosoma tiaratum* enclosure to kill potential bacterial and fungal infections (Fig. 7) (email from E. Sullivan to T. Clevenger, personal communication, 2015). Additionally, F10, a disinfectant distributed via nebulizer, was recommended (Fig. 8). While using the F10 SC Veterinary Disinfectant (0.1 mL solution, 0.1 mL of medication mixed with 25 mL of Saline) the *Extatosoma tiaratum* population experienced less death.

Figure 7. Exo Terra Repti Glo 5.0 Compact Terrarium lights provide the insects with moderate UVB radiation that stimulate appetite and reproductive behavior while killing potential bacterial and fungal infections on the plants and insects.

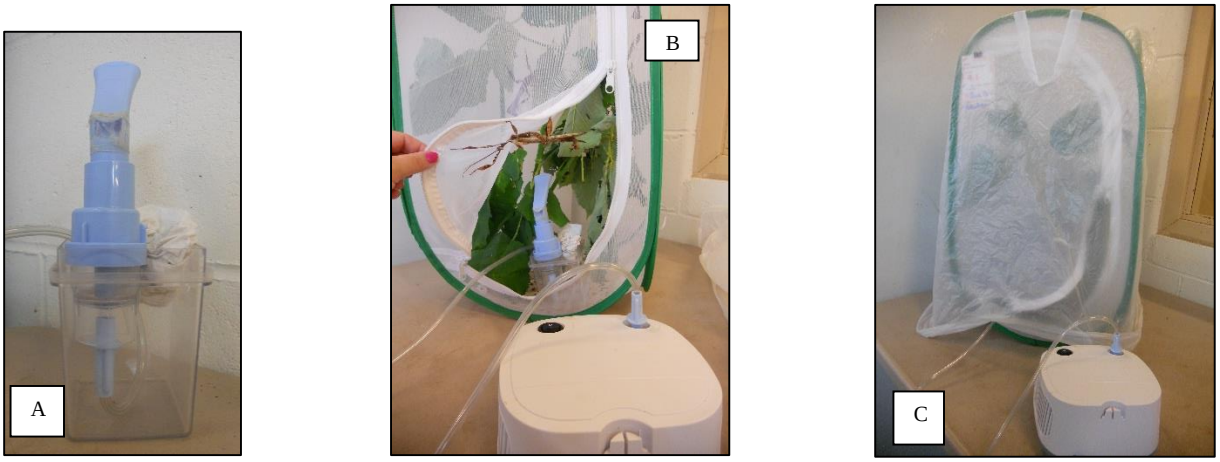

Figure 8. The F10 SC Veterinary Disinfectant nebulizer set up. A) The F10 solution is placed in the bottom portion of the nozzle and is secured upright in a magenta with a paper towel. B) The magenta is placed inside the pop-up caterpillar castle and a rubber hose is connected to the nebulizer. C) A clear plastic garbage bag is placed over the top to hold in the medicated mist.

CONCLUSION:

While the F10 was the last treatment we used and the population did stabilize, there is no conclusive evidence to support it was the singular stabilizing factor. In retrospect, it was probably a combination of all the environmental changes coupled with the medications that steadied the population.

I will share with you what we do know. Currently, we have a healthy, stable, maturing population of 16.13. However, we are still uncertain of our stick bugs' future due to low population fecundity. We are not seeing the same number of dropped eggs previous to the treatment. We also have not had any nymphs hatch since finishing the treatment. Raising this population will be ongoing battle for us. We would love to continue the collaboration efforts and help prevent this from happening again.

REFERENCES:

Brock, P. D. (2000). *A Complete Guide to Breeding Stick and Leaf Insects*. England: Kingdom Books.

Rose, Jilli. "Sticky." Online video clip. *Vimeo*. Vimeo, 2013. Web. 2015.