The Sleepy Orange transits the Pacific: a new butterfly species for Hawaii

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Abaeis (*Eurema*) *nicippe* (Cramer, 1779), native to the Americas, is widespread from the southern tier of the United States, south, to Brazil (Scott, 1986). In summer, it regularly strays well north of its permanent range, rarely reaching Canada. The species overwinters as an adult, and has two forms which are most easily distinguished by coloration of the underside of the wings: light yellow in summer and reddish-brown in winter, both with dark brown maculation. The larval host plants, various species of *Senna*, are widely planted as ornamentals.

On December 23, 2013, R. McGough observed *A. nicippe* adults and pupae on Senna in the town of Waialua, on the North Shore of the island of Oahu. This represents only the third pierid species to become established in Hawaii; the two others are *Pieris rapae*, which was introduced over a century ago, and *Phoebis agarithe*, which was first detected in 2004 (HDOA, 2005).

A. nicippe was sighted again on Oahu in February 2014, and then quickly became relatively common, with sightings across the island in 2014, including in the city of Honolulu. By October 2014, *A. nicippe* was extremely abundant on Maui, with an egg seen by F. and K. Starr on *Cassia* sp. By the end of 2014, the butterfly was also sighted or collected on Kauai, Molokai, Big Island, and even the tiny island of Kahoolawe. Sightings occurred from sea level up to at least 6,800 feet on the slopes of Haleakala on Maui. This rapid expansion across the Hawaiian Islands demonstrates the strong dispersal ability of *A. nicippe*. It is remarkable how quickly and thoroughly *A. nicippe* spread throughout the archipelago, especial considering the high levels of single island endemism in many native groups of Hawaiian Lepidoptera (e.g. Haines et al. 2014), which suggest that populations frequently become isolated on islands.

Mid-elevation sites on Maui, which experienced the most profound population explosion in October 2014, report very few individuals in February 2015, which could be a sign of population collapse, or cyclic dormancy of the adults, since the montane areas do experience significantly cooler winter seasons. The reddish-brown winter form of *A. nicippe* has not been recorded yet in Hawaii, which may be related to the Archipelago's climate and latitude. Specific sightings or collection data follow:

Material Examined

All material is deposited in the University of Hawaii Insect Museum (UHIM) and Hawaii Department of Agriculture Insect Collection (HDOA).

Kauai

Kokee State Park, Mohihi Rd. 22.1311, -159.6376. 6 December 2014. W. Haines 3 adults. (UHIM)

Oahu

1) Waialua, 23 December, 2013, Adults on *Senna surrattensis*. coll: R. McGough 20 adults and 4 pupae (HDOA). **2)** Kaena Point, 27 February 2014, 4 adults (HDOA). **3)** Waianae, Kaala trailhead, Waianae Valley Rd., 21.4829, -158.1551 27 Jan 2015. W. Haines and C. Maeda. 1 adult (UHIM).

Maui

1) Haiku, Kokomo, Kailiili Rd. 20.8666, -156.3046. (12 October 2014). W. Haines. 1 adult (UHIM). **2)** Olinda, Makawao, Olinda, 149 Hawea Pl., 11 October, 2014. F. and K. Starr 5 adults (UHIM). **3)** Olinda , Makawao, Olinda, 149 Hawea Pl., 1 December, 2014 F. And K. Starr 4 adults (UHIM)

Non-vouchered sightings

Kauai

1) Kokee State Park, along Kawaikoi Stream Trail, 4 September, 2014. One adult flying at large. N. Reimer. **2)** Kokee State Park, cabins near Kokee Lodge, 6 September, 2014. One adult flying at large. N. Reimer.

Oahu

1) Pawa'a, Honolulu. September, 2014. One adult puddling near building. N. Reimer, J. Matsunaga, B. Kumashiro. **2)**Honolulu, Manoa, 29 November, 2014. One adult flying by. D. Rubinoff. **3)** Makaha Valley, 9 September, 2014. One adult flying among weeds and grasses. J. Matsunaga. **4)** Kawainui Marsh, January-February, 2015. Abundant

adults flying at large. F. Joy. **5)** Waianae Kai, 31 January, 2015. Adults flying around alien forest. Abundant. F. Joy. **6)** Pohakea, Kunia, January, 2015. Adults flying around farmlands. Abundant. F. Joy. **7)** Ka'au Crater, 14 February, 2015. 3 adults flying at large. F. Joy. **8)** Poamoho Ridge Trail, 1 February, 2015. One adult flying in a mixed native and invasive habitat. J. Matsunaga.

Maui

1) Olinda, (visiting the flowers of watermelon and other plants), Makawao, Pukalani, and Kula. 1-15 October, 2014. Abundant. F. And K. Starr. **2)** Keanae School (Hana Hwy.). 27 October 2014. Abundant. F. And K. Starr. **3)** Hosmer's Grove, Haleakala National Park, 6,800'. Early November, 2014. F. And K. Starr. **4)** Nakula Natural Area Reserve, ~5,000', 13-20 November, 2014. Adults flying around native area with mostly *Acacia koa*, *Metrosideros polymorpha*, and grasses. Abundant. J. Matsunaga.

Molokai

Kaunakakai to Kakahaia, 25 October, 2014. Marginally abundant along the south shore. F. and K. Starr.

Kahoolawe

Kaukaukapapa. One individual sipping from a mao (*Gossypium*) flower on 17 December, 2014. F. and K. Starr.

Hawaii (Big Island)

Makaula O'oma Tract of Honua'ula Forest Reserve on 27, January 2015. T. Poklen.

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References

Scott, J. 1986. Butterflies of North America. Stanford University Press.

Haines, W. P., P. Schmitz and D. Rubinoff. 2014. Ancient diversification of *Hyposmocoma* moths in Hawaii." *Nature Communications* **5**: 3502 **DOI: 10.1038/ncomms4502**.

Hawaii Department of Agriculture. 2005. Hawaii Department of Agriculture's Annual Report for Fiscal Year 2004. Ed Janelle Saneishi. Honolulu, HI: Hagadone Printing Company. Available at: **http://hdoa.hawaii.gov/wp-content/uploads/2013/01/AR05-Text.pdf** (page 24).

Kawainui Marsh, Oahu, January 2015. F. Joy.

□, Maui, Olinda, 11 October, 2014. F. & K. Starr, coll. (UHIM)

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