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Samsum ant, *Brachyponera sennaarensis* (Formicidae: Ponerinae): Distribution and abundance in Saudi Arabia



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Abstract Invasive species are capable of causing considerable damage to natural ecosystems, agriculture and economies throughout the World. Samsum ant, *Brachyponera* (*Pachycondyla*) *sennaarensis* has been a reason for medical implication and social nuisance through its poisonous and severely painful sting causing anaphylactic shock in many cases. We surveyed for the presence of the samsum ant in various provinces of Saudi Arabia. *B. sennaarensis* was the abundant Ponerinae species in human settlements. In the Eastern provinces, however, few samples were collected, and none were found in the Northern and Western provinces. Infestations of *B. sennaarensis* were particularly severe in the spring and summer seasons, when the ants make nests in moist areas and in cracks in cemented structures, whereas the extent of infestation reduced in winter seasons. © 2015 The Authors. Production and hosting by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Climate change and land degradation are factors known to alter the distribution and abundance of species worldwide by

reducing biological diversity and increasing the susceptibility of habitats to invasion (Warren et al., 2001). Biological invasions are not novel events, but over the last 200 years the number of species that have been introduced into new ranges has grown due to the increase in human mobility (Castrì, 1989). As a result, biotic invasions are not only a consequence but also a significant component of human-driven global change (Hulme, 2003).

Invasive ants are a major challenge for conservation (Sanders et al., 2003) since their small size and high surface to volume ratio make them prone to desiccation (Edney, 1977). It is also known that physical factors such as solar

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radiation, temperature and water can play important roles in determining ant diversity (Bestelmeyer, 1997). Several studies analysing the diversity of ant communities in tropical (Torres, 1984), semi-arid (Bestelmeyer and Wiens, 1996) and arid habitats (Bestelmeyer and Schooley, 1999), have explored the physical factors, which affect the species richness and abundance of ants. The alleviation of the environmental conditions prevailing in particular sites may enhance the distribution of some ant species, particularly those species with low thermal tolerances (Cerdá et al., 1998; Johnson, 2000). This could be especially important in arid and semi-arid sites, where high levels of direct solar radiation, temperature and water loss through evaporation make it difficult for ants to survive.

Genus *Pachycondyla* is classified into 19 genera. The samsum ant (*Pachycondyla sennaarensis*) belongs now to genus *Brachyponera* and the name was changed to *Brachyponera sennaarensis* (Fig. 1) (Schmidt and Shattuck, 2014). *B. sennaarensis* was described by Mayr (1862) from the locality Sennar in Sudan. Leveux and Diomande (1978) proclaimed it to be the most common ant in the savannah regions in Sudan and these have also been reported across much of the Sub-Saharan Africa, northward to Somalia and to the southern edge of the Sahara in Niger, north of Niamey. In West Africa, Taylor (2005) reports their occurrence in Congo, Guinea, Ethiopia, Nigeria, Senegal, Zaire and Cameroon. Tirgari and Paknia (2005), meanwhile, have collected *P. sennaarensis* in Iran from Lar County, whilst Akbarzadeh et al. (2006) have reported their presence in the Iranshahr County, with their assumption that they have also spread into the southern provinces of Sistan-Baluchestan, Kerman, Fars, Hormozgan and Bushehr being confirmed by Paknia (2006).

The distribution of the invasive ant species has been reported to be dependent upon many abiotic ecological and social factors; most importantly, competition with other ant fauna (Hölldobler and Wilson, 1990; Holway, 1999) and the availability of food resources (Vinson, 1997). Interspecific competition has been hypothesised to determine the distribution of *Myrmica rubra* within the United Kingdom (Elmes, 1978), and the availability of food resources has been suggested to limit its populations in central Europe (Uchmanski and Petal, 1982). Other biotic factors have also been suggested to affect invasive ant distributions, including the surrounding plant community (Kennedy, 1998), human disturbance (Williams, 2003), and initial colony size (Hee et al., 2000). In warm weather including summer, autumn and spring their activities were affected by high temperatures which commence an hour before sunset and last for several hours until midnight (Al-Khalifa et al., 2010).

Collingwood (1985) observed and reported *B. sennaarensis* in the Kingdom of Saudi Arabia, where it is commonly known as the samsum ant. Later, Collingwood and Agosti (1996) followed and recorded their occurrence in Oman, Yemen and Kuwait, whilst Collingwood et al. (1997) reported it in the United Arab Emirates. *B. sennaarensis* is considered to constitute a public health hazard in the Kingdom of Saudi Arabia owing to its sting, which has been known to cause cases of fatal anaphylactic shock (Dib et al., 1992, 1995). Al-Shahwan et al. (2006) reported a case of anaphylactic shock and since then several more such cases have been reported following samsum ant stings, some of which were really critical (Al-Anazi et al., 2009). Notwithstanding this negative reputation, however, *B. sennaarensis* can also be beneficial to humans: Dkhil et al. (2010) found that *B. sennaarensis* venom has an anti-inflammatory effect that may be useful in the treatment of



Figure 1 Map of Saudi Arabia showing distribution of *Brachyponera sennaarensis*.

inflammatory skin diseases, whilst [Badr et al. \(2012\)](#) found that *B. sennaarensis* venom induces apoptosis in certain human breast cancer cells.

This study describes the current known distribution and abundance of the samsum ant, *B. sennaarensis* in the Kingdom of Saudi Arabia.

2. Materials and methods

Surveys for *B. sennaarensis* were carried out between January 2010 and December 2011 throughout nine provinces in the Kingdom of Saudi Arabia: Asir ($28.6 \pm 2.5^\circ\text{C}$, 69.0 RH), Eastern region ($36.0 \pm 5^\circ\text{C}$, 66.5 RH), Jazan ($36.0 \pm 3.5^\circ\text{C}$, 69.5 RH), Northern Frontiers ($30.6 \pm 3.6^\circ\text{C}$, 42.0 RH), ArRiyadh ($39.5 \pm 5.4^\circ\text{C}$, 35.5 RH), Tabouk ($33.5 \pm 2.8^\circ\text{C}$, 35.5 RH), Najran ($37.0 \pm 4.2^\circ\text{C}$, 20.0 RH), Makkah ($44.4 \pm 5.5^\circ\text{C}$, 0 RH) and Madina ($36.0 \pm 4.3^\circ\text{C}$, 24.0 RH) ([Fig. 1](#)).

Searches for samples were made in urban areas in streets, houses, hospitals, irrigated parks, gardens and farms, as well as in the surrounding semi desert areas. Searches were conducted during daylight and during the twilight periods before sunset and sunrise, using flashlights for illumination. Searches consisted of scanning the ground and turning stones to find colonies and forager workers. No specific permission was required for collecting and surveying the ants. Forager and stationary specimens were collected directly using feather-weight forceps or an aspirator, and were held in separate vials. Each specimen was labelled with the date, time and locality of collection.

Ants were identified using the keys of [Collingwood \(1985\)](#) and [Collingwood and Agosti \(1996\)](#). Three to ten dry specimens from each morphospecies were mounted and stored properly to document the geographic record. A few individuals of workers of each morphospecies were preserved in 70% ethyl alcohol in small specimen vials and sent to Dr. Collingwood at the Leeds Museum in Great Britain for confirmation of identification. Colony collection for the determination of caste types and numbers was performed by digging at a distance of 30–50 cm around the orifice(s) of the nest to a depth of 50–100 cm and lifting the whole earth mass and placing into a cloth bag for analysis in the laboratory. To determine the type and number of the different castes, each earth mass containing a colony was spread out in a large tray, the rim of which was covered with petroleum jelly. The whole earth mass was then carefully examined and each caste type was placed in a separate jar.

Specimens collected from different localities were usually contained in bags, jars or vials, according to the sample size, mixed with miscellaneous matter. As soon as they reached the laboratory, the field specimens were spread out in Petri dishes, ethyl alcohol was added and the ant samples were manually removed from other materials with the aid of a stereoscopic microscope using a watchmaker or featherweight forceps and identified.

3. Results

Ants were not detected during surveys in all the seasons throughout the year amongst Asir, Northern Frontiers, Tabouk, Madina and Makkah Provinces. Whilst samsum ants

were recorded throughout the year in Jazan, Najran, Eastern and Al-Riyadh Provinces ([Table 1](#)), their occurrence was increased during spring and summer and in addition to workers few males were also identified in large colonies collected from Jazan and Al-Riyadh. However, their number remained alleviated in autumn and winter. This ant was found as heavily infested, and hundreds of workers with few males were found without any exception in the public gardens of the governorates of Jazan, Abu Arish, Ahad Al Masariyah, Al Ayadabi, Baysh, Jizan, Sabaya and Samtah and were heavily distributed in the form of large nests containing all cast types in the summer and spring.

B. sennaarensis were found under the organic wastes, leaves and wooded and grassed fields, under covered objects such as porous stones or logs specially in termite inhabited logs, trailing in a mass on and also outside and within buildings in all the governorates of Najran, Khubash, Sharurah, Thar and Yadamah.

Samsum ant were detected in streets, gardens, public parks and university and hospital housings in all the governorates of the Ar Riyadh Province, Ar Riyadh, Ad Diriyah, Al Kharj, Ad Dawadimi, Al Majmah, Al Quwayyah, Wadi Ad Dawasir, Al Aflaj, Al Zulfi, Shagra, Hawtat Bani Tamim, Afif, As Sulayyil, Duruma, Al Muzahimiya, Hurymila, Al Hariq and Al Ghat and also their occurrence was enhanced during spring and summer. *B. sennaarensis* was also found in the different governorates of the Eastern Province including Dammam, Al-Ahsa, Al-Jubail, Al-Khubar, Al-Qatif and Hafr Al-Batin ([Fig. 1](#)).

4. Discussion

In this study, *B. sennaarensis* was detected in four provinces: ArRiyadh, Jazan, Najran and Eastern Province but was not detected in, Asir, Northern Frontiers, Tabouk, Makkah and Al-Madina. [Collingwood \(1985\)](#) suggested that the Arabian Peninsula is probably the northern limit of *B. sennaarensis* distribution. Different levels of occurrence of *B. sennaarensis* in the different regions of Saudi Arabia essentially confirm the non-indigenous status of the species. The population level also appears to depend on the geographical features of the location, with the high altitude of Asir, Makkah and Al-Madina regions, that each stands between 2000 and 3000 m above sea level, appearing to prohibit the occurrence of the species. Provinces such as Jazan and Najran are partially or completely Afrotropical in climate, since *B. sennaarensis* is indigenous to Africa this would explain their occurrence here. ArRiyadh and the Eastern region, meanwhile, are infested with a large number of ants due to large, frequent transport and heavy exchange of goods ([Al-Khalifa et al., 2010](#)). The Tabouk and Northern frontier regions, meanwhile, remain behind in terms of their developmental aspect and geosocial contacts, due to their distant location from the inhabited regions and have thus not yet been reached by these ants ([Siddiqui and Al-Khalifa, 2013](#)).

Commercial activity has probably also played a major role in transferring *B. sennaarensis* from Africa to the Arabian Peninsula across the Red Sea and the Arabian Gulf ([Collingwood et al., 1997](#)). All records of *B. sennaarensis* from subtropical sites in Bahrain, Kuwait, Iran, Oman, Qatar, the United Arab Emirates and Saudi Arabia are dated after 1950. Seeking to explain this, [Wetterer \(2013\)](#) stated that whilst

Table 1 Locations where *Brachyponera sennaarensis* has been collected in the Kingdom of Saudi Arabia.

Collection site		Location	Latitude	Longitude	Altitude (m)	Number of specimens
Province	Town					
Eastern	Ad Dammam	Roadside plantation and near beach	26°25'N	50°6'E	6	18
	Al Ahsa	Garden	25°17'N	49°29'E	155	2 colonies, 11 males, 2 queens
Jazan	Abu Arish	Garden	16°58'N	42°49'E	68	11
	Jizan	Roadside plantation	16°53'N	42°33'E	18	5 colonies, 23 males, 3 queens
	Farasan	Park	16°42'N	42°7'E	23	8
Najran	Najran	Roadside plantation, Garden	17°28'N	44°6'E	1308	23
ArRiyadh	Ad Diriyah	Roadside plantation	24°45'N	46°35'E	702	1 colony
	Ar Riyadh	Roadside plantation & near beach, Garden	24°38'N	46°46'E	614	47
	Hawtat Bani Tamim	Farm	23° 30'N	46° 30'E	390	2 colony, 7 males, 5 queens
	Al Hariq	Roadside plantation	23°38'N	46°30'E	675	13
	Al Majmah	Park	25°54'N	45°20'E	591	9
	Al Zulfi	Garden	26°17'N	44°48'E	612	15
	Al Aflaj	Park	22°15'N	46°49'E	480	6

the samsum, *B. sennaarensis*, is a widespread, conspicuous ant in the savannas and open forests of sub-Saharan Africa, it is possible that populations have lived in subtropical areas of the Middle East for a long time, but are only now being reported, perhaps due to a recent population increase of this species.

Many studies have focused on effects of climate change on invasive species, and have used distribution models to estimate changes in their geographic ranges under different scenarios of global warming (Heikkinen et al., 2006). Mashaly et al. (2013) stated that the foraging activities of *B. sennaarensis* were influenced by time, ambient temperature and relative humidity (abiotic factors). Seasonal variation in the range foraging activity has previously been reported in other tropical ponerines, such as *B. sennaarensis*, *P. marginata*, and *P. striata* (Leal and Oliveira, 1995; Medeiros, 1997).

5. Conclusion

The samsum ant, *B. sennaarensis*, spreads only in the south (Jazan and Najran) and Eastern and central provinces (Ar-Riyadh) of Saudi Arabia. This difference in distribution is due to differences in climate and human activity.

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