

Review of the type specimens of Hawaiian *Sierola* Cameron (Hymenoptera: Bethyliidae) at the Natural History Museum, London, with lectotype designations¹

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Abstract. *Sierola* Cameron is one of the largest radiations of endemic insects in Hawaii, but has been neglected for nearly 100 years. Four of the eight species described early in Hawaiian entomology were based on mixed syntype series and require lectotypification. Lectotypes are designated for these and the type status of the others is reviewed.

INTRODUCTION

The bethyloid wasps of the genus *Sierola* Cameron are one of three “hyperdiverse” lineages in the Hawaiian islands, together with the *Hyposmocoma* moths and *Drosophila* pomace flies. Unfortunately, parasitic Hymenoptera was one of the weaker parts of the monumental *Fauna Hawaiiensis* (Perkins 1910), and as a result many taxa have been poorly studied since the early period of Hawaiian insect collecting. *Sierola* is notable for producing a remarkably high diversity of species per number of individuals collected (Fullaway 1920), but the large series collected by R.C.L. Perkins were grouped by Ashmead (1901) into only a few species. Although Fullaway (1920) recognized the great diversity of the group and described 171 new species, the collections available to him were almost entirely limited to the islands of O‘ahu and Hawai‘i, he did not have access to the previously-described specimens, and his key is difficult to use due to its subjective characters (e.g., “clypeal process large” vs. “clypeal process small”). As a result, study of the group has languished. Fullaway’s description of such a large number of species from few specimens has been questioned (Gruner 2004), but examination of a large number of specimens from across all the islands indicates that the group is in fact considerably more diverse than described by Fullaway (unpubl. data). In preparation for future work on the Hawaiian species, it is necessary to designate lectotypes for several species with type series in the Natural History Museum, London (NHMUK).

The genus *Sierola* was described by Cameron (1881), based on a single Hawaiian specimen collected by Rev. Thomas Blackburn. Later, two more species were added (Blackburn & Cameron 1886). Although the descriptions of these are insufficient to distinguish them from the variety of species that exist, their taxonomy is not problematic since all three are based on single specimens. Two of the three (*S. testaceipes* Cameron and *S. monticola* Blackburn & Cameron) are very distinct morphologically and can be easily recognized. Four of the five species described by Ashmead (1901) consist of mixed series, and require lectotypification. Ashmead also identified numerous specimens collected by Perkins as members of the Blackburn & Cameron (1886) species; nearly all of these are incorrect identifications.

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MATERIALS AND METHODS

The syntype series for the eight Hawaiian species in the NHMUK and the Smithsonian National Museum of Natural History (NMNH) in Washington, D.C. were examined, along with additional specimens in those collections and at the Bernice Pauahi Bishop Museum (BPBM) obtained by Perkins. Lectotypes were selected primarily on the basis of specimen quality and, if relevant, on match to the species description. Some NHMUK specimens had red-ringed holotype labels in addition to blue syntype labels, but these indicate only the specimens that were taken to a safe location during World War II (D. Notton, pers. comm.; see also Evenhuis 2007a). NHMUK holotype and lectotype specimens were imaged using the museum's montage system and assigned unique specimen numbers. Specimen data and images for NHMUK specimens are recorded on the NHMUK database, and are publicly available through the NHMUK Data Portal (Natural History Museum, 2014). At NMNH, one specimen is kept in the type collection and the remainder in the regular collection; some of these have paratype labels and others do not. Since Ashmead (1901) did not specify type and non-type material, or designate paratypes, all of those identified in his descriptions are considered part of the syntype series (I.C.Z.N. 1999; Art. 72.4.1). Text on each label on the pin is separated from that on the next label by a double slash (//); lines within a label are separated by a single slash (/). Text on the underside of a label is enclosed in quotes; text in square brackets indicates additions for clarification.

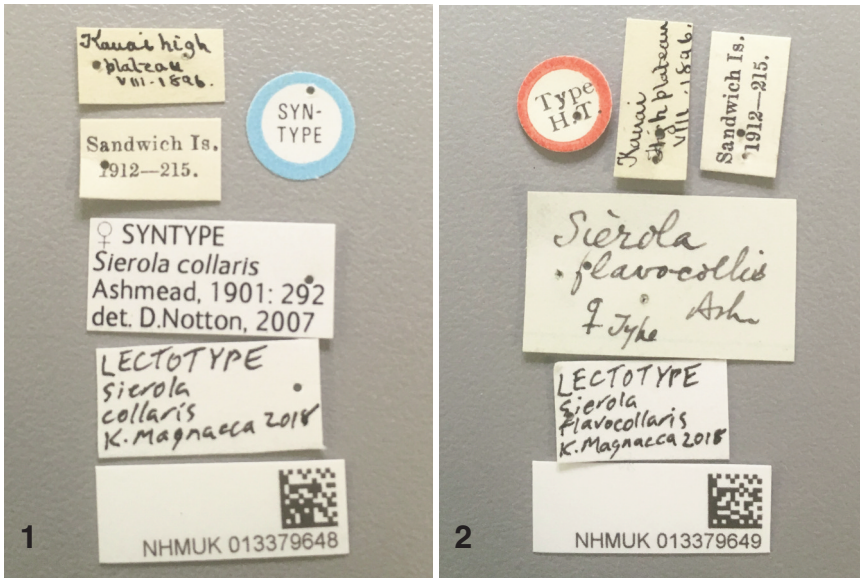
Sierola collaris Ashmead

Sierola collaris Ashmead, 1901:292.

Type series. There are six specimens in the type series at the NHMUK, five of which appear to be the same species, although one is missing its head and cannot be properly evaluated. The sixth differs from the others by having the mesosoma almost entirely dark brown, with the pronotum light brown anteriorly and grading into dark brown posteriorly. It bears a recent label which says “Not a syntype of *Sierola collaris* Ashmead, 1901. Does not agree with description, mesonotum is black. det. D. Notton 2007.” However, this refers to its relationship to the other specimens; it is in fact part of the syntype series (it may also be conspecific, as color can be variable and all other characters appear to be the same). A specimen in the NMNH type collection has a paratype label but is distinctly different, with a more flattened head resembling *S. gracilis* Fullaway of O‘ahu. Three additional specimens in the regular collection do not have paratype labels but have the same collection data as the NHMUK specimens. These appear to match the lectotype here designated, but will need to be examined further.

Lectotype designated. ♀ specimen mounted on its right side on card; left wing broken off and glued separately on card. All characters are clearly visible including the clypeus and mandibles. Label data (Fig. 1): Kauai high / plateau / VIII-1896 // Sandwich Is. / 1912—215. // SYNTYPE [round blue-ringed label] // ♀ SYNTYPE / *Sierola collaris* / Ashmead, 1901: 292 / det. D. Notton, 2007 // LECTOTYPE / *Sierola* / *collaris* / K. Magnacca 2018 // NHMUK 013379648 [barcode] (NHMUK).

Notes. This species is endemic to Kaua‘i. The four described species from the island are each distinctively colored, unlike most species on the other islands, but many undescribed all-black species have also been collected from Kaua‘i.



Figures 1–2. *Sierola* lectotype labels. 1. *S. collaris* Ashmead; 2. *S. flavocollis* Ashmead.

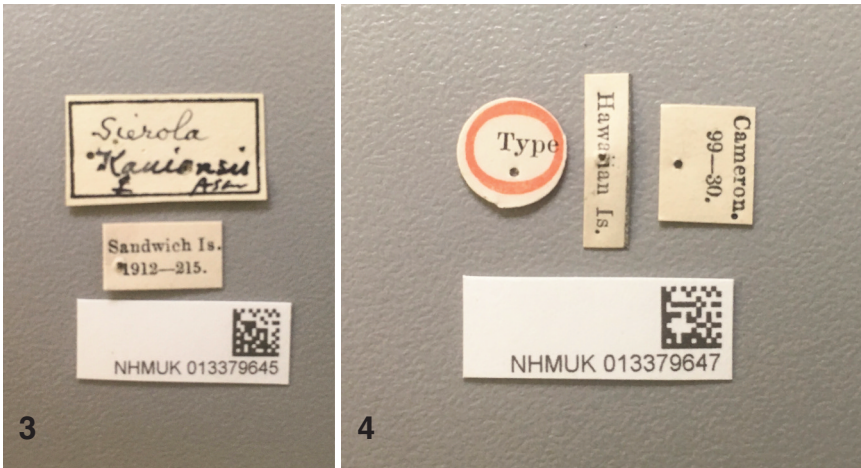
Sierola flavocollis Ashmead

Sierola flavocollis Ashmead, 1901: 291.

Type series. The description in *Fauna Hawaiiensis* states that this species is based on five specimens, including one from Maui. Two are present at the NHMUK and two at the NMNH; all are from Kauaʻi. One of the NHMUK specimens is missing its head, which bears most of the defining characters; the body coloration of both is very similar to that of the aberrant *S. collaris* syntype. The other, intact specimen is designated as the lectotype. The headless specimen is also much smaller and has granulate sculpturing on the propodeum, which suggests it belongs to the same species as the aberrant syntype of *S. collaris*, as do both of the NMNH specimens, which have small heads.

Lectotype designated. ♀ specimen mounted on its left side on card. All characters are clearly visible including the clypeus and mandibles. The four terminal segments of the left antenna are missing but it is otherwise in excellent condition. Label data (Fig. 2): Type / H.T. [round red-ringed label] // Kauai / high plateau / VIII-1896 // Sandwich Is. / 1912—215. // *Sierola* / flavocollis [note misspelling] / ♀ type Ashm // LECTOTYPE / *Sierola* / flavocollis / K. Magnacca 2018 // NHMUK 013379649 [barcode] (NHMUK).

Notes. The enormous head of this species is striking. The fact that a Maui specimen was grouped with it suggests that a similar species is present there; however, it has not been located. Although the majority of the specimens are of a small-headed species, Ashmead clearly describes it as having a large head, indicating that the large one should be the lectotype. The name of the species is spelled “flavocollis” on the type label and in section 5 of Ashmead’s (1901) key, but in section 10 of the key and in the description itself it is



Figures 3–4. *Sierola* type labels. 3. *S. kauaiensis*, syntype labels; 4. *S. leuconeura*, holotype labels.

given as “flavocollaris”; the latter was fixed as the correct original spelling by Kieffer (1914). It is remarkably similar to *S. leeuwinensis* Turner from Western Australia, differing in the coloration and details of the head characters.

Sierola kauaiensis Ashmead

Sierola kauaiensis Ashmead, 1901: 292.

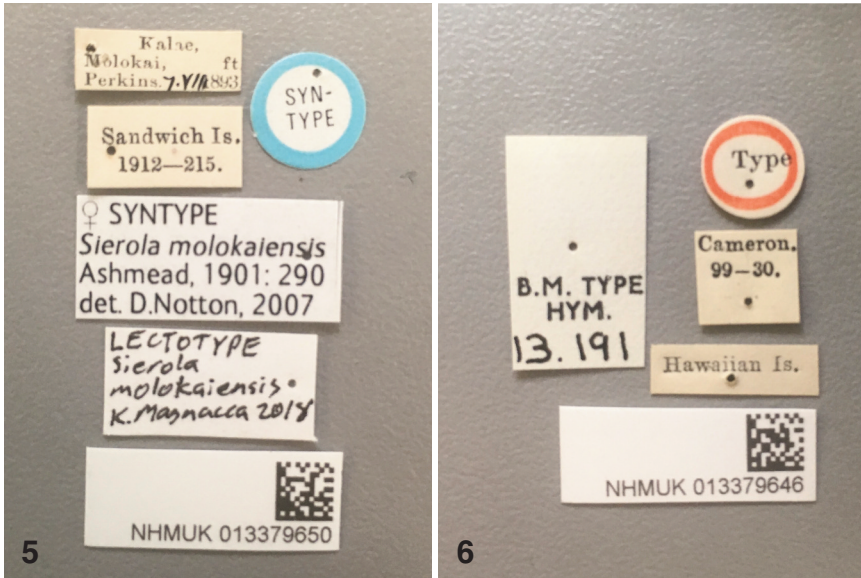
Syntype series. Described from three female specimens; two are at the NHMUK, and one at the NMNH. All represent the same species. Label data (Fig. 3): Kaholuamano [sic: Kahōluamanu] / Kauai / IV.95 [handwritten on card with specimens] // Sandwich Is. 1912—215. // *Sierola* / *Kauaiensis* [sic] / ♀ Ashm // NHMUK 013379645 [barcode] (two specimens on one card, NHMUK). Kaholuamano / Kauai / IV.95 // ParatypeNo / 40421 / U.S.N.M. // *Sierola* / *Kauaiensis* [sic] / ♀ type Ashm (one specimen on a point, NMNH).

Notes. One of the NHMUK specimens is more intact, but is glued in such a way that the important characters of the clypeus and mandibles are obscured. The other has the head detached and glued on the card next to the body. Since there is no confusion about the taxonomy and no one specimen shows all the characters, no lectotype is designated.

Sierola leuconeura Blackburn & Cameron

Sierola leuconeura Blackburn & Cameron, 1886: 177.

Holotype. ♀ specimen mounted ventral side down on card. The specimen is in good condition and all characters are visible, albeit with some difficulty because the head is flat against the card. Label data (Fig. 4): “*Sierola* / *leuconeura* / Cam / Hawaii / 112 [written at end of card perpendicular to other text]” [underside of card with specimen] // Type [round red-ringed label] // Cameron. / 99–30. // “Hawaiian Is.” // NHMUK 013379647 [barcode] (NHMUK).



Figures 5–6. *Sierola* type labels. 5. *S. molokaiensis*, lectotype labels; 6. *S. monticola*, holotype labels.

Notes. This species was described from a single specimen, which is the holotype by monotypy. The description states that it came from Lānaʻi, presumably derived from the collection code “112” written on the card. No other species are currently described from Lānaʻi, but many are present in collections. None of the 24 Perkins specimens from various islands at NHMUK identified by Ashmead as *S. leuconoura* actually are this species.

Sierola molokaiensis Ashmead

Sierola molokaiensis Ashmead, 1901: 290.

Type series. Only one of the 13 specimens in the type series at NHMUK is actually from Molokaʻi. The remaining specimens are from other islands, and each represents a separate species; only one from Hawaii, probably *S. kilauea*, resembles it. Likewise, at NMNH only the female in the type collection and one male in the regular collection are from Molokaʻi; the remainder represent a variety of species, including several of the distinctive *S. blackburni* and *S. sima* from Hawaiʻi. The NMNH Molokaʻi specimen is close to *S. obscura* Fullaway of Oʻahu and may be conspecific; it is clearly different from the illustration of *S. molokaiensis* in *Fauna Hawaiiensis* (Plate VIII, Fig. 1), and hence was excluded from consideration as lectotype.

Lectotype designated. ♀ specimen mounted ventral-side down on card. The mandibles are partially concealed due to the gluing position but the carinate clypeus is visible; the apicodorsal margin of the clypeal carina is nearly straight in lateral view and appears to be broken off. The antennae are intact but also embedded in glue. Label data (Fig. 5): Kalae / Molokai, [blank area for hand-writing elevation] ft. / Perkins. 7.VIII.1893 //

Sandwich Is. 1912—215. // SYNTYPE [round blue-ringed label] // ♀ SYNTYPE / *Sierola molokaiensis* / Ashmead, 1901: 290 / det. D. Notton, 2007 // LECTOTYPE / *Sierola molokaiensis* / K. Magnacca 2018 // NHMUK 013379650 [barcode] (NHMUK).

Notes. The description states that this specimen came from an elevation of 4000 ft.; however, Kala'e is at about 1600 ft., and the label does not have an elevation on it. Perkins' journal entry for the date says "Collected from Kalae upwards...right up to Kalamaula..." (Evenhuis 2007b). The spot Perkins refers to is unknown, but since the ahupua'a of Kalamaula extends only to about 3000 ft. elevation, it is likely to have come from below this. The only other species described from Moloka'i, *S. pilosa* Fullaway, is distinctly different by having the gena strongly produced ventrally so that the head is triangular in lateral view, but a large number of undescribed species are known to occur there. *Sierola molokaiensis* is similar to *S. hirticeps* Fullaway and *S. usitata* Fullaway of O'ahu, differing in the extremely broad fore femora and high OOL/WOT ratio. Prior to Fullaway's work, several papers used the name *S. molokaiensis* for various other species. For example, Swezey's (1909) account of it parasitizing the sugarcane bud moth refers to *S. acuta* Fullaway.

Sierola monticola Blackburn & Cameron

Sierola monticola Blackburn & Cameron, 1886:177.

Holotype. Label data (Fig. 6): "Sierola / monticola / Cam / Hawaii" [underside of card with specimen] // Type [round red-ringed label] // Cameron. / 99–30. // B.M. TYPE / HYM. / 13.191 // NHMUK 013379646 [barcode] (NHMUK).

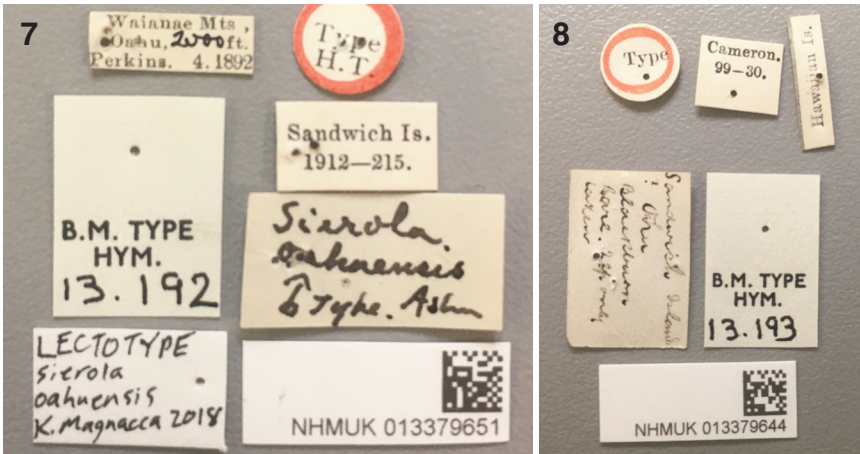
Notes. This species was described from a single specimen, which is the holotype by monotypy. The label does not contain any locality data (not even collection codes), but the description states that it comes from "Mountains of Hawaii (no. 134)". It is almost unique in the genus in having the metasomal tergites distinctly coriaceous all over and distinctly punctate. None of the 11 specimens at NHMUK identified as this species by Ashmead are it (three are missing from cards), but recent specimens have been taken from the Mauna Loa–Mauna Kea saddle area.

Sierola oahuensis Ashmead

Sierola oahuensis Ashmead, 1901: 290.

Type series. At least two specimens from Kīlauea are supposed to be in the type series. The pin of one is in the NHMUK collection, but the specimen is missing from its point. The remaining specimen at NHMUK, from O'ahu, is designated as the lectotype. One specimen is in the regular collection at NMNH, but is missing its head.

Lectotype designated. ♂ specimen mounted on its left side on card. The mandibles are concealed due to the gluing position but the non-carinate clypeus is visible. The antennae are intact but also embedded in glue. Label data (Fig. 7): Waianae Mts , / Oahu, 2000 ft. / Perkins. 4.1892 // Type / H.T. [round red-ringed label] // Sandwich Is. 1912—215. // *Sierola oahuensis* / ♂ type Ashm // B.M. TYPE / HYM. / 13.192 // LECTOTYPE / *Sierola oahuensis* / K. Magnacca 2018 // NHMUK 013379651 [barcode] (NHMUK).



Figures 7–8. *Sierola* type labels. 7. *S. oahuensis*, lectotype labels; 8. *S. testaceipes*, holotype labels.

Notes. Males are generally difficult to associate with females, but the unusual morphology of the head suggests that it is conspecific with *S. distincta* Fullaway. Males of this form are regularly collected in company with “*S. distincta*” females. Formal determination of synonymy will await revision of the O’ahu species.

Sierola testaceipes Cameron

Sierola testaceipes Cameron, 1881: 556.

Holotype. Label data (Fig. 8): [Blackburn symbol for O’ahu, on card with specimen] 94 // Type [round red-ringed label] // Cameron. / 99–30. // (Hawaiian Is.) // *Sierola* / *testaceipes* Cam / (type) / “Sandwich Islands / ? Oahu / Blackburn / Rare. 2 sp only / taken” // B.M. TYPE / HYM. / 13.193 // NHMUK 013379644 [barcode] (NHMUK).

Notes. This species was described from a single specimen, which is the holotype by monotypy. It is a senior synonym of several species described by Fullaway; it is the only broad-mandible species to have the median and submedian wing cells glabrous, although the key character of the ventral head setation is obscured in the type of *S. testaceipes*. The overwhelming majority of Perkins’s specimens were placed under this name by Ashmead, but only one of the 79 identified as such at NHMUK is actually *S. testaceipes*.

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