

***Parabuthus granulatus* identified as the most venomous scorpion in South Africa:**

Motivation for the development of a new antivenom

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- The currently available South African scorpion antivenom is manufactured from the venom of *Parabuthus transvaalicus*.
- The efficacy of this antivenom is questionable.
- At best, a moderate therapeutic effect is only seen 4 – 6 hours post administration.

Objective

- Due to the questionable efficacy of the currently available antivenom a study was undertaken to identify the scorpion species responsible for cases of severe scorpionism in order to:

facilitate and/or motivate for the development of a more effective and rapid-acting antivenom.

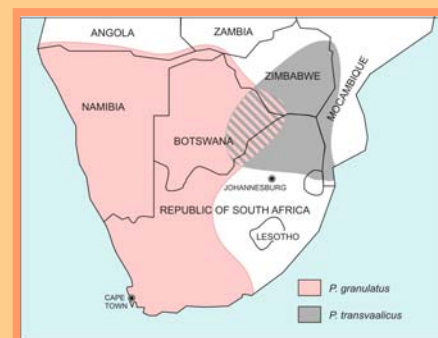
Methods

- A study of all cases of **scorpionism** (scorpion sting associated with systemic toxicity) dealt with by the Tygerberg Poison Information Centre over a period 20 years (1990 to 2010) was undertaken.
- The **geographical locations** of all cases, were recorded.
- Where available **scorpions were identified**

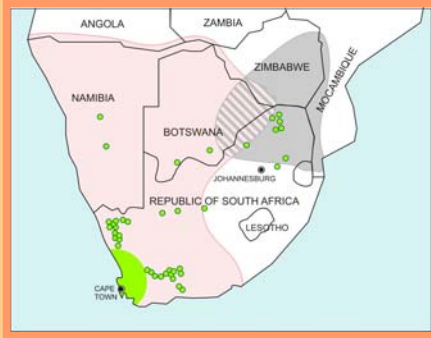
Results

- Of the 148 cases studied, 90% occurred in the Western & Northern Cape provinces.
- In 38 of the 148 cases, the scorpion was available for identification.
- **All of the 38 specimens were identified as *Parabuthus granulatus*.**

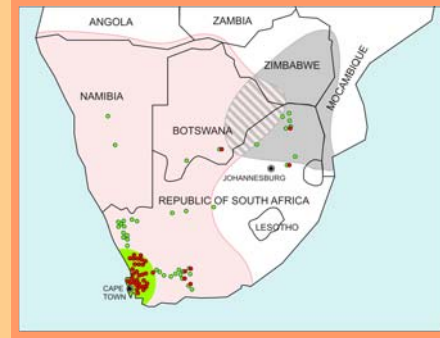
Geographical distribution of *Parabuthus granulatus* and *P. transvaalicus*



Geographical distribution of 148 cases of severe scorpionism.



Geographical distribution of the 38 identified scorpions.



Discussion

- The syndrome of serious scorpion envenomation is characterized by copious oral and pharyngeal secretions and symptoms and signs of bulbar paralysis.
- The result is loss of protective laryngeal / upper airway reflexes, difficulty in swallowing, upper airway obstruction, aspiration and respiratory failure.
- Children are particularly vulnerable, with a mortality rate of 12 – 15%.

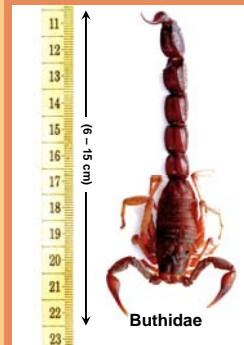
- Death may occur within 1 – 2 hours post envenoming – often while the patient is on route to a medical facility.
- To reduce morbidity and mortality, prompt respiratory support and administration of an effective antivenom is crucial.
- If antivenom is not administered, the toxic syndrome may last days to a week before clearing up.

Scorpions

- South Africa has a rich scorpion fauna with 127 species.
- Most scorpions stings are relatively harmless and cause mild to moderate local pain only.

Venomous scorpions

Thin pincers & thick tail



Less venomous scorpions

Thick pincers & thin tail



Four scorpion families occur in South Africa:

- Buthidae (34%)
- Scorpionidae (42%)
- Liochelidae (21%)
- Bothriuridae (2%)

The potentially dangerous and medically important species belong to the family **Buthidae**.

Seven Buthid genera occur in South Africa:

- *Parabuthus*
- *Uroplectes*
- *Hottentotta*
- *Pseudolychas*
- *Lychas*
- *Karasbergia*
- *Afroisometrus*

Parabuthus is medically the most important.

- Of the *Parabuthus* species, 22 are endemic to southern Africa.
- Some of the larger species in this genus include:

<i>P. granulatus</i>	<i>P. transvaalicus</i>
<i>P. capensis</i>	<i>P. raudus</i>
<i>P. villosus</i>	<i>P. kalaharicus</i>
<i>P. schlechteri</i>	<i>P. mossambicensis</i>

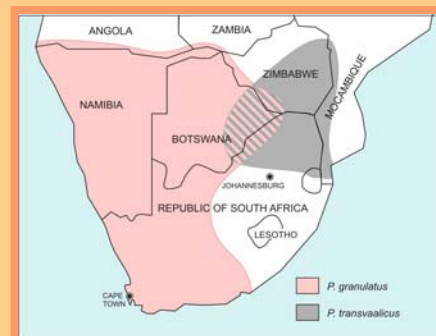
- It was assumed until recently that all of the above larger *Parabuthus* species are equally venomous.
- However, we now know that only two spp, namely *P. granulatus* and *P. transvaalicus*, can cause serious envenoming.
- We now also know that, although *P. transvaalicus* may cause significant systemic envenomation, *P. granulatus* is the no 1 culprit, causing life-threatening scorpionism.
- This finding has also recently been supported by LD₅₀ experiments in mice. (Current PhD study)

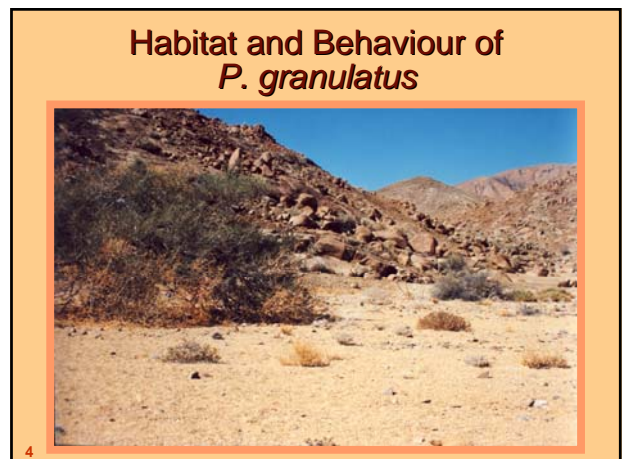
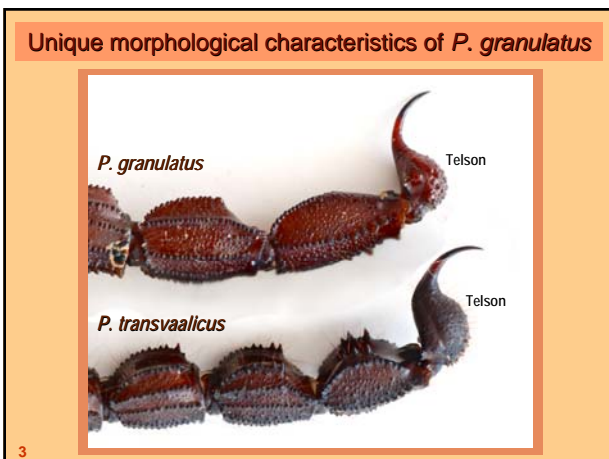
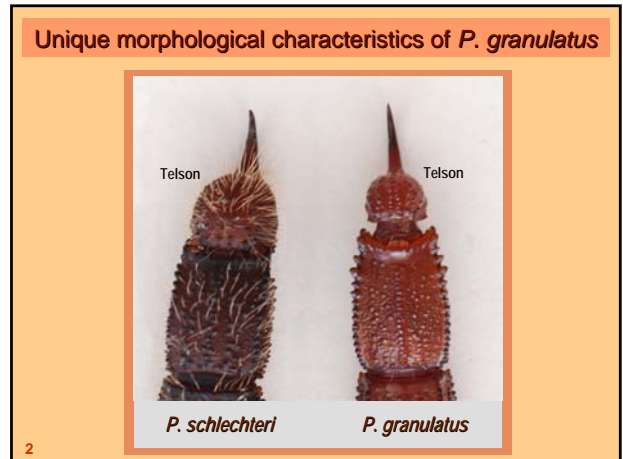
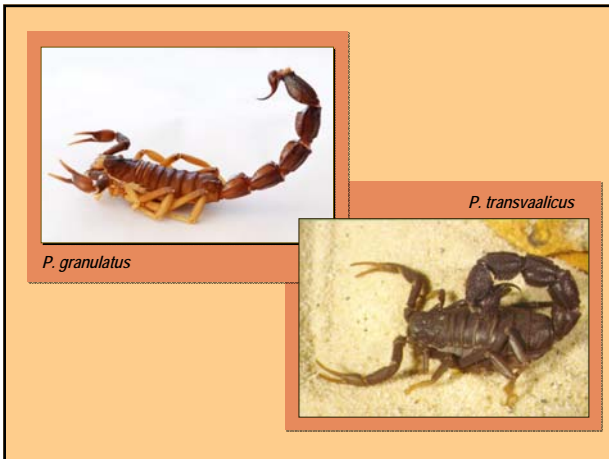
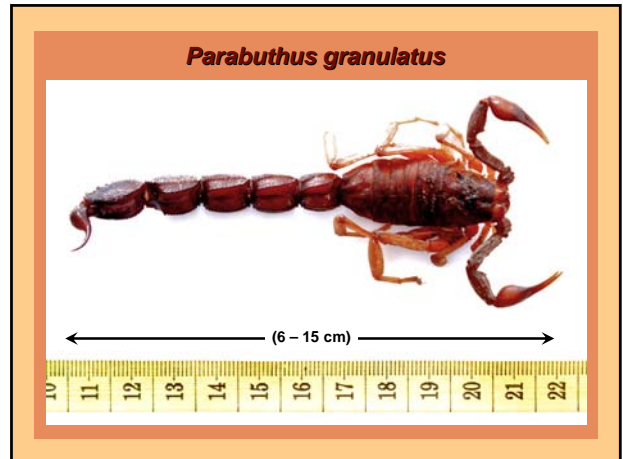
LD₅₀ values of the venom of 5 *Parabuthus* scorpion species.

Experiments performed on adult Balb C mice.
(Meier and Theakston, 1986)

Scorpion Species	LD ₅₀ Values mg/kg
<i>Parabuthus granulatus</i>	1,56 mg/kg
<i>P. transvaalicus</i>	4,25 mg/kg
<i>P. schlechteri</i>	> 20 mg/kg
<i>P. capensis</i>	> 20 mg/kg
<i>P. mossambicensis</i>	> 20 mg/kg
<i>Centruroides noxius</i> (control venom)	1,19 mg/kg

Geographical distribution of *Parabuthus granulatus* and *P. transvaalicus*







In Conclusion

- *P. granulatus* has now for the first time been positively identified as the most venomous scorpion species in southern Africa.
- It is important to note that *P. transvaalicus* (the venom of which is used in the production of the current antivenom) does not occur in the Western and Northern Cape, regions known for a high incidence of scorpionism.

- The most probable reason for the sub-optimal efficacy of the antivenom is that the venom of the wrong scorpion is used in its production
- In light of this, a strong case exists for the development of a specific *P. granulatus* antivenom, or the inclusion of both *P. granulatus* and *P. transvaalicus* venom in the production of a more effective polyvalent antivenom.

