Amateur venom-extraction business may hasten extinction of scorpions

Alireza Zamani, Ilari Eerikki Sääksjärvi & Lorenzo Prendini

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Abstract. The pharmacological utility of various biochemical compounds in scorpion venom offers promise in several research fields but its potential economic value has placed pressure on scorpion populations already threatened by habitat destruction and overharvesting for the international trade in exotic pets. Since at least 2016, several countries in Africa and Asia reported an increase in the number of people investing in farms for maintaining scorpions and extracting ('milking') their venom for commercial use. In addition to serious doubts about the quality of the venom extracted at these farms, repeated collecting of wild specimens may denude an area of scorpions. Given estimates of a million species threatened with extinction over the next decade, unsustainable overexploitation remains a major driver of biodiversity loss. The amateur venom-extraction business has the potential to adversely affect scorpion biodiversity in several biologically rich but poorly documented countries, which calls for urgent action from governments, universities and scientific societies to enhance the conservation of local scorpions. The following activities should thus be initiated or expanded: faunistic surveys and developing national lists of endemic species, red-listing threatened and endangered species using the IUCN Red List categories and criteria, educating local communities, and ceasing to issue permits for the collection of scorpions for commercial exploitation of any kind.

Key words: biodiversity, conservation, Iran, Middle East, Scorpiones, venom milking

Zusammenfassung. Die Giftentnahme durch Amateure kann das Aussterben von Skorpionen beschleunigen. Der pharmakologische Nutzen verschiedener biochemischer Bestandteile von Skorpiongift ist für mehrere Forschungsbereiche vielversprechend, aber sein potenzieller wirtschaftlicher Wert hat die Skorpionpopulationen unter Druck gesetzt, die bereits durch die Zerstörung von Lebensräumen und die übermäßige Entnahme für den internationalen Handel mit exotischen Haustieren bedroht sind. Mindestens seit 2016 meldeten mehrere Länder in Afrika und Asien eine Zunahme der Zahl der Personen, die in Skorpionfarmen investieren um deren Gift für kommerzielle Zwecke zu extrahieren („melken"). Es gibt erhebliche Zweifel an der Qualität des auf diesen Farmen gewonnenen Gifts. Zusätzlich kann das wiederholte Sammeln die natürlichen Populationen ernsthaft gefährden. Es gibt Schätzungen, dass eine Million Arten im nächsten Jahrzehnt vom Aussterben bedroht sind. Die nicht nachhaltige Übernutzung ist ein Hauptgrund für den Verlust der biologischen Vielfalt. Das Geschäft mit der Giftextraktion hat das Potenzial, die Artenvielfalt von Skorpionen in artenreichen, aber unzureichend untersuchten Ländern nachteilig zu beeinflussen. Dies erfordert dringend Maßnahmen von Regierungen, Universitäten und wissenschaftlichen Gesellschaften, um den Schutz der lokalen Skorpione zu verbessern. Es sollten faunistische Erhebungen durchgeführt werden, nationale Listen endemischer Arten erstellt werden, bedrohte und gefährdete Arten mithilfe der Kategorien und Kriterien der IUCN in Roten Listen geführt werden, die örtlich Verantwortlichen geschult werden und das Sammeln von Skorpionen zur kommerziellen Verwertung jeglicher Art nicht mehr genehmigt werden.

Scorpions are among the most iconic arthropods, inspiring fear and fascination. The scorpion fossil record dates back 435 million years to the Silurian, since which time these arachnids have hardly changed morphologically (Dunlop et al. 2008). Currently comprising over 2500 extant species, scorpions occur on all major landmasses except Antarctica and New Zealand, in a range of habitats, including deserts, savannas, temperate and tropical forests, caves, and the intertidal zone (Polis 1990, Dupre 2021).

All scorpions are predators which use their venom to subdue and paralyze prey, as well as for defense. Envenomation by scorpions, known as scorpionism, is a significant source of mortality and morbidity in several parts of the world. More than 100000 envenomations, including around 200 fatalities, are recorded annually (Chippaux & Goyffon 2008). Nevertheless, fewer than 50 scorpion species possess potentially fatal toxins: out of 104 medically-important scorpion species, only 32 were assigned to the most severe sting classes II and III by Ward et al. (2018).

Scorpion venoms are diverse and complex in structure, containing phospholipases A2, serine proteases, metalloproteases, lipolysis activating peptides (LVPs) and hyaluronidases, proteins and peptides (antimicrobial and toxic peptides performing on ion channels). The pharmacological utility of various biochemical compounds in scorpion venom offers promise in several research fields, including biotechnology, cancer therapy, and treatment of neurodegenerative and cardiovascular diseases (Kazemi & Sabatier 2019). Although the venoms of only a small fraction of scorpion species have been studied in any detail (Ortiz et al. 2015), the potential economic value of scorpion venom has placed new pressure on scorpion populations, adding to existing threats such as habitat destruction and degradation, as well as overharvesting for the commercial trade in exotic pets, souvenirs and, in China and Southeast Asia, for food (Prendini 2001a, 2003, Prendini et al. 2003, Prendini & Loria 2020, Fig. 1).

Since at least 2016, several countries in Africa (e.g. Egypt and Kenya) and Asia (e.g. Afghanistan, China, Iran, Iraq, Pakistan and Sri Lanka) reported a dramatic increase in the number of people collecting, supplying or investing in farms for maintaining scorpions and extracting ('milking') their venom for commercial use. In Iran, where the trend appears to be particularly acute, the concept was originally promoted via social media, but Iranian state media soon began to claim that entrepreneurs could earn up to US$10 million per liter of venom (Alijani 2018). Simultaneously, businesses devoted to training people in captive husbandry and rearing, marketing and bulk distribution of live scorpions, began to flourish. As the situation escalated, farms housing up to 12000 scorpions appeared (MashreghNews 2018, Fig. 1). Smugglers value scorpions based on body weight and deceive amateurs into purchasing common, large-bodied 'exotic' species at inflated prices, as happened with the Emperor Scorpion, *Pandinus imperator* (C. L. Koch, 1841), a large African species commonly

Alireza ZAMANI, Ilari Eerikki SÄÄKSJÄRVI, Zoological Museum, Biodiversity Unit, 20014 University of Turku, Finland;
E-mails: zamani.alireza5@gmail.com, ileesa@utu.fi
Lorenzo PRENDINI, Scorpion Systematics Research Group, Division of Invertebrate Zoology, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, U.S.A.; E-mail: lorenzo@amnh.org

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Fig. 1: a-c. Harvesting of CITES-listed Emperor Scorpions, *Pandinus imperator* (C. L. Koch, 1841), for the international trade in exotic pets. **a, b.** Wild caught animals in Cameroon; **c.** Shipment seized by customs authorities in Poland (2006); **d.** Hundreds of *Mesobuthus eupeus* (C. L. Koch, 1839) specimens collected from an illegal scorpion farm in Iran. Photos by Peter Nsonge (a, b), Polish Customs Service (c) and Alireza Shahrdari (d)

available in the exotic pet trade (Fig. 1), but highly sought-after in Iran for venom milking. Considering the short timeframe during which this market developed and the fact that it takes many years for the larger scorpion species to reach sexual maturity (Prendini 2001a, Prendini et al. 2003), it may reasonably be assumed that most if not all the scorpions in these farms were wild-caught despite claims to the contrary.

The majority of scorpion species are local or regional endemics, inhabiting particular substrates or geological formations and known from one or a few localities (Prendini 2001b, Barahoei et al. 2020). The world scorpion fauna remains poorly sampled, especially in Africa and Asia, with new species regularly discovered. Few studies have addressed the conservation status of scorpions. Despite a massive international trade in these arachnids, only five species are protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 2020). Stricter regulation of the harvesting of wild scorpions by the conservation authorities of several countries (e.g. Iran and Pakistan) has not impacted the venom-extraction business, which continues to escalate illegally. For example, although the Iranian Department of Environment permits legal harvesting and venom-extraction from six scorpion species (Fig. 2), this is difficult to enforce due to the limited expertise available to verify the taxonomic identity of material harvested and traded commercially. For similar reasons, entrepreneurs are unlikely to discriminate but rather to collect all individuals encountered.

It is not difficult, using modern methods of ultraviolet light detection, to collect hundreds or thousands of scorpions in a single night. Repeated collecting may rapidly denude an area of scorpions. Given the often geographically restricted distributions, substratum-specific and philopatric nature of

Fig. 2: Scorpion species targeted for venom-extraction in Iran. **a.** *Scorpio townsendi* (Pocock, 1900); **b.** *Odontobuthus doriae* (Thorell, 1876); **c.** *Hottentotta saulcyi* (Simon, 1880); **d.** *Mesobuthus phillipsii* (Pocock, 1889); **e.** *Hemiscorpius lepturus* Peters, 1861; **f.** *Androctonus crassicauda* (Olivier, 1807). Photos by Soheyl Sami (a, b) and Alireza Zamani (c-f)

scorpions, as well as their K-selected life history, including long generation times and relatively small brood sizes, by arthropod standards, many scorpion species will be slow to repopulate and some could be exterminated altogether by continued harvesting (Prendini 2001a, 2001b, 2003, Prendini et al. 2003, Prendini & Loria 2020). As such, wild harvesting of scorpions is unlikely to be sustainable. For similar reasons, concerning the specific ecological requirements and longevity of scorpions, captive breeding programs, whether for commercial venom-extraction or conservation efforts, are unlikely to be successful for most species.

Additionally, there are serious doubts about the quality of the venom being extracted at amateur scorpion farms, including the likely possibility that the venom of heterospecific scorpions is being pooled. As such, the value of this venom on the international market is highly questionable, raising the possibility that venom extracted from wild-caught scorpions will be impossible to sell. Scorpion venom is indeed expensive, but there is little market for it, less so for venom of dubious quality. Several international venom suppliers confirm having been contacted by Iranian scorpion farmers but are not interested in purchasing amateur products (Alijani 2018). As such, the venom business may imperil scorpion biodiversity for no purpose.

Today, we face the greatest biodiversity loss ever recorded, as it is estimated that a million species are threatened with extinction within the next decade (IPBES 2019). Unsustainable overexploitation is a major driver of biodiversity loss,

especially in biologically rich but poorly documented countries. Without urgent action, we may witness the extinction of many remarkable species in the near future. In addressing the threat to scorpion populations, we recommend that governments, universities and scientific societies rapidly take steps to enhance the conservation of local scorpions, by initiating or expanding faunistic surveys and developing national lists of endemic species, red-listing threatened and endangered species using the IUCN (2001) Red List categories and criteria, educating local communities and ceasing to issue permits for the collection of scorpions for commercial exploitation of any kind.

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