

## Notes on the Hawaiian Flora: Kaua‘i Rediscoveries and Range Extensions

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We report the rediscovery of two Kaua‘i single-island endemic flowering plant taxa previously thought to be extinct, *Euphorbia remyi* var. *hanaleiensis* (Euphorbiaceae) and *Melicope nealae* (Rutaceae); and two new Kaua‘i island records for endemic pteridophyte taxa, *Hymenophyllum obtusum* (Hymenophyllaceae) and *Athyrium haleakalae* (Athuriaceae). The rediscoveries and new island records offer hope that other individuals or populations of these species may exist and advances the potential to protect rare Kaua‘i taxa and secure *ex situ* conservation collections.

### Athyriaceae

#### *Athyrium haleakalae* K.R. Wood & W.L. Wagner    **New island record**

*Athyrium haleakalae*, a recently discovered and described fern species that was considered to be a single-mountain endemic restricted to Haleakalā, East Maui (Wood & Wagner 2017), has now been documented in a remote interior canyon drainage of northwestern Kaua‘i (Fig. 1). True to its description as being an obligate rheophyte, preferring sites of fast-moving water along steep-walled drainages, two close groupings of ca. 80 individuals total were documented along the walls of a small side drainage of Wai‘alae Stream. Observed late in the day while rushing to make a helicopter rendezvous, it is likely that with additional regional surveys in the general area more individuals will be located. Maui’s *Athyrium haleakalae* is currently being cultivated by the Hawai‘i State Division of Forestry and Wildlife at their Olinda Rare Plant Facility on East Maui. Naturally occurring plants on Maui are estimated to total around 700 individuals (Wood & Wagner 2017; H. Oppenheimer, pers. comm., Jan 2022). It is recommended that conservation efforts be made to collect spores and grow representatives of the Kaua‘i population, and that molecular phylogenetic research be conducted to gain a clearer understanding of the relationship between the Kaua‘i and East Maui populations of *A. haleakalae*, in addition to other athyroid fern taxa, especially its Hawaiian endemic relative, *Athyrium microphyllum*.

*Material examined.* **KAUAI:** side streamlet of Wai‘alae, *Metrosideros-Cheirodendron* montane wet forest with matting ferns of *Dicranopteris-Diplopterygium-Sticherus*, trees and shrubs of *Clermontia fauriei*, *Cyanea hirtella*, *C. leptostegia*, *Dubautia paleata*, *D. raillardioides*, *Elaeocarpus bifidus*, *Hydrangea arguta*, *Kadua affinis*, *Leptecophylla tameiameia*, *Melicope clusiiifolia*, *M. kauaiensis*, *Vaccinium calycinum*, and *V. dentatum*, herbs and vines of *Peperomia hesperomannii*, *Smilax melastomifolia*, *Stenogyne purpurea*, ferns and lycophytes of *Asplenium insiticium*, *Huperzia serrata*, and sedges of *Gahnia vitiensis* subsp. *kauaiensis* and *G. beecheyi*. Fern, rheophyte, terrestrial and lithophytic on stream banks, rhizome erect, up to 9 cm tall × 1.25 cm wide, scales pale-brown on rhizome tips and lower stipes, stipes delicate, up to 40 mm long × 0.3 mm wide, up to 12 fronds, fertile

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**Figure 1.** *Athyrium haleakalae*, fertile along headwater drainage of Wai‘alae, Kaua‘i, 7 Aug 2019, Wood, Walsh & Perlman 18272 (BISH, NY, PTBG, UC, US).

blade 3.5–9.0 cm long  $\times$  1.5–3.0 cm wide, lanceolate, single colony of ca. 40 plants, sympatric with *Athyrium microphyllum*, 1,170 m elev., 7 Aug 2019, K.R. Wood, S. Walsh & S. Perlman 18272 (BISH, NY, PTBG, UC, US); *loc. cit.*, additional small colony, 1,170 m elev., 7 Aug 2019, K.R. Wood, S. Walsh & S. Perlman 18274 (PTBG).



**Figure 2.** *Euphorbia remyi* var. *hanaleiensis*, herbarium specimen, showing branching inflorescence and cyathia with insert showing close-up of diagnostic tomentose capsule, Wainiha, Kaua‘i, 23 Apr 2014, Wood, Perlman & Query 15925 (BISH, CAS, PTBG).

## Euphorbiaceae

*Euphorbia remyi* A. Gray ex Boiss.

### Rediscovery

var. *hanaleiensis* (Sherff) Degener & I. Degener

Previously known only from the type collection made by Mann & Brigham between 1864 and 1865 on Kaua‘i and described by Earl Edward Sherff (1936: 588), this variety of *Euphorbia remyi* is unique for its densely tomentose capsules (Fig. 2). A significant colony of ca. 100 trees fitting Sherff’s description was documented around the upper north-eastern fork of Wainiha Valley, Kaua‘i in April 2014. The authors have since observed this colony to be somewhat stable but the region is seriously threatened by invasive weedy plant species such as *Buddleja asiatica*, *Hedychium gardnerianum*, *Miconia crenata* (= *Clidemia hirta*), and *Psidium guajava*.

In the *Manual of the Flowering Plants of Hawai‘i* (Wagner *et al.* 1999: 614), Koutnik mistakenly describes the presumed extinct *Euphorbia remyi* var. *hanaleiensis* as having solitary cyathia. This was an error that delayed us from reporting this discovery. Subsequently, the authors have examined the holotype specimen from CU (Cornell University), which conforms to Sherff’s description of *E. r.* var. *hanaleiensis* having a branched inflorescence (*i.e.*, “inflorescence open, branched, 3–7-cephalous and capsules with broad lengthwise bands of dense tomentum”) (Sherff 1936: 588; 1938: 15, 23). It should also be noted that previous to his contribution to Wagner *et al.* (1999), Koutnik had



**Figure 3.** *Euphorbia remyi* var. *kauaiensis*. **A.** Erect tree habit, headwaters of Wailua River, Kaua'i, 29 Sep 2021, Wood, Heintzman & Deans 18814 (PTBG). **B.** Cyathia with glabrous capsules, *loc. cit.*, 21 Feb 2017, Wood, Walsh & Perlman 17259 (BISH, CAS, PTBG, US).



**Figure 4.** *Euphorbia remyi* var. *remyi*. **A.** Low shrubby habit. **B.** Cyathia with glabrous capsules, headwaters of Lumaha'i River, Kaua'i, 18 May 2017, Wood *et al.* 17413 (BISH, PTBG, US).

correctly described the inflorescence as having open-branched cymes (Koutnik 1987: 377). The following emended key should now be used in Wagner *et al.* 1999, page 614, to divide the 3 varieties: var. *hanaleiensis*, a tree with many-branched inflorescences and tomentose capsules (Fig. 2); var. *kauaiensis*, a tree with many-branched inflorescences and glabrous capsules (Fig. 3); and var. *remyi*, a scandent shrub with solitary cyathia (or occasionally few-branched) and glabrous capsules (Fig. 4). Further molecular research is suggested to investigate whether the highly distinctive scandent shrub, *E. r.* var. *remyi*, may be recognized at the species level, as its habit differs strikingly from the two tree varieties of *E. remyi*, and whether the unusual narrow-leaved variety described as *E. remyi* var. *molesta* Sherff (1938: 19–20) from Wahiawa, Kaua‘i, *i.e.*, *Forbes 224-K* (F); *Lorence et al. 6758* (BISH, DAV, PTBG, US); *Wood 0722* (DAV, PTBG, US), should remain a synonym of *Euphorbia halemanui* Sherff, be considered an aberrant form of *E. r.* var. *remyi*, or be recognized as a unique taxon (pers. comm. T. Flynn, PTBG Curator).

*Material examined.* KAUA‘I: Hanalei, 1864–1865, *Mann & Brigham s.n.* (CU, holotype; GH, isotype); Wainiha, upper northeastern fork, closed *Metrosideros* lowland wet forest, 8–12 m canopy, surrounded by steep valley walls with *Dicranopteris* and mixed shrubs, understory dominated by *Antidesma* with associated trees and shrubs of *Cheirodendron* spp., *Coprosma waimeae*, *Cyrtandra* spp., *Dubautia* spp., *Geniostoma* spp., *Hydrangea arguta*, *Perrottetia sandwicensis*, *Polyscias kavaiensis*, *P. oahuensis*, *Psychotria* spp., *Syzygium sandwicense*, and a rich fern and bryophyte understory. Tree, 3 m tall, capsules purple-red with dense white villousness, cyathia purple-red, ca. 100 trees around gulch banks and surrounding slopes, 671 m elev., 23 Apr 2014, *K.R. Wood, S. Perlman & M. Query 15925* (BISH, PTBG, US).

## Hymenophyllaceae

*Hymenophyllum obtusum* Hook. & Arn.

### New island record

*Hymenophyllum obtusum* (Fig. 5), an epiphytic, filmy fern with filamentous rhizomes, previously documented as endemic to O‘ahu, Moloka‘i, Lāna‘i, Maui, and the Big Island of Hawai‘i (Palmer 2003) was recently documented in several disjunct areas on the island of Kaua‘i, including Kahuama‘a Flat, Kōke‘e, and Lumaha‘i Valley. The authors have also seen a recent photograph of *H. obtusum* taken in Limahuli Valley by Cassandra Jensen, Kupu Conservation Technician. Because of its broad distribution from the Big Island to O‘ahu, local botanists believed that it was only a matter of time before this relatively small epiphyte would be documented on Kaua‘i. Plants are easily distinguishable from the sympatric *Hymenophyllum lanceolatum* by their ovate to oblong blades (vs. lanceolate), and blades clothed in hairs that branch at the base and distally (vs. hairs unbranched or 1-branched only at base) (Palmer 2003). On Kaua‘i, plants were observed growing epiphytically on *Antidesma* and *Metrosideros*.

*Material examined.* KAUA‘I: Kahuama‘a Flat, Kōke‘e, *Metrosideros-Cheirodendron-Dicranopteris* montane wet forest, with trees and shrubs of *Bobeia brevipes*, *Coprosma kauaense*, *C. waimeae*, *Elaeocarpus bifidus*, *Ilex anomala*, *Melicope clusiifolia*, *Myrsine lessertiana*, *Nestegis sandwicensis*, *Perrottetia sandwicensis*, *Polyscias waialealae*, *P. waimeae*, *Psychotria greenwelliae*, *P. hexandra*, *P. mariniana*, *Scaevola procera*, *Syzygium sandwicense*, and *Xylosma hawaiiense*, herbs of *Astelia argyrocoma*, and ferns of *Athyrium microphyllum*, *Dryopteris fusco-atra*, *D. glabra*, *D. unidentata*, *Diplazium sandwichianum*, *Doodia kunthiana*, *Microlepia strigosa*, *Sadleria pallida*, and *S. cyatheoides*. Fern, rhizome filamentous, long-creeping, epiphytic on *Metrosideros*, 310 deg. NW aspect, fronds green with brownish tinge, fertile, first time documented on Kaua‘i, with *H. lanceolatum*, 1,260 m elev., 14 Aug 2019, *K.R. Wood & S. Walsh 18278* (BISH, PTBG); Lumaha‘i Valley, along main drainage, *Metrosideros* lowland wet forest bordered by steep slopes of *Dicranopteris* and *Diplopteridium* matting ferns, 90% closed canopy, with *Antidesma platyphyllum* var. *hillebrandii*,



**Figure 5.** *Hymenophyllum obtusum*, Kahuama‘a Flat, Kōke‘e, Kaua‘i, 14 Aug 2019, Wood & Walsh 18278 (BISH, PTBG).

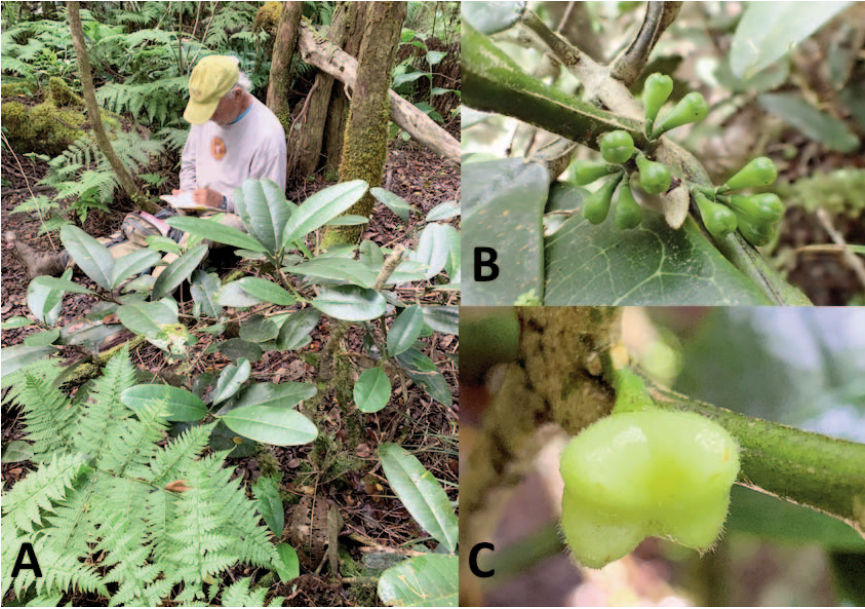
*Cheirodendron forbesii*, *Cibotium* spp. *Diplazium sandwichianum*, *Dubautia knudsenii*, *Ilex anomala*, *Kadua affinis*, *Melicope feddei*, *M. wawraeana*, *Psychotria mariniana*, *Sadleria* spp., and *Syzygium sandwicensis*. Fern, epiphytic on *Antidesma*, rhizome creeping, with *Hymenophyllum lanceolatum*, uncommon on Kaua‘i, 512 m elev., 8 Aug 2021, K.R. Wood, S. Heintzman & N. Barca 18762 (BISH, PTBG, US).

### Rutaceae

*Melicope nealae* (B.C. Stone) T.G. Hartley  
& B.C. Stone

### Rediscovery

Only two known collections of the Kaua‘i single-island endemic *Melicope nealae* have been previously recorded, one made in 1909 by C.N. Forbes in the Kahōluamanu region, east of Wai‘alae Canyon, and the other by B.C. Stone in 1960 along a level forested region to the north of Kumuwela, Kōke‘e (Stone 1969). In March 2019, a single vegetative plant of *M. nealae* was discovered in the Kahuama‘a Flat region of Kōke‘e State Park, in quite similar habitat as its previously known range around Kahōluamanu and Kumuwela. Subsequently, the plant has been observed in flower during the months of July through September and with immature fruit from September through December (Fig. 6). Flowers have consistently aborted before fruit-set, with the exception of two fruit initially observed forming on 26 Sep 2019 and closely monitored on 24 Oct 2019 and 22 Nov 2019. Returning on 18 Dec 2019, the fruit were observed prematurely fallen, most likely the result of torrential rains during the previous week. The capsules were empty of seed.



**Figure 6.** *Melicope nealae*, Kahuama‘a Flat, Kōke‘e, Kaua‘i. **A.** Low decumbent shrub habit, with Steve Perlman, 21 Sep 2021. **B.** In flower bud, 21 Nov 2021, *Wood, Walsh & Query 18235* (PTBG). **C.** Immature fruit with puberulent exocarp, 22 Nov 2019, *Wood, P. Wood & Atwell 18351* (PTBG).

The Plant Extinction Prevention Program has attempted air layers, but without success. Continued attempts to monitor and collect fruit for conservation and propagation are necessary to prevent extinction of the species, as are additional attempts to obtain air layers or other means of vegetative reproduction, and continued searches of the surrounding forests for additional individuals. It should be noted that this rediscovery leaves only one other Kaua‘i species of *Melicope* remaining on its presumed extinct list with no wild individuals known, namely *M. macropus* (Hillebr.) T.G. Hartley & B.C. Stone, a megacarp from northwestern Kaua‘i.

*Material examined.* **KAUA‘I:** Kahōluamanu, Sep 1909, *Forbes 341K* (BISH); Kumuwela, Kōke‘e plateau, 3,500 ft. (1,067 m), 12 Apr 1960, *B.C. Stone, P.J. Scheuer & F. Werny 3359* (BISH, holotype); Kahuama‘a Flat, *Metrosideros-Cheirodendron-Dicranopteris* montane wet forest with trees and shrubs of *Bobea brevipes*, *Claoxylon sandwicensis*, *Coprosma kauaense*, *C. waimeae*, *Dodonaea viscosa*, *Elaeocarpus bifidus*, *Ilex anomala*, *Kadua affinis*, *Melicope clusiifolia*, *Myrsine lessertiana*, *Nestegis sandwicensis*, *Perrottetia sandwicensis*, *Planchonella sandwicensis*, *Polyscias waialealae*, *P. waimeae*, *Psychotria greenwelliae*, *P. hexandra*, *P. mariniana*, *Scaevola procera*, *Syzygium sandwicensis*, *Xylosma hawaiense*, *Zanthoxylum dipetalum*, perennial herbs of *Astelia argyrocoma* and *Peperomia membranacea*, and ferns of *Athyrium microphyllum*, *Coniogramme pilosa*, *Elaphoglossum crassaule*, *E. paleaceum*, *E. wawrae*, *Deparia marginalis*, *Diplazium sandwichianum*, *Doodia kunthiana*, *Dryopteris fusco-atra*, *D. glabra*, *D. unidentata*, *Microlepia strigosa*, *Sadleria cyatheoides*, and *S. pallida*. Shrub or small tree, 1 m tall, vegetative, leaf size and pubescence unusual, recommend returning for fertile material, single plant observed, 1,265 m elev., 14 Mar 2019, *K.R. Wood & M. Query 18131*; *loc. cit.*, stems gray-brown, sprawling, leaf size and pubescence

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unusual, with ca. 3–5 small buds (mostly in leaf axils, occasionally ramiflorous), 12 m tall canopy, 60% closed, single plant observed, 2 Jul 2019, *K.R. Wood, S. Walsh & M. Query 18235* (PTBG); *loc. cit.*, 2 small immature fruit fallen after storm with heavy rain, hairs on exocarp, no seeds forming, fruit collected for voucher, only known plant, 18 Dec 2019, *K.R. Wood, P. Wood & R. Atwell 18351* (PTBG).

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