ASIAN MYRMECOLOGY Volume 9, e009004, 2017
ISSN 1985-1944 | eISSN: 2462-2362 © James K Wetterer DOI: 10.20362/am.009004

Geographic distribution of the weaver ant *Oecophylla smaragdina*

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ABSTRACT. Weaver ants (*Oecophylla* spp.) are conspicuous arboreal ants, which build distinctive nests in trees. In many regions, people use weaver ants for food, medicine, and/or as biological control agents. There are two recognized species of weaver ants: *Oecophylla longinoda* (Latreille, 1802) in Africa and *Oecophylla smaragdina* (Fabricius, 1775) in Asia, Australia, and the Western Pacific. Here, I mapped the geographic distribution of *O. smaragdina* based on >2700 site records from 21 countries: Australia, Bangladesh, Bhutan, Brunei, Burma (Myanmar), Cambodia, China, India, Indonesia, Laos, Malaysia, Nepal, Palau, Papua New Guinea, Philippines, Singapore, Solomon Islands, Sri Lanka, Thailand, Timor Leste, and Vietnam. The vast majority of *O. smaragdina* records come from areas with Tropical (Group A) climates according to the Köppen-Geiger system: rainforest (Af), monsoon (Am), and savanna (Aw). However, >250 records come from areas classified on the map as having a Subtropical (Group C) climates, mostly in the Himalayan foothills of India and Nepal, southern China, northern Vietnam, and the southern coast of Queensland, Australia. Almost all these sites are classified as dry winter subtropical climate (Cwa). A few *O. smaragdina* sites are classified as having Arid (Group B) climates, all from warm semi-arid (BSh) areas. This range map based on site records corrects inaccuracies in earlier published range maps.

Keywords: biocontrol, biogeography, entomophagy, geographic range

INTRODUCTION

Weaver ants (*Oecophylla* spp.) are conspicuous arboreal ants, well known in the humid tropics and subtropics of Africa, Asia, Australia, and the Western Pacific. Weaver ants build large distinctive nest structures in trees by binding together bunches of leaves using a silk-like substance secreted by the larvae. Groups of *Oecophylla* workers hold the leaves together while other workers move the silk-producing larvae back and forth across the gap, effectively weaving the leaves together. The name *Oecophylla* derives from the Greek: oikos (house) and phyllo (leaf).

People use weaver ants in many regions for food, medicine, and/or as biological control agents. Although *Oecophylla* species show much geographic variation in color (including shades of green, yellow, orange, red, and brown), their appearance, behavior, and nest construction are so distinctive that the genus can be easily identified through written accounts and from photographs. Currently, there are two recognized species of weaver ants: *Oecophylla longinoda* (Latreille, 1802) in Africa, and *Oecophylla smaragdina* (Fabricius, 1775) in Asia, Australia, and the Western Pacific. Numerous papers on weaver ants (Cole & Jones

1948, Lokkers 1986, Azuma et al. 2002, 2006, Dlussky et al. 2008, Crozier et al. 2010) include basic range maps. In an earlier paper, Wetterer (submitted) examined the distribution of *O. longinoda* in Africa. Here, I document in detail the known geographic distribution of *O. smaragdina*. The epithet smaragdina derives from the Latin smaragdinus (emerald), referring to the green coloration of *O. smaragdina* queens.

The earliest known report on *O. smaragdina* can be recognized in the book "Nan Fang Cao Mu Zhuang" (Plants and Trees of the Southern Regions), reputedly written by Ji Han in 304 AD, who described the use of weaver ants in biological control: "In the market, the natives of Jiao-zhi [now part of northern Vietnam and southern China] sell ants stored in bags of rush mats. The nests are like thin silk. The bags are all attached to twigs and leaves, which, with the ants inside the nests, are for sale. The ants are reddish-yellow in color, bigger than ordinary ants. In the south, if the Gan [Mandarin orange] trees do not have this kind of ant, the fruits will all be damaged by many harmful insects and not a single fruit will be perfect" (Li 1979 in Huang & Yang 1987).

Even before Fabricius (1775) described *Formica smaragdina* (= *O. smaragdina*) based on specimens from India, James Cook (1773) gave excellent accounts of the species in Australia. Upon making landfall on 23 May 1770 at a site now called Seventeen Seventy (formerly Round Hill; 24.17°S, 151.88°E) in Queensland, Australia, Cook (1773) wrote: "We found several bogs, and swamps of salt water, upon which, and by the sides of the lagoon, grows the true mangrove, such as is found in the West Indies, and the first of the kind that we had met with. In the branches of these mangroves there were many nests of a remarkable kind of ant, that was as green as grass: when the branches were disturbed they came out in great numbers, and punished the offender by a much sharper bite than ever we had felt from the same kind of animal before." Later, in August 1770, Cook (1773: 627) observed in Australia: "Of the ant there are several sorts some are as green as a leaf, and live upon trees, where they build their nests of various sizes, between that of a man's head and his fist. These nests are of a very curious structure: they are formed by bending down several of the leaves, each of which is as broad as a man's hand, and gluing the points of them together, so as to form a purse; the viscus used for this purpose, is an animal juice, which Nature has enabled them to elaborate. Their method of first bending down the leaves, we had not an opportunity to observe; but we saw thousands uniting all their strength to hold them in this position, while other busy multitudes were employed within, in applying the gluten that was to prevent their returning back. To satisfy ourselves that the leaves were bent, and held down by the effort of these diminutive artificers, we disturbed them in their work, and as soon as they were driven from their station, the leaves on which they were employed sprung up with a force much greater than we could have thought them able to conquer by any combination of their strength. But though we gratified our curiosity at their expense, the injury did not go unrevenged; for thousands immediately threw themselves upon us, and gave us intolerable pain with their stings, especially those which took possession of our necks and our hair, from whence they were not easily driven: the sting was scarcely less painful than that of a bee; but, except it was repeated, the pain did not last more than a minute."

Weaver ants are so conspicuous and recognizable that they have local common names throughout their range. Common names used for both species of *Oecophylla* include tailor ant, red tree ant, and red ant.

English common names for *O. smaragdina* include Asian weaver ant, green ant (Australia, Papua New Guinea), and muli ant (Papua New Guinea). Common names in other languages for *O. smaragdina* include fourmi tisserande (French), kerengga (Malay), dimiya (Sinhala), semut rangrang (Indonesian), hantik (Tagalog), wong mamah (Thailand), mottdaang (Lao), angkrang or ongkrong (Cambodian), kiến vàng (Vietnamese), Kharchin-aon or 'kâ-gyin (Burmese), kilau lagah (Borneo), karrakum (Sepik), and kurakum (Tok Pisin). There are a vast number of local names in India, e.g., in Arunachal Pradesh, the ant is known as tonge or babuk (Chakravorty et al. 2016).

METHODS

I treat all *Oecophylla* records from outside Africa as *O. smaragdina. Oecophylla smaragdina* has a number of subspecies still considered valid: *Oecophylla smaragdina fuscoides* Karavaiev, 1933 (described from Java, Indonesia), *Oecophylla smaragdina gracilior* Forel, 1911 (described from Bacan, Indonesia), *Oecophylla smaragdina gracillima* Emery, 1893 (described from Bacan, Indonesia), *Oecophylla smaragdina selebensis* Emery, 1893 (described from Sulawesi, Indonesia), and *Oecophylla smaragdina subnitida* Emery, 1892 (described from Morotai, Indonesia and New Guinea). These names, however, have not been applied in any consistent manner, and the status of these taxa is unclear. In addition, Kurane et al. (2015) recently described a new *Oecophylla* species from India, *Oecophylla kolhapurensis* Kurane, Bhoje, & Satheal, 2015. The description, however, is insufficient to distinguish *O. kolhapurensis* from *O. smaragdina*. The description uses imprecise measurements (e.g., "Head 2 mm long, 1 mm broad; thorax 3 mm long") apparently taken from a single worker (as there is no range or error in the measurements), and does not actually compare these measurements to those of *O. smaragdina* workers, which are extremely polymorphic and show strong allometry. Though formal synonymisation is outside the scope of this study, I treat *O. kolhapurensis* as conspecific with *O. smaragdina*.

I obtained unpublished *O. smaragdina* site records from museum specimens in the collections of the United States National Museum of Natural History and through personal communications from M. Janda (Australia, Bangladesh, Indonesia, Laos, Malaysia, Papua New Guinea, Philippines, and Thailand), D. General (Philippines), R. Recustodio (Philippines), T. Colvin (Thailand), T. Chan (Laos), S. De Greef and numerous members of Natural Cambodia (Cambodia), J. Fellowes (China), and H. Bharti (India). In addition, I used on-line databases with collection information on specimens by the Field Museum, Antweb (antweb.org), and the India Biodiversity Portal (indiabiodiversity.org). Because the genus *Oecophylla* is so easy to recognize, I was able to obtain many site records based on photos published on-line at a variety of sites, including iNaturalist (www.inaturalist.org), Ispotnature (www.ispotnature.org), Project Noah (www.projectnoah.org), National Geographic (yourshot.nationalgeographic.com), Flickr (www.flickr.com), and Instagram (instagram.com). The first three of these sites provided locale names and geo-coordinates for all photographs, whereas the other sites only provided locale names and coordinates for some of the photographs. For photographs without locale names or geo-coordinates, I contacted the person who posted the photograph to ask for this information.

Geographic coordinates for sites came from published references, from specimen labels, geotagged photos, or I looked up the coordinates. For older references and

specimens, some site names were no longer in use or are now spelled differently; I searched, not always successfully, to determine current names.

Some occurrence records I found for *O. smaragdina* included no specific "point locales." The most significant of these are records from two provinces in China: Jiangsu (Hua 2006 in Guénard & Dunn 2012) and Sichuan (Mou 1959), which I mapped to their capitals, Nanjing and Chengdu, respectively.

To classify climates, I followed the Köppen-Geiger system which considers only precipitation and temperature variation through the year (Peel et al. 2007). Of the 30 possible climate categories, the ten that occur in and adjacent to areas occupied by *O. smaragdina* are as follows: Tropical climates (Group A; shades of blue in Figs. 1 & 2) = rainforest (Af), monsoon (Am), and tropical savanna (Aw); Arid climates (Group B; oranges and red in Figs. 1 & 2) = warm semi-arid (BSh) and warm desert (BWh); Temperate/Subtropical climates (Group C; greens and yellows in Figs. 1 & 2) = humid subtropical (Cfa), dry winter subtropical (Cwa), highland subtropical (Cwb), warm Mediterranean (Csa), and temperate Mediterranean (Csb). For more details on the Köppen-Geiger classification system, see Peel et al. (2007).

The climate of each record site I categorized according to the designations found on climate-data.org. If this site did not list a site by name, I matched each record to the closest listed site with a similar elevation, as recorded on google earth.

RESULTS

I mapped the geographic distribution of *O. smaragdina* based on >2700 site records (Fig. 1) from 21 countries, including the first published records from Bhutan and Palau (Table 1).

The single record I found of *O. smaragdina* from Palau (Table 1; identified by S. Shattuck), collected on the small island of Peleliu (13 km^2) in 1936, may represent a temporary introduction. Ant researcher Jesse Czekanski-Moir (pers. comm.) has spent three years working in Palau, including seven days collecting on Peleliu, and he has never seen *Oecophylla* in the island group. Czekanski-Moir (pers. comm.) wrote: "Palauan people actually have words for several different types of ants, including *Anoplolepis gracilipes*, *Solenopsis geminata*, and *Odontomachus simillimus*. If *Oecophylla* were known to Palauan people, I suspect I would have heard about it." J. Czekanski-Moir (pers. comm.) added "During the last glacial maximum, Peleliu and most of the ~500 islands to the North were part of a single island. Thus, if *O. smaragdina* were native to Palau, one would expect it to be distributed more widely in the archipelago." Much of Peleliu's vegetation was burned during the 2.5-month long Battle of Peleliu in 1944 between American and Japanese forces during World War II. If any *Oecophylla* were living on the island, they may have been killed off at this time.

The single record I found of *O. smaragdina* from Bhutan (Table 1) is based on a photograph posted by Vanessa McLaughlin (www.flickr.com/photos/gatos_rojos/8607316210; V. McLaughlin, pers. comm.) taken at Kharbandi Gompa, Phuentsholing, Bhutan (26.85°N, 89.39°E; 370m asl), <200m from the border with West Bengal, India. Research on the ants of Bhutan is extremely limited, so it is possible that *O. smaragdina* is actually widespread in the lowlands of southern Bhutan as well in valleys further north. The entire southern border of Bhutan is below 500m asl.

Overall, records of *O. smaragdina* spanned 66.8° of latitude, from Fugou, Henan Province, China (34.1°N; Wang 2008) and Surinsar, Jammu & Kashmir State, India

Table 1. Earliest known records for *Oecophylla smaragdina*. +no previously published records.

	Earliest record
Australia	1770 (Cook 1773)
Bangladesh	≤1925 (Mukherji & Ribeira 1925)
+Bhutan	2013 (V. McLaughlin, Flickr): Kharbandi Gompa
Brunei	1983 (P. J. DeVries, Antweb: LACMENT142773): Maura Coast
Burma (Myanmar)	1885-1887 (Emery 1889)
Cambodia	1914 (Friederichs 1920)
China	304 (Huang & Yang 1987)
India	≤1775 (Fabricius 1775)
Indonesia	1854-1856 (Smith 1857)
Laos	≤2005 (Yhoung-Aree & Viwatpanich 2005)
Malaysia	1854-1856 (Smith 1857)
Nepal	1958 (Kapur 1961)
+Palau	1936 (Z. Ono, Antweb: ANIC32-023162): Peleliu
Papua New Guinea	1896-1897 (Forel 1901)
Philippines	1854-1856 (Smith 1857)
Singapore	≤1890 (Ridley 1890)
Solomon Islands	1909 (Forel 1910)
Sri Lanka	≤1858 (Smith 1858)
Thailand	≤1903 (Bingham 1903)
Timor Leste	2003 (Trainor & Andersen 2010)
Vietnam	≤1879 (Forel 1879)

(32.7°N; H. Bharti; pers. comm.) in the north, to Seventeen Seventy, Queensland, Australia (24.2°S; Cook 1773) in the south, and spanned 98.3° of longitude, from Junagadh, Gujarat State, India (70.5°E; Tak & Rathore 2004) in the west, to Tikopia, Solomon Islands (168.8°E; Greenslade 1965) in the east. Wang (2008) reported *O. smaragdina* from numerous sites in Zhoukou Prefecture, Henan, including farmland, residential areas, woodlands, riversides, and wastelands.

Comparing the documented distribution of *O. smaragdina* (Fig. 1) with a Köppen-Geiger climate map (Fig. 2) indicates that the vast majority of *O. smaragdina* records (>2200) come from sites classified as having Tropical (Group A) climates: rainforest (Af), monsoon (Am), and savanna (Aw) (shades of blue in Fig. 2).

Fewer than 50 *O. smaragdina* sites are classified as having Arid (Group B) climates. All are from warm semi-arid (BSh) areas, and all are from India or Australia, except one, from Mandalay, Burma (Myanmar). Many of the Indian *O. smaragdina* records are from urban areas (e.g., Patiala, Dehli, Agra), whereas the Australian records are almost all from forested river gorges.

In addition, >250 records occur in areas classified on the map as having a Subtropical (Group C) climate. Almost all of these sites were classified as dry winter sub-

tropical (Cwa). In southeast Australia, the southernmost sites (23.1-24.2°S) were classified as humid subtropical (Cfa), as were most of the sites in China north of 23.0°N. Six high elevation sites (>1200m asl) in southern India were classified highland subtropical (Cwb), as were three sites in Darjeeling District, India.

On-line photographs from Flickr and Instagram alone accounted for almost 1000 of the mapped *O. smaragdina* site records. Photographs of *O. smaragdina* on Flickr and Instagram were particularly common from areas with higher density of people with smartphones, such as southwestern India, Java, Bali, peninsular Malaysia, and Australia. Unfortunately, both Flickr and Instagram are currently banned in China. *Oecophylla* is particularly amenable to such crowd-sourced information because it is both photogenic and simple to identify reliably from photographs, though I believe the same methods could be used for many other species.

DOUBTFUL RECORDS

I excluded two doubtful *O. smaragdina* records. Santschi (1919) reported *Oecophylla smaragdina* from Apia, 'Upolu, Samoa. Wilson & Taylor (1967) listed this record as doubtful. Nonetheless, Kami & Miller (1998) included this record in their list of ants from Samoa. Given the conspicuousness of this ant, it is unlikely that the extensive surveys in Samoa (e.g., see Wetterer & Vargo 2003) have overlooked any populations of *O. smaragdina* in Samoa. I also excluded a record listed on-line as from Geraldton in Western Australia, Australia (28.8°S, 114.6°E; J. Clark; Museum Victoria; http://biocache.ala.org.au/occurrences/c5e8b619-59a6-415e-b042-a18a8e7b393d) is a geographic isolated outlier located 4.6° further south than any other record. I expect that this record is actually from a different Geraldton, one in Queensland, Australia (16.6°S, 145.3°E).

While working in Zanzibar, Tanzania, Vanderplank (1959) wrote that he imported *Oecophylla* queens from South America. There are no records of *Oecophylla* in the New World, so Vanderplank (1959) must have been mistaken about the origin of his alleged South American queens.

PREVIOUS DISTRIBUTIONAL SUMMARIES

Bingham (1903) wrote that the geographic range of *O. smaragdina* included "the whole of India, Burma, and Ceylon within our limits, except the desert and treeless tracts. The range of this species extends through the Malayan subregion to Australia and New Guinea." This account seems accurate, though it omits several major areas, i.e., Nepal, China, and the Solomon Islands. Keuchenius (1914) wrote that *O. smaragdina* was widespread in tropical Asia and Polynesia, but there are actually no records known from Polynesia. Vanderplank (1959) reported that *Oecophylla* "is distributed throughout the tropics of Asia, Africa, America, Australia and is found on most Pacific Islands." *Oecophylla* is not known from the Americas nor on most Pacific Islands and is also absent in most arid tropical areas.

Several *Oecophylla* studies have included distribution maps for *O. smaragdina* (Cole & Jones 1948, Lokkers 1986, Azuma et al. 2002, 2006, Dlussky et al. 2008, Crozier et al. 2010). All the maps, however, include numerous errors. Cole & Jones (1948) incorrectly included Vanuatu within the range of *O. smaragdina*, and indicated its presence in Australia by a single point in the middle of the continent. Lokkers (1986) incorrectly included New Caledonia, Fiji, and Vanuatu in the range of *O. smaragdina* and omit-

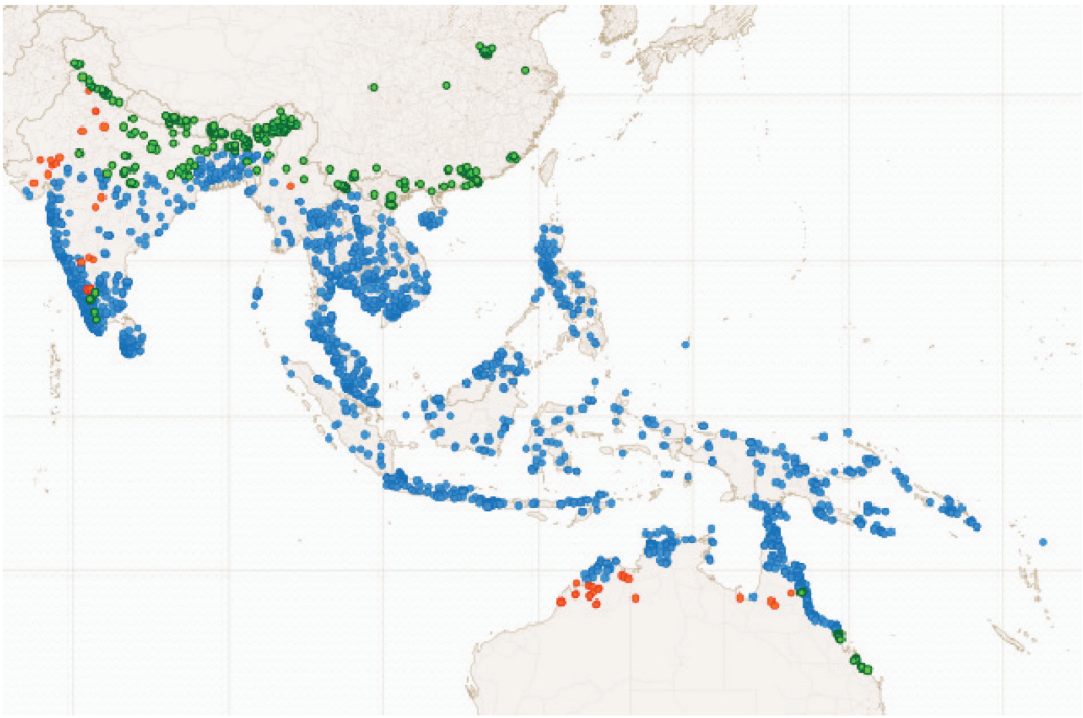

Fig. 1. Site records for *Oecophylla smaragdina* (mapped using carto.com). Records from sites with Tropical climates (Group A) = blue; with Semi-arid climates (Group B) = orange; with Subtropical climate (Group C) = green.

ted its range in north India, Nepal, Bhutan, and China. The maps of Azuma et al. (2002, 2006), Dlussky et al. (2008), and Crozier et al. (2010) correctly omitted New Caledonia, Fiji, and Vanuatu from the distribution of *O. smaragdina*, but incorrectly omitted the range of *O. smaragdina* in north India, Nepal, Bhutan, and China. Lokkers (1986) examined the climatic factors that appear to delimit the range of *O. smaragdina* in Australia, predicting a range that closely matches the actual known distribution.

DISCUSSION

Oecophylla smaragdina site records are broadly spread across regions of Asia, Australia, New Guinea, and the Solomon Islands classified by the Köppen-Geiger system as having Tropical climates (Group A) and dry winter subtropical (Cwa) climates (Figs. 1-2).

In the west (in India and Pakistan) and much of the south (in Australia), the range of *O. smaragdina* appears to be largely bounded by lands with Arid (Group B) climates. The range of *O. smaragdina* appears to extend into these more arid regions only in riparian forests, irrigated lands, and urban areas. In western India, I found no records of *Oecophylla* from the Thar Desert region that covers most of Rajasthan and much of Gujarat, in agreement with Bingham's (1903) evaluation that it is absent from "desert and treeless tracts."

In much of the north, across Himalayan India, Nepal, Bhutan, and Burma (Myanmar), the range of *O. smaragdina* appears to be largely bounded by areas classified as highland subtropical (Cwb). Although

I found no records of *Oecophylla* from Pakistan, it seems likely that it occurs there in areas which have the same dry winter subtropical climate (Cwa) as neighboring areas India where *O. smaragdina* is known (Figs. 1 & 2). High latitude would seem to limit *O. smaragdina* populations in southeastern Australia at around 24.2°S. Similarly, in China, I found numerous *O. smaragdina* site records from the four southernmost provinces of Hainan, Guangdong, Guangxi, and Yunnan, as well as Hong Kong and Macau, but I found only four isolated areas of *O. smaragdina* in China north of 24.7°N (Fig. 1). Ying (1966) reported that *O. smaragdina* from Guangdong Province, was twice imported, in 1958 and 1963, into Huang Ling Miao village (30.8°N) in Hubei Province, China. Ying (1966) noted that *O. smaragdina* could not survive outdoors in the winter in Hubei. It seems likely that *O. smaragdina* also reached the three other areas in northern China through intentional introductions and must be artificially maintained in the winter. Yet *O. smaragdina* has been found naturally occurring at many sites in the India and Nepal at latitudes of 27-32°N. This indicates that *O. smaragdina* populations in northern India and Nepal have greater tolerance for cold compared with populations in eastern China and Australia.

Collingwood (1970) reported *Oecophylla* in Nepal from trees on "the high mountainside of Tamba Kosi" (27.4°N; 1150-1450m asl). Collingwood (1970) noted that "presumably there the species must undergo some form of hibernation for periods of at least some weeks in mid winter." Winter inactivity has been reported in China. Groff & Howard (1924) wrote: "At Saisha the growers told us that their region is too cold to winter these ants but that in the Ts'ingun [Quinyuan, Guangdong Province] district a regular business has developed in the rearing of these beneficial insects for Szewui [= Sihui, Guangdong Province] fruit growers. The nests are purchased in Ts'ingun during the Chinese first and second months of the year (usually February and March), shortly before the break of spring. The ants have not yet emerged from the nests, and after the latter have been placed in the crutches of the citrus trees, some candle wax is smeared about the branches to prevent them from running away when they do venture out. At this time of year it is very easy to transport the nests, whereas if they wait until the third or fourth month, after the weather is warmer, the ants will escape in transit."

In contrast to the extensive subtropical populations documented for *O. smaragdina* (green in Fig. 1), there are very few subtropical populations of *O. longinoda* in Africa (Wetterer submitted). The highest latitude records of *O. longinoda* (28.4°S), come from coastal South Africa, less than one degree of latitude south of areas classified as having Tropical climates (Wetterer submitted).

Several studies have begun to analyze the genetic diversity of *Oecophylla*. Azuma et al. (2002, 2006) sequenced DNA from numerous populations of *O. smaragdina*, using two populations of *O. longinoda* as outgroups, and found seven geographically distinct *O. smaragdina* clades (1 = southern Indian, 2 = Indochina Peninsula, 3 = Philippines, 4 = Flores, Indonesia, 5 = Sulawesi, Indonesia, 6 = Halmahera, Indonesia, 7 = Australia and New Guinea). These genetic analyses did not include samples from populations in many parts of the known range of *O. smaragdina*, e.g., Solomon Islands, Nepal, northern India, and China. It is possible that cold-tolerant *Oecophylla* from subtropical climates in northern Asia are a separate species, though none of the currently valid subspecies of *O. smaragdina* are known from these areas. Genetic analyses are needed.

Some populations in China have been introduced for biological control (e.g., see above). In addition, Young (2001) wrote that in Papua New Guinea, "unsuccessful

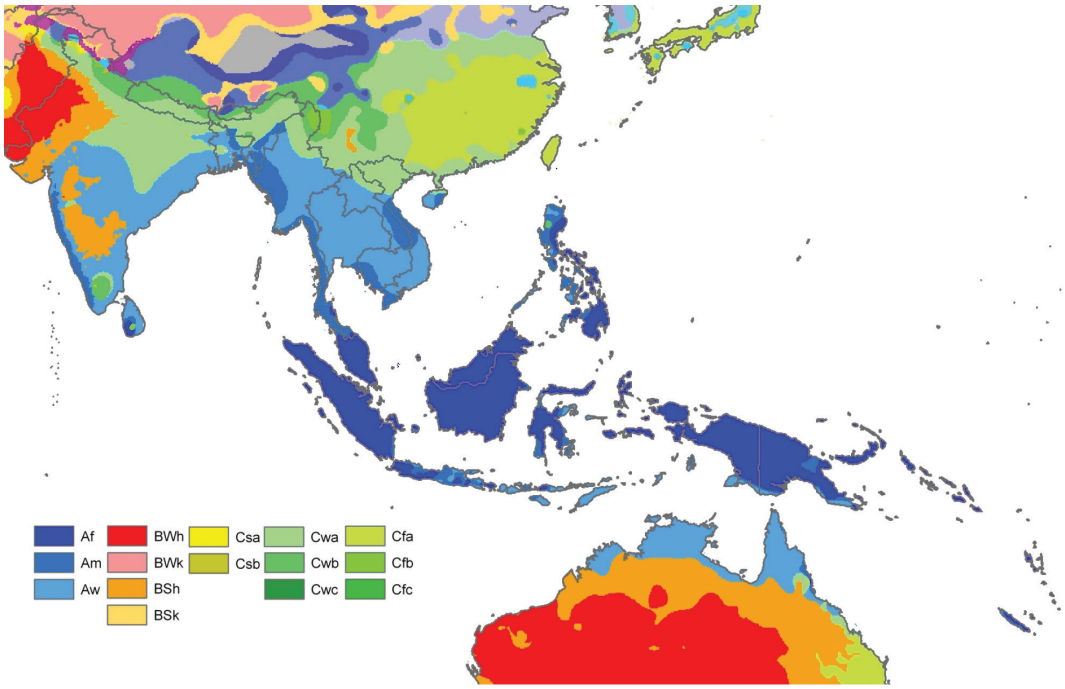

Fig. 2. Climate classification in and adjacent to areas occupied by *O. smaragdina* based on the Köppen-Geiger system (modified from Peel et al. 2007 used under Creative Commons License). Tropical climates (Group A) = shades of blue; Arid climates (Group B) = oranges and red; Temperate/Subtropical climates (Group C) = greens and yellows. See Methods for more details.

attempts were made to introduce the ant into some islands of the Manus province where it does not occur naturally (P. Room pers. comm.).” There are some *O. smaragdina* specimens from Manus (1963; J. Szent-Ivany; antweb: ANIC32-043779), but it is unclear whether these are from a naturally occurring population. Greenslade (1965) reported on the intentional introduction of *O. smaragdina* to the small island of Tikopia (5 km^2) in the eastern Solomon Islands to control the Hispine coconut beetle, *Promecotheca opacicollis* Gestro, 1897: “consignments of leaf nests of *O. smaragdina* were sent to the island from Guadalcanal in the Solomons in August and November 1962. The ant was reported to be established by subsequent observers, but it is not known what effect it had on *Promecotheca* populations. An attempt by the writer in August 1963 to investigate this and to ship a further batch of *Oecophylla* nests was unsuccessful on account of high seas.” This record from Tikopia is far to the east of all other records for *O. smaragdina* (Fig 1). I found no further reports on the fate of this population, so I contacted Thomas Lien, who contacted the Chief Tafua on Tikopia and reported “they still have the weaver ants there, but it’s getting less. Not like in the 70s and 80s. The problem with them is that they bite, when they want to climb the trees.”

Researchers promote the use of weaver ants in orchards as an eco-friendly alternative to chemical pest control, reporting an increase in productivity associated with this practice (e.g., Van Mele 2008). Using weaver ants to protect crops within the ants’ native range has great potential benefits. However, importing weaver ants into locales where these ants are not native, these ants could have a great negative effect on the native fauna, particularly in areas where there

are large swaths of land with suitable climate for the ants, such as many Pacific islands and much of the New World tropics. In fact, Duncan (1999) proposed introducing weaver ants to El Salvador to help control pests on cashew plantations, writing that a consultant proposed that an "avenue of investigation should be the introduction and trial of the green ant, *Oecophylla smaragdina* which has proved to be a highly efficient predator of cashew insect pests in Australia... The proposed trial to give a preliminary evaluation of the ant as a biological control agent under El Salvador conditions would take about 4 to 5 months. The physical requirements to conduct the importation and trial of the ant are not difficult, however the approval from official authorities in El Salvador may be more complicated." The catastrophic ecological and economic results of numerous exotic species introduction, both accidental and intentional around the world has still not taught everyone its cautionary lessons.

ACKNOWLEDGEMENTS

I thank M. Wetterer for comments on this manuscript; T. Schultz and E. Okonski for help at the Smithsonian; M. Janda, D. General, R. Recustodio, T. Colvin, T. Chan, S. De Greef, J. Fellowes, and H. Bharti, as well many users of Facebook, Instagram, Flickr, Yourshot, inaturalist, ispotnature, and Project Noah, for sharing unpublished records and photographs; D.P. Wojcik and S.D. Porter for compiling their valuable FORMIS bibliography; R. Pasos and W. Howerton of the FAU library for processing so many interlibrary loans; Florida Atlantic University for financial support.

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