

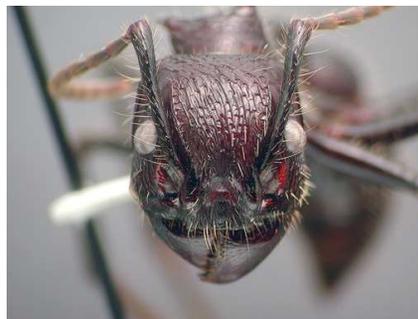
## Princess Bala's sting

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**'Zookeepers are trained to inspect and monitor service portal perimeters before opening and while inserting their arms. Always use long forceps to change food dishes or remove debris.'** Against which animal could these warnings be for? A ferocious feline? A vicious viper? A ruthless rodent? Nope. An ant. *Paraponera clavata*, otherwise known as the bullet ant. Bullet ants are jet black and about 25mm in length. They are amongst the most primitive of the ant species: their social organisation is envied by no other species of ant and their queen is barely larger than her subjects. Princess Bala in the famous movie *Antz* was named so after the Spanish 'bala' meaning 'bullet'. And the bullet ant is also known as the bala ant for the same reason.

One of the first descriptions ever of a bullet ant's sting on a human, was made in the 1920s by the Belgian natural historian Joseph Charles Bequaert (1886-1982). Such a sting is extremely painful and often compared with the pain caused by a bullet shot – hence the name bullet ant. For those who have not been shot but rather stung by a wasp, the pain caused by the sting of a bullet ant is 30 times worse... The ants do this by way of a retractable syringe-like lance on their abdominal tip from which they inject a potent nerve toxin into prey or enemies. The debilitating pain lasts for 3 to 5 hours and only lessens the following day. Trembling, perspiration, nausea and paralysis of the injured member are also frequently part of the bargain, and multiple stings can lead to death.

The nastiness of the sting is due to a very small neurotoxin peptide: poneratoxin. Poneratoxin was first described in the early 1990s when an effort was being made to find natural substances which could lead to the development of insecticides and new types of muscle-relaxing compounds. Poneratoxin is the major active neurotoxic compound in ant venom. It causes slow and long-lasting contractions of mammalian smooth muscles, blocks synaptic transmission by changing the kinetics of the voltage-dependent sodium channels and affects the excitability of insect axons. At low concentrations, these effects are reversible.



*Paraponera clavata*

Courtesy of Chris Schmidt

One venom reservoir holds 1 $\mu$ g of poneratoxin; for a small insect this is enough to block transmission irreversibly if the venom is injected straight into the creature's central nervous system. For a vertebrate, it has been estimated that 30 bullet ant stings per kg is enough to kill. It is believed that poneratoxin accounts for the paralysis, death and uncontrollable trembling of a subject but the severe and long-drawn-out pain is probably the achievement of another neuroactive fraction of the ant's venom.

More research will undoubtedly lead to the development of new drugs and insecticides. The Indians of Central America, however, did not wait for the era of genetic engineering to address their ails and pains. Bullet ant stings

have been used for centuries to treat rheumatism and similar afflictions besides being administered during tribal manhood rituals. The ant itself has very strong mandibles that can serve as a suture. It is left to bite close to the

wound; its head is then twisted off and the pincers hold the wound tightly closed. And the ant's saliva causes the skin to swell thus sealing the opening hermetically.

## Cross-references to Swiss-Prot

Poneratoxin, *Paraponera clavata* (Bullet ant) : P41736

## References

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