Wallace's Giant Bee for sale: implications for trade regulation and conservation

Article *in* Journal of Insect Conservation · November 2018

DOI: 10.1007/s10841-018-0108-2

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https://doi.org/10.1007/s10841-018-0108-2

SHORT COMMUNICATION

Wallace's Giant Bee for sale: implications for trade regulation and conservation

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Received: 17 September 2018 / Accepted: 17 November 2018

Abstract
The recent rediscovery of what is perhaps the most iconic and the world's largest wild bee species, endemic from just a handful islands in Indonesia, represents a major finding and opens up new avenues for conservation research on this species thought to be extinct. But there is one twist in this otherwise positive insect conservation tale: two female specimens of *Megachile pluto* collected on Bacan (Indonesia) in February and on Halmahera (Indonesia) in September 2018 (respectively) appeared on an international online auction site, and fetched several thousands of US$ each to private collectors. These online sales marks a new chapter in bee conservation, and will likely present important new policy and scientific challenges to protect this species from extinction. Indeed, while Wallace's Giant Bee is currently red listed according to the International Union for Conservation of Nature, the international trade of this species is currently not restricted as it does not appear on the appendices of the Convention on International Trade in Endangered Species. Wider implications are discussed to highlight how the case study of Wallace's Giant Bee also applies to other threatened insect species subject to international trade, and how conservation actions should be developed.

Keywords Insect trade · IUCN · CITES · Insect conservation · Policy · Island biodiversity

Wallace's Giant Bee—the Dodo of the bee world

Islands have always fascinated scientists and their exploration has been central in the development of the theory of evolution by natural selection in the mid-nineteenth century. Onboard the H.M.S. Beagle, Charles Darwin investigated the unique array of animals and plants on the Galapagos Islands, while Alfred Russel Wallace ventured in the remote islands of the Malay Archipelago (Singapore, Malaysia, Indonesia and East Timor). Many of the specimens they collected have been key to crafting ideas which today underpin the entire edifice of evolutionary theory. Many of these specimens were also unique as they represent species found nowhere else on Earth, and a minority of them have seldom been recorded since the Victorian era.

Wallace, co-discoverer of evolution by natural selection, collected specimens of several thousands of animal species new to science in the Malay Archipelago, and also sold specimens in order to make a living (Quammen 1997). During a longer stay on the Bacan Island of the Moluccas (Indonesia) in 1859, Wallace managed to get hold of what he described as "a large black wasp-like insect, with immense jaws like a stag-beetle" (Wallace 1869). The specimen was described a year later by the British entomologist Frederick Smith as a new species of wild bee known today as *Megachile* (*Callomegachile*) *pluto* (Smith, 1860) (Megachilidae) (Smith 1861). This would have been "just another report of a new species to science" had the species not been identified as the largest known living bee species on Earth [females may reach a length of 38 mm (1.5 in.), with a wingspan of 63.5 mm (2.5 in.)] (Fig. 1), periodically referenced in lists of "megabugs" and other amateur naturalists' classifications of the world's largest insects species.

There had been no confirmed records of Wallace's Giant Bee and the species was therefore presumed extinct (Wells et al. 1983), until Adam Catton Messer reported the findings of previously undocumented males, as well as females in 1981, and confirmed that *M. pluto* was a narrow endemic species found only on three islands of the North Moluccas in Indonesia: Bacan, Halmahera and Tidore. Messer (1984)

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Published online: 20 November 2018

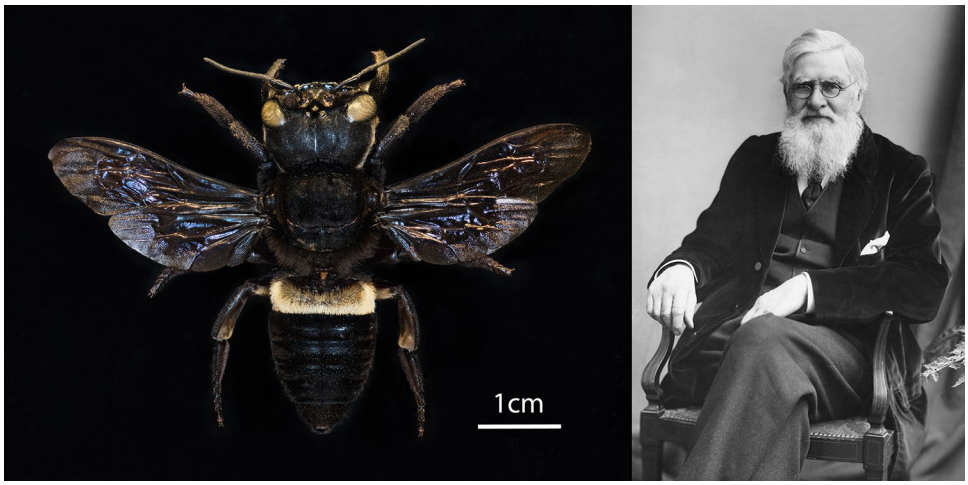

Fig. 1 Left: Female of *Megachile* (*Callomegachile*) *pluto* (Smith, 1860), here a specimen collected in the Moluccas islands (Indonesia) in 1953 and curated at Naturalis in Leiden (Netherlands) (Photograph by NJ Vereecken). Right: Portrait of Alfred Russel Wallace [London Stereoscopic & Photographic Company (active 1855–1922)]

also suggested that Wallace's Giant Bee was rare, and that it had presumably evolved a high degree of ecological specialisation, being seemingly associated with primary low-land forest and coastal habitats on these mountainous islands, and also to the presence of the tree-dwelling termite *Microcerotermes amboinensi* Kemner (Termitidae), whose nests are used (or "rented") by the female bees. The adaptive value of the extraordinary long mandibles and expanded labrum displayed by the females of *M. pluto* was also uncovered by Messer (1984) who reported observing nesting females gathering resin on nearby trees as primary nesting material.

With no documented records the species since Messer's (1984) re-discovery, ecologists no longer held high hopes for the continued survival of Wallace's Giant Bee, particularly in the context of extensive deforestation for the development of unsustainable forms of agriculture over the past few decades. These and other major threats all also contribute to a number of natural disasters that have plagued Indonesia, the largest archipelagic nation in the world and a major biodiversity hotspot with high levels of endemism (Cleary and DeVantier 2011). For all these reasons, *M. pluto* was assessed as Vulnerable (« VU ») by the International Union for the Conservation of Nature (IUCN) due to its restricted range (Fig. 2) and the degradation of habitats within that range, it was also featured recently in "The Search for Lost Species" campaign led by Global Wildlife Conservation (GWC), and listed in 2017 by more than 100 specialist groups under the Species Survival Commission at the IUCN among the "World's Top 25 "Most Wanted" Animals for Conservationists".

International trade of a threatened species

Wallace's Giant Bee has unexpectedly reappeared on the radar on March 19, 2018 in two very different ways from within its known historical range. An informal initiative led with my fellow bee conservationists to digitize the very few available records in accessible museum collections across the world has allowed me to discover a pinned female specimen collected by the French-born entomologist Roch Desmier de Chenon in 1991 on the island of Halmahera, and curated at Naturalis in Leiden (Netherlands). And on the exact same day, I found out that a single female specimen freshly collected on Bacan in February 2018 appeared on an international online auction site. The specimen sold to an anonymous private collector for US$ 9100 (ca. 8000 €) on March 24, 2018 after the price rose as high as US$ 39,000

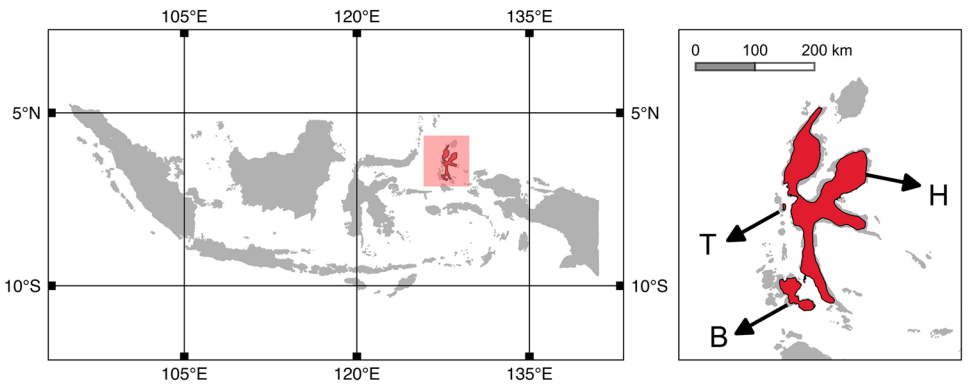

Fig. 2 World distribution of *Megachile* (*Callomegachile*) *pluto* (Smith, 1860): Wallace's Giant Bee is only known from three islands of the North Moluccas in Indonesia: Bacan (B), Halmahera (H) and Tidore (T) (Messer 1984; Kuhlmann 2014)

(ca. 34,250 €) during the bidding process. More recently, on September 16, 2018, a second specimen of *M. pluto* was sold for US$ 4150 (ca. 3645 €) on the same online auction site.

The sales of these specimens will undoubtedly mark a new chapter in bee conservation, and will likely present important new challenges. Some advocated that spreading awareness on these sales is a "double edged sword", because while it informs and educates about a threatened species, it also unintentionally advertises to the insect collecting community and hobby trade, some of which operates outside the realm of laws and in less exposed arenas than international auction sites. Shortly after the end of the Victorian era in 1910, specimens of the richly coloured and extinct English race of the large copper (*Lycaena dispar* (Haworth, 1802), Lycaenidae) fetched as much as £200 (an enormous amount of money back then), and some of today's rarest butterflies including the Large Blue (*Phengaris arion* (Linnaeus, 1758), Lycaenidae) sell for hundreds or thousands of US dollars each at public insect sales (Fig. 3). Therefore, many entomologists and bee conservationists expressed their concerns about the emergence of a "market niche" for *M. pluto*, a vulnerable, red-listed wild bee species according to the IUCN, with an extremely narrow distribution range and high ecological specialization. The Nagoya Protocol on Access and Benefit-sharing (https://www.cbd.int/abs/) forbids museums to buy such specimens, even if they were to be secured for scientific study and public awareness campaigns at a given natural history museum. The online sales of Wallace's Giant Bee are also presumably considered "legal" since selling specimens is only forbidden for species listed by the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora, https://www.cites.org/), an international, voluntary agreement between governments aiming to ensure that international trade in specimens of wild animals and plants does not threaten their survival. So, one wonders why such an iconic wild bee species such as *M. pluto* did not make its way into the list, particularly in light of the obvious concerns on its extinction risk by the IUCN (Kuhlmann 2014). The fact that *M. pluto* was was considered to be extinct is probably a valid explanation for its omission in the CITES listing.

CITES is one of the world's most powerful tools for wildlife conservation through the regulation of trade. Yet the present case study on Wallace's Giant Bee exemplifies why more coherence between international trade regulation agreements and the IUCN criteria are urgently required to really contribute to the preservation of biodiversity, particularly for species facing extinction. Another example of an

Fig. 3 The wings of desire: while butterfly collecting is no longer the stock hobby it used to be up until the first half of the twentieth century, rare tropical butterflies, beetles and other insects are still high on the wish-list of the insect collecting community and hobby trade, with specimens selling for hundreds to thousands of $US (Photograph by NJ Vereecken)

apparent lack of coherence is the Bay Cat (*Catopuma badia*, Felidae), a red-listed species considered to be Endangered (EN) according to the IUCN but only listed in the Appendix II of CITES, along with all other felids that are still allowed to be traded commercially (albeit with permits for tracking the amount of trade). This situation is unsustainable and calls for immediate action: I therefore urge all State Parties of CITES to take the opportunity of the forthcoming biannual Conference of the 181 Parties (countries) (CoP18) in Colombo, Sri Lanka, from 23 May to 3 June 2019, and consider these and other IUCN–CITES incoherences without further delay. It is now a pressing issue to revise the lists of species covered by the Convention, by fully integrating IUCN red listed species into a revised version of the Appendix I on taxa that are prohibited from international commercial trade.

Preserving wild bees facing an extinction risk in different regions of the world and encouraging their scientific study—through responsible harvesting, taxonomic work and well-designed monitoring—is a pressing priority to meet our fundamental biodiversity conservation targets and safeguard their role as pollinators and our well-being (Potts et al. 2016). By and large, very little is known about the details of the ecological requirements of wild bees facing extinction risk (e.g., Nieto et al. 2014; Vereecken 2017 in Europe). Although available information suggests that *M. pluto* is generally rare and might be restricted to primary lowland forests of the Northern Moluccas, it might be able to survive in other habitats provided nesting sites and host plants are present. Its rediscovery should therefore stimulate an evidence-based reevaluation of its conservation status.

Wider implications for international trade and conservation

The present paper aims to inform inter-governmental policy through the report on a specific case study (Wallace's Giant Bee) and, more generally, to highlight the multifaceted challenges surrounding the international trade of endangered insect species. While exporting rare wildlife to satisfy the demand of wealthy insect lovers and gift shops is considered by some collectors as a significant source of income, and therefore as a solution to escape the harsh conditions of rural poverty, it is now clear that many of the currently unsustainable forms of commercial exploitation can negatively affect the reproductive output and the survival of the targeted species in their natural habitats. For insects, this also means negatively affecting the ecosystem services they provide, such as pollination or the decomposition of organic matter required to maintain soil fertility on farmland, for bees or beetles (respectively). This, in turn, can have a negative impact on ecosystem health and potentially also to the sexual reproduction and health of wild plants and crops that are directly connected to food production in rural areas.

First, it seems obvious that, besides Wallace's Giant Bee, many more of the largest, much sought after and threatened insect species need to find their way into the Appendix I of CITES (species threatened with extinction; trade permitted only in exceptional circumstances). These purely bureaucratic agreements require all CITES Parties to rapidly implement these legislative changes for wildlife conservation. Today, the Appendix I only includes three insect species, all belonging to the Lepidoptera family Papilionidae, namely Queen Alexandra's birdwing (*Ornithoptera alexandrae* Rothschild, 1907), Luzon's Peacock swallowtail (*Papilio chikae* Igarashi, 1965) and Homerus' swallowtail (*Papilio homerus* Fabricius, 1793). These butterflies are all giant, narrow insular endemics (from Papua New Guinea, Philippines and Jamaica, respectively), and Queen Alexandra's birdwing, which is considered the largest diurnal butterfly on Earth, fetched close to US$ 10,000 (ca. 8750 €) on the black market in the USA back in 2007 just before the smuggler of this endangered butterfly was arrested.

Second, there is an obvious need to increase incentives, to create and report on business models, and to facilitate market access to exporters specifically through the development of insect farms whenever possible. Government-led insect breeding initiatives such as the Insect Farming and Trading Agency (IFTA) set up in Papua New Guinea: this initiative proved efficient to regulate the exploitation and conservation of valuable butterflies collected in the wild and sold by and to expatriate dealers. Other butterfly farms have since been established in many tropical countries worldwide, including the Philippines, Costa Rica, Uganda, Kenya and Tanzania, nearby areas of natural forest fragments, to provide an alternative and sustainable income to rural communities. This helps to promote breeding the insects, and, to some extent at least, to divert international traders away from the most endangered species collected from the wild. However, most wild bees are notorious for being difficult—if not impossible—to breed in (semi-)captivity (Pitts-Singer and Cane 2011), and the presumed communal nesting habit of Wallace's Giant Bee in aerial termite nests (Messer 1984), along with the many unknowns of its ecological requirements, probably represent major obstacles to the development of any breeding programme.

Third, most conservation NGOs highlight the fact that a more active monitoring of international trade is hampered by the lack of national capacities. Strengthening capacities through strong commitment by the central, regional and district governments of Indonesia, and also through the education of officers in charge of the trade monitoring, is pivotal to detect samples of readily identifiable, protected species crossing international borders through trade.

Last, the protection of Wallace's Giant Bee and other threatened insect species subject to undesirable international trade requires significantly more efforts to set aside reserves of remaining natural habitat (see e.g., You et al. 2005), to recreate new areas of habitat, and to carry out further ecological research and education. This is particularly challenging in the context of narrow insular endemic species threatened by extinction and struggling to maintain their populations in habitats subject to illegal logging, trapping, hunting and unsustainable forms of agriculture, including oil palm plantations.

Everybody knows flagship animals like elephants, tigers and rhinos are well known, yet the case of Wallace's Giant Bee reminds us that many other animal species, particularly insects, don't receive the same attention and conservation efforts. A major update of CITES Appendices is long overdue in light of (i) the many forms of illegal trade involving readily identifiable species, and (ii) the need to strengthen the legal protection of many other insect species recognized by the IUCN as facing extinction. Needless to say, all stakeholders need to be enrolled into a more global, multi-actor platform to safeguard Wallace's Giant Bee and other threatened insect species worldwide, for the ecosystem services they provide as well as for their outstanding universal value for present and future generations. With the rise of interest for rare insect species and in a context of a high demand to supply ratio (as illustrated by the high price tags of the recent online sales discussed above), international trade should be taken into account to revise the IUCN evaluation of Wallace's Giant Bee and other species, as trade might add up to the negative effects of other threats faced by some of the most spectacular insect species on earth, such as habitat loss, resource depletion and climate change.

Acknowledgements I am grateful to Frederique Bakker, Leon Marshall and Koos Biesmeijer (Naturalis, The Netherlands) for allowing access to the specimens of *Megachile pluto* curated in Leiden, and also to Clay Bolt (World Wildlife Fund's Northern Great Plains Program), Eli Wyman (American Museum of Natural History, New York, USA) and Roch Desmier de Chenon (CSIRO) for fruitful discussions during the preparation of this manuscript. Finally, I acknowledge the constructive comments of anonymous referees of a previous version that helped improve the quality of this paper.

Compliance with ethical standards

Conflict of interest I declare no financial or non-financial conflict of interest.

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