*Scientific Note*

# The Mango Flower Beetle, *Protaetia fusca* (Herbst), on Wake Island, Western Pacific Ocean (Coleoptera: Scarabaeidae: Cetoniinae)—an Accomplished Island Invasive

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**Abstract.** The mango-flower beetle, *Protaetia fusca* (Coleoptera: Scarabaeidae: Cetoniinae) is newly recorded for Wake Island. The distribution and invasive history of this species on tropical oceanic islands are briefly reviewed and the causes for its success as an established alien and sometimes invasive species discussed.

**Key words:** Wake Island, new record, island invasive, *Protaetia*, Scarabaeidae

The mango flower beetle, *Protaetia fusca* (Herbst 1790) (Coleoptera: Scarabaeidae: Cetoniinae), is a common flower chafer in tropical and subtropical Asia and Australia that has spread to various islands in the Indian and Pacific Oceans over the last sixty years and has recently become established in Florida and some Caribbean islands (Woodruff 2006). We here report a new record for a remote atoll, Wake Island, and briefly review the invasive history of this species.

## New record

Wake, United States Air Force Base, north-east corner of Wake Island near Heel Point, 19°18'26"N, 166°38'46"E, elev. 9 m, 28 April 2013, leg. Mark Breidenbaugh, 2 spm. (det. Krell), in Denver Museum of Nature & Science.

Records of this species from Wake have never been published (Bryan 1926, 1959; Joyce 1955; Cartwright and Gordon 1971; Demarest 1999; Hebshi et al. 2011). The Bishop Museum in Honolulu has no specimen from Wake (Jim Boone, pers. comm. Jan. 2016).

## Discussion

*Protaetia fusca* seems to be particularly amenable to establishing itself on tropical islands. In the case of this new location, it most likely was facilitated by human transportation as the nearest land to Wake Island is the Bokak Atoll located 580 km to the southeast and the nearest inhabited land is the Utirik Atoll 952 km to the southeast. The most common transports arrive from Hawaii located 3,700 km to the east, being a fortnightly supply by air and deliveries by ships moving between Guam, Wake, Hawaii and back. Some ships go through southern Japan for resupply. Airtraffic for refueling without supply deliveries comes from all directions. It is unknown when the introduction of the *P. fusca* occurred, but since 2012 Wake Island has implemented a formal biosecurity plan. While this plan focuses on vertebrates, and in particular rats, it includes inspections of aircraft and ocean vessels by trained staff.

In the Pacific, *Protaetia fusca* has been reported in the northeast from several

islands of the Hawaiian Archipelago (see below) as far west as Midway (Nishida and Beardsley 2002, first collected in 1997; 3 spm. in Bishop Museum); in the west from New Caledonia (Cochereau 1970, Paulian 1991, from the mid-1960s), Guam (Pemberton 1954, Chilson 1955, Cartwright and Gordon 1971, first collected in 1954), and the Northern Mariana Islands (Bourquin 2013, first collected in 1954); in the south from the Cook Islands (Watt 1986, McCormack 2007), Tonga and Samoa (Watt 1986); and as introduced in the 1970s from French Polynesia (Gourves 1976, Paulian 1998, Ramage 2015). The species had been established in Fiji a century ago (Veitch and Greenwood 1921) or even earlier.

In the Hawaiian Islands, it was first recorded in Oahu in 1949 (Maehler 1950) and was soon distributed over several islands of the archipelago (Sherman 1955 [Kauai], Van Zwaluwenburg 1955 [Hawaii 1954, Maui 1954], Hawaii Insect Report 1966 [Molokai], Mau 1977 [Lanai 1975], Ramsdale and Samuelson 2006 [Lehua Islet off Niihau 2002]).

In the Indian Ocean, the species colonized Mauritius in the 19th century at the latest, being recorded by Alluaud (1899), but it was not noted as a mango pest (Emmerez de Charmoy 1898), and was listed for Rodrigues as early as 1935 (Vinson 1935). It apparently arrived later at Diego Garcia in the Chagos Archipelago, from where it was collected in 1971 by Hutson (1981), but not by the Percy Sladen Trust Expedition in 1905/1908 (Scott 1912). It was also not recorded by a later expedition in 1996 (Barnett and Emms 1998) indicating its rarity, seasonality, or extinction. In the 1980s the species arrived in the new world, getting established in Florida and recorded from Barbados and the Bahamas (Woodruff 2006).

The adult seems to be a trophic generalist as it has been reported feeding on fruits or flowers of African rattlepods (*Crotalaria saltiana* Andrews; Look 1952), Alexander palms (*Ptychosperma elegans* (R.Br.) Blume; Woodruff 2006), avocadoes (*Persea americana* Mill.; Simpson 1990, CABI 2008), candle flower (*Senna alata* (L.) Roxb.; Chilson 1950), canna plants (*Canna* sp.; Arrow 1910: 155), cassia pea (*Cassia brewsteri* (F. Muell.) Benth., *Cassia* sp.; Swaine 1971), citrus (*Citrus* spp.; Swaine 1971, Watt 1986, Simpson 1990, Woodruff 2006), coconut (*Cocos nucifera* L.; Maehler 1950), corn (*Zea mays* L.; Chilson 1950, Swaine 1971, Watt 1986, CABI 2008), figs (*Ficus* sp. and *Ficus retusa* L.; Hawaii Insect Report 1966, Simpson 1990), giant granadilla (*Passiflora quadrangularis* L.; Veitch and Greenwood 1921, Swaine 1971), Hawaiian prickly poppy (*Argemone glauca* (Nutt. ex Prain) Pope; Barton 2014), kiawe (*Prosopis pallida* (Humb. and Bonpl. ex Willd.) Kunth; Matayoshi 1971), common ironwood (*Casuarina equisetifolia* L.; Fukumura and Oshiro 1966), longan (*Dimocarpus longan* Lour.; Tan et al. 1998), lychee (*Litchi chinensis* Sonn.; Hawaiian Entomological Society 1964, Tan et al. 1998), mango (*Mangifera* sp.; Chilson 1950, Hawaiian Entomological Society 1964, Mumford 1967, Matayoshi 1971, Woodruff 2006, CABI 2008), noni (*Morinda citrifolia* L., Hawaiian Entomological Society 1964), orange jessamine (*Murraya paniculata* (L.) Jack; Woodruff 2006), peaches (*Prunus persica* (L.) Batsch; Simpson 1990), pear (*Pyrus* sp.; Tryon 1917), pigeon pea (*Cajanus cajan* (L.) Millsp.; Weber 1952, Woodruff 2006, CABI 2008), pineapple (*Ananas comosus* (L.) Merr.; CABI 2008), pitaya (*Hylocereus* spp.; Rughoo et al. 2009), Queen's bird of paradise flower (*Strelitzia reginae* Aiton (Mumford 1967), riverhemp (*Sesbania* sp.; Mumford 1967), roses (*Rosa* sp.; Simpson 1990, Woodruff 2006), silver buttonwood (*Conocarpus erectus* L. var. *sericeus* DC; Woodruff 2006), sugarcane

(*Saccharum officinarum* L.; CABI 2008), white ginger (*Hedychium coronarium* J. Koenig; Maehler 1954), and yellow ginger (*Hedychium flavescens* Carey ex Roscoe; Chilson 1950), and leaves of poinciana trees (*Delonix regia* (Boj. ex Hook.) Raf.; Weber 1954) and sea grape (*Coccolobis uvifera* L.; Beardsley 1964). The feeding sometimes, but not regularly reaches an extent that would allow assigning *P. fusca* a pest and invasive status (e.g., Weber 1952, Swaine 1971, Woodruff 2006). On the other hand, the species has been recorded as pollinator of sesame (*Sesamum indicum* L., Du et al. 2011) and sunflower (*Helianthus annuus* L., Du et al. 2012). The larva (grub) does not feed on live roots (Sakimura 1950), but only on dead organic matter such as compost or composting dung (Chilson 1950, Sakimura 1950, Kusui 1980, Watt 1986). Swaine (1971) stated that for this species, no control measures were recommended.

**What makes *Protaetia fusca* a particularly successful invader of remote tropical islands?** Oceanic islands are susceptible to the establishment of alien and invasive species because of their lower overall species diversity due to their isolation (Fridley 2011). The isolation, however, requires a successful long-distance travel by the invasive, which humans' trade and transport facilitate ubiquitously. *Protaetia fusca* has been recorded to survive airplane transport (Kusui 1980) and has actually been intercepted in an airplane in Hawaii (Mumford 1967), and three times in cars coming from Hawaii to California (Gill 1988). Hawaii is the potential origin of the Wake specimen for Hawaii being the origin of most transports arriving at Wake, followed by Guam and Japan. *Protaetia fusca* is easily attracted to ships and loading airplanes at night because of its attraction to light (Cartwright and Gordon 1971). Since the species is not rare and can even develop mass occurrences (Kohno 2000), entering transport vessels in respective areas might be a common occurrence. As a generalist, the species is likely to find host plants for the adult has been recorded feeding on a diversity of plant families, such as Anacardiaceae, Arecaceae, Bromeliaceae, Cactaceae, Cannaceae, Casuarinaceae, Combretaceae, Fabaceae, Lauraceae, Moraceae, Papaveraceae, Passifloraceae, Poaceae, Polygonaceae, Rosaceae, Rubiaceae, Rutaceae, Sapindaceae, Strelitziaceae, and Zingiberaceae. Establishing a permanent population should equally be easy as the larva feeds on decaying plant material of which there is plenty in both natural habitats and human settlements on tropical islands.

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