

# The Facts Behind the Moruga Scorpion and the Chile Pepper Institute Super-Hot Study: A Talk With Jim Duffy

Scott Roberts February 10, 2012 at 10:00 am



From the Chile Pepper Conference, left to right: Dr. Paul Bosland, Danise Coon, Jim Duffy, Sue Hard, and CaJohn Hard

It's official that [there's a new hottest kid on the block](#) - the Moruga Scorpion chile pepper. What's more important than that is that the largest and most comprehensive study on super-hot chile peppers has been made by New Mexico State University's [Chile Pepper Institute](#) and that tons of data will soon be available. After nearly 11 months of work that was headed up by graduate student Gregory Reeves, CPI senior research specialist Danise Coon and CPI director and regents professor Dr. Paul Bosland, the results were publicly announced at last weekend's Chile Pepper Conference in Las Cruces, New Mexico.

Essential to a lot of this was my good friend and chile pepper grower [Jim Duffy](#) of [Refining Fire Chiles](#). He, along with Dr. Herman Adam of CARDI, (Caribbean Agriculture Research & Development Institute) provided the vital seeds used to grow the plants in this testing.

Jim has long been a proponent of cutting through the clutter of hype and misconceptions regarding super-hots and instead has been pushing for thorough testing of the hottest of the hot of the *capsicum chinense* species. So when this the results of this testing was made public (especially the announcement of the Moruga Scorpion as being the world's hottest chile pepper) it was big news in chile pepper circles; and of course, it wasn't without controversy.

To help make clear up some matters, I asked Jim some questions last night, to which he graciously and expertly answered...

**Scott: So Jim, how was your first ever Chile Pepper Conference?**

Jim: Well Scott, it was wonderful. I had met some of the Leaders at last year's New Mexico Fiery Foods Show, and now would really see what they are all about. A few days before going I was called by Mark Gladden and asked if I wanted to attend their Leadership Council dinner on Monday night. Just the thought of being at that dinner with many leaders in the chile industry was an honor in itself.

**Scott: So what happened at the dinner?**

Jim: First of all, we were served a seven course meal prepared by a master chef and some of the students. They started us off with a Heritage chile chicken soup that I could have eaten all night long. Then a small scoop of Lemon Sorbet to clean up the palette. After that, a nice salad with greens, black beans, corn and jicama. Then we were served some pulled pork with a small amount of Holy Jolokia BBQ sauce. They went easy on the sauce and it had little heat. We also had something called Calabitas in a nice sauce, some roasted seasoned potatoes and a stuffed Yellow Rocoto pepper. Then for dessert a chocolate flan with a touch of Sancto Scorpion sauce mixed in to give it a little heat.

**Scott: You're making me hungry! Sounds like a nice dinner you guys had. What else happened?**

Jim: Well, while the first courses were being served Mark Gladden talked about fundraising and goals for the future. Then Dr. Paul Bosland came up to thank everyone on the council for all they do and talked about some of the Grad students he was proud of. One student visited from Thailand and had never seen snow. So when it snowed last year the student took pictures of everything with snow on it. A total of over 1,800 pictures in all. Then Dr. Bosland talked about salt tolerance with certain chiles and what they were trying to do about it. Finally he talked about the super-hot study and showed everyone some of the results for the first time. This was great for this study started almost 11 months ago when I donated my seeds to the Institute in March

2011. So was great to see the record results from the seeds that my plants produced.



*Paul Bosland and Jim Duffy*

**Scott: How did this project to test the super-hots start? Who was involved?**

Jim: Back in late 2010, [CaJohn Hard](#) brought up the idea to get real super-hot comparison testing done. Finally at the Fiery Foods Show I met Mark Gladden and Dr. Bosland's assistant Danise Coon. I offered to share my pure seeds with them because I wanted to get real testing done. Not this "single pepper test, instant new record!" crap that was going on. In 2010, Marlin Bensinger and I had tested a lot of super-hots and got some data but more needed to be done. John talked them into it and a student named Gregory Reeves wanted to have it as part of his thesis, so now it would happen. So when I got home to San Diego, I packed up the seeds and sent them to Danise to germinate.

**Scott: How long did this project last?**

Jim: The project started in March 2011 with seeds being set up for germination in the greenhouse. Final testing of pepper samples was finished in January by two other independent labs. So a little it took over 10 months for the entire study.

**Scott: What chile peppers were tested?**

Jim: I sent them over two hundred seeds each of Trinidad Scorpion, Trinidad 7 Pot Jonah (7 Pot), Chocolate 7 Pot (Dougiah) and Moruga Scorpion. They also planted seeds of Trinidad Scorpion from Herm Adams of CARDI (Caribbean Agriculture Research & Development Institute) and Bhut Jolokia from their own seed stock. So about 150 plants were grown of each variety. And they were not grown all together. They had quadrants of each variety grouped together in various areas of the field. So picture a grid with many boxes. Now picture 6 boxes of Scorpion, 6 boxes of 7 Pots, etc. in different areas of the grid. I might add also that they had great germination which was a reflection on the seed quality they used from all the sources.

**Scott: Where and how were they grown?**

Jim: I already described the layout of the field. The plants were planted in a clay field like any chiles are in New Mexico. They were irrigated and fed just like normal chiles. Nothing fancy or special. This was a research study remember so an average growing setting was all they used.



# 'Moruga Scorpion' Pepper is the World's Hottest Chile Pepper at more than 2 million Scoville Heat Units

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### Introduction

Chile peppers are members of the Solanaceae family and are one of the most popular and economically important crops in the world. Chile peppers are grown in a wide range of environments and are used in a variety of cuisines. The Moruga Scorpion is a super-hot chile pepper that is native to the state of Chihuahua, Mexico. It is the world's hottest chile pepper variety, with a mean Scoville Heat Unit (SHU) of 1,703,744. This study was conducted to determine the genetic relationships among the Moruga Scorpion and other super-hot chile peppers.




Figure 1. Fruits of super-hot varieties: (A) 7-pot and (B) Moruga Scorpion. (C) Chocolate 7-pot. (D) Bhut Jolokia.

### Methods

Chile pepper plants were grown in the PVC Field following standard agricultural practices for 150 days. To determine heat tolerance and stability, 2000 plants of each variety were tested using the High Performance Liquid Chromatography (HPLC) method. The mean SHU for each variety was determined. The genetic relationships among the Moruga Scorpion and other super-hot chile peppers were determined using RAPD markers. The RAPD profiles were generated by primer DNA1. Polymorphic bands are indicated by arrows. Lane 1: 100 base pair DNA ladder, lanes 2 through 8 are: Moruga Scorpion, Trinidad Scorpion, Chocolate 7-pot, 7-pot, Bhut Jolokia, Cayenne and Orange Habanero, respectively.

### Results

Variety	Mean Mean (SHU)	High Mean (SHU)	Low Mean (SHU)
Moruga Scorpion	1,703,744 <sup>a</sup>	2,009,231	500,130
Chocolate 7-pot	1,169,054 <sup>ab</sup>	1,853,916	973,889
7-pot	1,006,461 <sup>ab</sup>	1,291,000	773,000
Trinidad Scorpion	1,019,271 <sup>b</sup>	1,392,452	601,140
Bhut Jolokia	1,019,007 <sup>b</sup>	1,570,540	279,315

Table 1. The Mean Heat Level in Scoville Heat Units for five super-hot chile peppers. Different letters indicate significant differences (P < 0.05) among varieties according to Duncan's test.

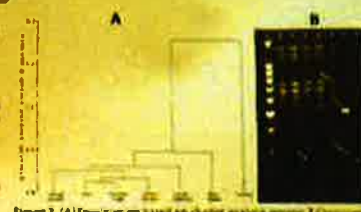


Figure 2. (A) Dendrogram based on cluster analysis among 7 Chile pepper accessions using RAPD markers. (B) RAPD profile generated by primer DNA1. Polymorphic bands are indicated by arrows. Lane 1: 100 base pair DNA ladder, lanes 2 through 8 are: Moruga Scorpion, Trinidad Scorpion, Chocolate 7-pot, 7-pot, Bhut Jolokia, Cayenne and Orange Habanero, respectively.

### Objectives

Determine the genetic relationships among the Moruga Scorpion and other super-hot chile peppers.

### Acknowledgements

We thank the staff of the PVC Field for their assistance in growing the plants. We also thank the staff of the Plant and Environmental Sciences Department for their assistance in the laboratory.

Poster with an overview of data. [Please click on this image to view it in larger detail.](#)

**Scott:** Was there a true "random" sample of chiles chosen that were tested?

**Jim:** Before I answer this, I want to point out that this was a complete study of super-hots. Things like germination rates, growth patterns, rate of growth, disease and pests, fruit development and production were observed and documented. Then after fruit harvest, they did genetic testing and Scoville heat testing. Growing the plants in different areas of the field and selecting large amounts of peppers from each plant made it truly random. Instead of just testing a pod or two here and there, they would make a pepper sample up of 20-25 peppers from one plant. Doing this could give you a lower heat rating; all plants have both low and high number peppers. So by mixing a whole group of peppers together, you really are getting the true average of a whole plant. This has never been done this way before. Usually it's just a few pods.

**Scott:** How many independent labs were used for testing?

**Jim:** After they did their own testing, they sent portions of their large samples to two other independent labs to verify their findings.

**Scott:** How thorough was the testing?

**Jim:** They did a lot of testing. That's why they grew about 150 plants of each variety. When you say thorough, I can say you have to be thorough if you're willing to let two other labs verify your findings. If not, then you're wasting your time and money. New Mexico State University with their Chile Pepper Institute is the leader in chile pepper research, so they have the highest standards. And one more thing: you don't send out your entire testing protocol and data to be reviewed by Horticulture Science magazine and your peers if your not thorough. Paul Bosland has been published by them before. So I think he knows what thorough is.

**Scott:** What kind of DNA testing was done?

**Jim:** I am not a genetics guy but they found out that the Trinidad 7 Pot and Chocolate 7 Pot were closely related. The Trinidad Scorpion was the only chile close to the 7 Pots but not that close. The Moruga Scorpion was way off on its own. And the Bhut Jolokia was so far distant from the other super-hots it wasn't even a distant cousin. Funny things is the Bhut Jolokia is pretty close to the Orange Habanero!

**Scott:** Did anything surprise you about the results?

**Jim:** Well I did not expect an over 2 million SHU high record number for any pepper. But I did expect the Moruga Scorpion to be the hottest. When Marlin tested them last year we had a group of de-seeded pods score 1,416,000! Keep in mind most of the inner placental tissue that holds the capsaicin was missing for this test. So I can only imagine what could have been if the pods were not cleaned. Maybe 1.6 to 1.7 million?? It also surprised me that the Bhut was closely related to the Orange Habanero genetically.

## Results

Variety	Mean Heat (SHU)	High Heat (SHU)	Low Heat (SHU)
Moruga Scorpion	1,207,764A <sup>2</sup>	2,009,231	580,198
Chocolate 7-pot	1,169,058AB	1,853,936	923,889
7-pot	1,066,882AB	1,291,800	727,680
Trinidad Scorpion	1,029,271B	1,392,452	801,180
Bhut Jolokia	1,019,687B	1,578,548	279,315

**Table 1. The Mean Heat Level in Scoville Heat Units for five super hot chile peppers. <sup>2</sup>Different letters indicate significant differences (P<0.05) among varieties according to Duncan's test.**

**Scott:** It seems like some people are still unclear on this issue, so please explain what the numbers mean: high heat, low heat, mean heat and average heat. What numbers should be the ones we care about and what really matters in the long run?

**Jim:** Here's what matters, Scott. The high record number of the Moruga Scorpion tells us that we have the possibility of getting that number of heat. Because it has happened. The low number tells us that every now and then we will get weak peppers and that is true for any variety. But the average or mean number is what we will get most of the time when growing it.

I tell my customers if they ask me how hot is the pepper. I tell them here is it's high record number which is a possibility because we have proof that it can get that high. And here is the average which is most likely what they will get. If they ask me how low it may get which they rarely do I will tell them that, too. But really they just want to know how hot it could get. They want to know how hot! That's why we have records. Records are not the norm but people want them.



*Moruga Scorpion chile pepper plants*

**Scott:** Why do you think some people are so critical with the results of these tests, when they were so open to the single-pepper HPLC tests done the past couple of years with the Infinity Chilli, the Naga Viper, and the Australian testing of the Trinidad Scorpion Butch T?

**Jim:** I don't know, Scott. None of the past three records verified their testing with another lab. Two of them were made up hybrids that could not be possible because it takes seven generations to create a variety! I think all the numbers confuses some people. But it's being honest. Nobody knows the low or average numbers for the other record holders. The Chile Pepper Institute did a research study while these others were just seeking a record.

Some will say that CPI was after a record. I say well what does a plant field study have to do with a record? What does genetic testing have to do with a record? This was a complete study sent off to be published by *Horticultural Science* magazine. This was not a quickie attempt at the next pepper heat record. Did they think there was a possibility of a record? Probably so. A new record

only helps the industry. It also will bring more attention and possibly funding to the institute. CPI supports chile growers all over the world through research. I don't know why anyone would not wish to see them do well.

**Scott: Jim, someone asked you why you questioned the records from the UK but not others?**

Jim: I said earlier the Infinity and Naga Viper were instant hybrids which is scientifically impossible. It takes 7 generations to create a new variety, not a year or two. Also there was no other lab to verify tests. The Bhut Jolokia test was done by CPI and was done the right way. Now I did not question the Butch T because me and Marlin got numbers very close to it in 2010. So we knew it was possible. Also the Scorpion was already a real variety. So nothing at all against England.



*Moruga Scorpion pods*

**Scott: What are, if any, the differences between the Trinidad Scorpion Butch T and the Trinidad Moruga Scorpion? What are they technically - different varieties? Strains?**

Jim: As I said earlier, genetics says they are very different. They also look completely different. Morugas are larger, more consistent in shape and have a rougher skin texture. Trinidad Scorpions or Butch T Scorpions (both are same just different names) are smaller, smoother and sometimes get the long skinny scorpion tails. But there is one similarity. Both have that fruity and floral like flavor. Some say they taste almost the same.

**Scott: Of course, the questions everyone are going to ask: how can someone get some of these Moruga Scorpion chile peppers? Where can they buy the plants, the individual chiles or the seeds?**

Jim: I have seeds of all the varieties studied at my website, [www.superhotchiles.com](http://www.superhotchiles.com), right now! I will have plants of all of them in April. Right now I am growing some in a greenhouse for produce that might be ready as early as May 2012. Then I plant a few more acres in April in three locations in California and one location in Missouri. These fields will be full of Scorpions and 7 Pots and should be ready August through November 2012.

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To view an enormous array of hot chile photos in the world go visit Jim's site at [www.refiningfirechiles.com](http://www.refiningfirechiles.com).

In addition to growing and chile peppers, Jim strongly supports [Youth Venture Teen Centers](#), a community-based, Christ-centered, guidance program open to all youth between the 6th and 12th grade based in Southern California. You can learn more about them by watching this short video: