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Confirmation of the existence of *Heliophanus apiatus* (Araneae: Salticidae) in the San Francisco Bay Area of California, USA, first records for North America

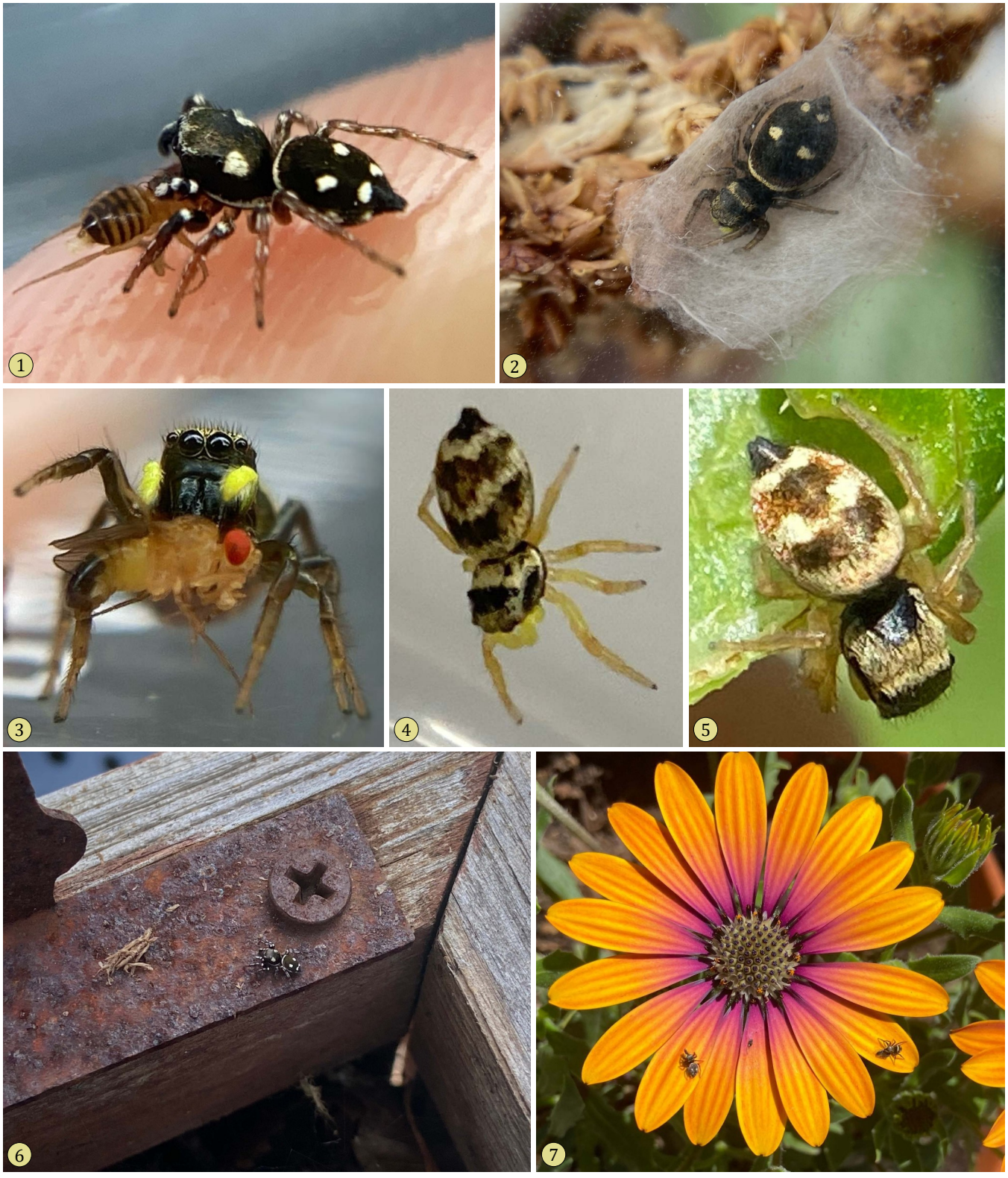
Bruce Cutler [1], Tim Manolis [2] and Alison Symonds [3]

[1] Department of Ecology & Evolutionary Biology, University of Kansas, 1200 Sunnyside Avenue, Lawrence, KS 66045-7534, USA, *email* dbronx@ku.edu; (ORCID ID 0000-0002-7412-5266)
[2] 808 El Encino Way, Sacramento, CA 95864
[3] 5024 Valpey Park Avenue, Fremont CA 94538

The genus *Heliophanus* C. L. Koch, 1833 is one of the largest genera of jumping spiders with over 150 species, widespread in the Palearctic and Africa. One center of diversity is the Mediterranean region with several dozen species represented. *Heliophanus* were first reported in the San Francisco Bay Area along the Hayward Regional Shoreline, Alameda County in June 2015, by Tony Iwane (Iwane, 2015). When the third report from this location was submitted by the same observer in 2017, Samuel Brown was the first person to suggest that the species in question might be *Heliophanus apiatus* Simon, 1868. Based on somatic characters these specimens have been identified as *H. apiatus*. Subsequently, 44 more reports with photographic documentation, from at least 26 different locations, have been submitted to either the *iNaturalist* or *BugGuide* web sites (only three reports to the latter site, one of these a duplicate of one of the iNaturalist reports). All reports come from the three counties – Alameda, Santa Clara and San Mateo – surrounding the southern arm of San Francisco Bay. Most of these locations are in the cities of Hayward (6 sites), Fremont (6 sites) and neighboring communities of Newark, Union City, San Lorenzo and Castro Valley (6 sites total), all in Alameda County. The furthest north record is from Oakland, Alameda County. There are records from four locations in San Mateo County on the west shore of San Francisco Bay, two each in the cities of San Mateo and Redwood City. The furthest south record is from San Jose, Santa Clara County. An additional three reports to *iNaturalist* were from exact locations obscured by the observers, but they are all from within Alameda County. See Appendix 1 for a list of the *iNaturalist* and *BugGuide* sightings.

Genitalic confirmation of species identity is necessary as there are at least two other species in the *H. apiatus* group with a similar somatic appearance (Wesołowska, 1986). Genitalic examination of specimens from Fremont, California (37.519250°N, 121.972260°W) have confirmed that the species in California is indeed *H. apiatus* (Figures 1-7).

This is the second Mediterranean species of *Heliophanus* to become established in the United States within the past decade, the other being *H. kochii* Simon, 1868, in New York (Cutler & Parr, 2020; Gall & Edwards, 2016). The original distribution of *H. apiatus* is in the northwestern Mediterranean, while that of *H. kochii* extends into central Europe from the northern Mediterranean (Wesołowska, 1986). Perhaps this explains the current introduced distribution of the genus in North America, with the strictly Mediterranean species found in the Mediterranean climate of the Bay Area of California, and the more widely distributed *H. kochii* found in New York State.



Figures 1-7. *Heliophanus apiatus* from the San Francisco Bay area of California. **1,** Male feeding on *Drosphila melanogaster*. Note the deep black coloration with four white spots, and the white spots on the black palpi. **2,** Female on retreat. Note the brown-black coloration and the lack of white spots or bands on the appendages. **3,** Anterior view of female feeding on *D. melanogaster*, displaying the typical brilliant yellow palpi typical of all instars except mature males. **4,** Early instar immature, ~2 mm long. Note the white abdominal markings or bands (not spots) that resemble early instars of *Salticus*. **5,** Same specimen as (4) after the next molt, ~2.5 mm long. Subsequent instars resemble the adult female in coloration. **6,** Adult male on edge of planter box. **7,** Two immatures on a composite flower.

As is typical of European *Heliophanus*, this is a small salticid. Mature males are ~3.5-4.0 mm in body length, mature females ~4.0-4.5 mm in body length. Somatically, mature males have a striking black and white appearance with paired white spots on the prosoma and abdomen, and a basal white abdominal band (Figure 1). Body coloration of females resembles that of males though the background color may be brown or bronze, and the prosomal spots are reduced, but the appendages retain the immature coloration, including the noticeable yellow palpi (Figures 2-3). Late instar immatures resemble females. Early instar immatures are banded instead of spotted (Figures 4-5), with the bands resolving into spots as the spider matures. Aside from the genitalic differences, *H. apiatus* differs from *H. kochii* in that most adult specimens from the United States have the posterior white scale patches as spots rather than as lines. However, this is not definitive as some *H. kochii* have the posterior white scale patches as spots. Under 365 nm ultraviolet light illumination, the yellow palpi fluoresce a brilliant white. The white scale markings on the body of all specimens, and the appendages of the male, do not fluoresce under 365 nm UV illumination.

These spiders are capable of taking prey similar to their own body size, e.g. *Drosophila melanogaster* Meigen are taken by immatures, and *D. virilis* Sturtevant are taken by adults. They also readily take appropriately sized Homoptera. Small immatures will feed on crushed *Drosophila* soaked in diluted honey. Ants of the appropriate size, *Monomorium minimum* Buckley (Myrmicinae), were rejected as prey. A near approach by one of these ants resulted in several strikes with the forelegs by the spider, followed by an unhurried retreat. Captive spiders make typical tightly constructed salticid retreats.

As is the case for *H. kochii* in the New York City area, *H. apiatus* is found on low vegetation and on hard structures on or near the ground (Figures 6-7). *H. apiatus* is well established in the southern San Francisco Bay area of California. While it is synanthropic, it is not confined to indoor structures but occurs primarily outdoors. Reports have come from all months except December, with all but 8 reports from the period March-July. Reports have peaked in March (14 reports) and April (10 reports), with a second peak in July (8 reports).

Selected specimens will be deposited in the California Academy of Sciences and the Entomology Collection, Biodiversity Institute, University of Kansas.

It would be informative to monitor the spread, if any, of this species in North America. Several Old World salticid species have become established recently and are apparently common where they occur. The recent popularity of citizen scientist forums like *iNaturalist* and *BugGuide* has provided an opportunity to trace the spread of these introduced species.

Acknowledgements

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Appendix 1

Heliophanus sightings in SF Bay Area from *iNaturalist* and *BugGuide*

https://www.inaturalist.org/taxa/141760-Heliophanus (map of all sightings)
https://www.inaturalist.org/observations?locale=en-US&place_id=14&subview=table&taxon_id=141760 (list of all sightings)
https://www.inaturalist.org/observations/95041847
https://www.inaturalist.org/observations/21127452
https://www.inaturalist.org/observations/48510846
https://www.inaturalist.org/observations/41278936
https://www.inaturalist.org/observations/54576841
https://www.inaturalist.org/observations/54186682
https://www.inaturalist.org/observations/43769208
https://www.inaturalist.org/observations/54186263
https://www.inaturalist.org/observations/62146025 (S. Chau)
https://www.inaturalist.org/observations/70525889 (S. Chau)
https://www.inaturalist.org/observations/61809839 (S. Chau)
https://www.inaturalist.org/observations/26883771
https://www.inaturalist.org/observations/71392254 (S. Chau)
https://www.inaturalist.org/observations/71250410 (yummysunflower)
https://www.inaturalist.org/observations/71250411 (yummysunflower)
https://www.inaturalist.org/observations/56175311 (yummysunflower)
https://www.inaturalist.org/observations/69231061 (yummysunflower)
https://www.inaturalist.org/observations/48024162
https://www.inaturalist.org/observations/38680667
https://www.inaturalist.org/observations/27540639
https://www.inaturalist.org/observations/1751189
https://www.inaturalist.org/observations/5500688
https://www.inaturalist.org/observations/1743890
https://www.inaturalist.org/observations/70578780
https://www.inaturalist.org/observations/39465279
https://www.inaturalist.org/observations/47892423

https://bugguide.net/node/view/1789891/bgimage
https://bugguide.net/node/view/1641503/bgimage
https://bugguide.net/node/view/2051721