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The alien nonmarine gastropods of the Hawaiian Islands were cataloged by Cowie (1997) and were reviewed by Cowie (1998a). Subsequent new records (both for the archipelago and for individual islands) were reported by Cowie (1998b, 1999, 2000), Kraus (2003), and, specifically associated with the horticultural industry between 2004 and 2006, by Hayes et al. (2007), reviewed and analyzed by Cowie et al. (2008). Subsequent surveys, covering 196 sites across the six largest Hawaiian Islands during 2006–2010, have resulted in the additional new records reported here.

We surveyed 29 locations on Kaua‘i, 48 on O‘ahu, 13 on Moloka‘i, 50 on Maui, 4 on Lāna‘i, and 52 on Hawai‘i. Sites ranged from highly disturbed lowland habitats dominated by nonnative vegetation to high elevation habitats at which most of the vegetation was native. Also included were a number of horticultural nurseries and agricultural research stations.

A small number of additional records based on collections by collaborators (1996–2007) are also included, as well as 2004–2005 records of Allopeas clavulinum that were inadvertently omitted by Hayes et al. (2007).

We document here the new state and island records. A more comprehensive analysis and discussion of all records will be published elsewhere.

Collections were made by Kenneth A. Hayes (KAH), Norine W. Yeung (NWY), Jaynee R. Kim (JRK), Robert H. Cowie (RHC), and others as indicated. All collected material, not only that reported here, is deposited in the Bishop Museum (BPBM) Malacology Collection. Catalog numbers are BPBM Malacology Collection numbers. Assignments to families follow Robinson (1999), with the exception of Bulimulus guadalupensis, which is assigned to the Orthalicidae following Bouchet & Rocroi (2005) rather than Bulimulidae, which these authors placed as a subfamily of Orthalicidae. Families are treated alphabetically. Latitude and longitude coordinates were recorded by GPS.

Agriolimacidae
Deroceras reticulatum (Müller) (Fig. 1A) New island records

This western European slug (Kerney & Cameron, 1979) was previously recorded in the literature only from the islands of Kaua‘i and Hawai‘i (Cowie, 1997). It is frequently brought to us for identification after being intercepted by State of Hawaii Plant Quarantine officials, especially on shipments of Christmas trees arriving in the islands from the Pacific Northwest of the mainland United States. It is widely seen as an agricultural pest (Barker, 2002). It may have been misidentified in the past, possibly confused with Deroceras laeve (Müller), but appears to be widespread and established on all six of the largest main Hawaiian Islands.

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Figure 1: Alien land snails. A. *Deroceras reticulatum*, B. *Cecilioides aperta*, C. *Zonitoides arboreus*, D. *Lehmannia valentiana*, E. *Milax gagates*, F. *Bulimus guadalupensis*, G. *Oxylinus alliarius*, H. *Allopeas clavulinum*, I. *Vallonia pulchella*. Scale bars for slugs = 5 mm; and for shells = 1 mm. All photos are of specimens in Hawai‘i except *Milax gagates* from Spain (Photo by Joaquín Ramirez).

**Ferussaciidae**

*Cecilioides aperta* (Swainson) (Fig. 1B) **New island record**

Previously recorded only from the islands of O‘ahu and Hawai‘i, but probably a synonym of *C. baldwini* (Ancey), though never formally synonymized, and therefore probably also
previously on Kaua‘i and Maui as well as O‘ahu and Hawai‘i (Cowie, 1997). This is the first formal record of *C. aperta* from Maui. This species is thought to be native to the West Indies but has been spread widely by human activities (Solem, 1964), and has probably been in the Hawaiian Islands for a long time, though probably only subsequent to Western discovery of the Islands (Christensen, 1984).

**Material examined:** MAUI: Kapalua, N21°0.672', W156°38.487', KAH, S.H. Arnason, J.R. Bedrosian, M.M. Parker, 7 Apr 2007 (282991).

**Gastropodidae**

*Zonitoides arboreus* (Say) (Fig. 1C) **New island record**

Previously only recorded from O‘ahu, Maui, and Hawai‘i (Cowie, 1997), this species is common and widespread and probably occurs on all islands. This is the first record from Kaua‘i. A pest in orchid nurseries (Hollingsworth et al., 2003), it is now widespread in forest habitats.

**Material examined:** KAUĀ‘I: Köke‘e Road, right side, Waimea, N22°01.297', W159°41.533', KAH, J.R. Bedrosian, W.M. Meyer, M.M. Parker, 24 Mar 2007 (282849); Right side of Moi Road, near cemetery, Hanapēpē, N21°54.622', W159°35.633', RHC, S.H. Arnason, B.S. Holland, C.T. Tran, 25 Mar 2007 (282873).

**Limacidae**

*Lehmannia valentiana* (Férussac) (Fig. 1D) **New island records**

This Iberian species (Kerney & Cameron, 1979) is now widespread as a result of human activities (Barker, 1999). It was first recorded in the Hawaiian Islands as the junior synonym *Limax poirieri* Mabille in 1982 from Maui (Cowie, 1997). Although not abundant, this slug species is widespread in the Islands, and on the basis of the present records, is now present on all six of the largest islands.

Milacidae

*Milax gagates* (Draparnaud) (Fig. 1E)  **New island record**

This European slug species has been present in the Hawaiian Islands since at least 1897; it was previously known only from Maui and Hawai‘i (Cowie, 1997). It appears to be a high elevation species, now recorded from the highest peak on O‘ahu. It is a major agricultural pest in Europe (Barker, 2002).


Orthalicidae

*Bulimulus guadalupensis* (Bruguière) (Fig. 1F)  **New state record**

This species originated in the Caribbean, where it is widespread, especially in disturbed habitats, (Robinson et al., 2009). It has been introduced to Florida, probably in association with agricultural or horticultural plants, and has been recorded in abundance in lawns and among ornamental plants in a residential area (Thompson, 1976), as was the present material. It is likely that it was introduced via the horticultural trade. The only two localities at which the species has been found in the Hawaiian Islands were close together and were also the only two localities at which *Vallonia pulchella* was found (see below). Although described originally from the island of Guadeloupe, Bruguière’s original spelling is retained because it is not clear that either the ‘a’ rather than ‘e’ or the ‘u’ rather than ‘ou’ were inadvertent errors (International Code of Zoological Nomenclature, Article 32.5).


Oxychilidae

*Oxychilus alliarius* (Miller) (Fig. 1G)  **New island records**

This western European species (Kerney & Cameron, 1979) is a facultative predator of other snails (Meyer & Cowie, 2010). It is known as the ‘garlic snail’ because of its ability to emit a strong smell of garlic when irritated. It was first recorded in the Hawaiian Islands in 1937 (Cowie, 1997), based on specimens in the Bishop Museum from Waimea, Island of Hawai‘i. Subsequently, it was recorded in abundance on both Hawai‘i and Maui (Cooke & Baker, 1947) where it was considered a threat to native species (Severns, 1984). It was later recorded from Kaua‘i and Moloka‘i (Cowie, 1997). Meyer & Cowie (2010) reported it from O‘ahu but without reference to voucher specimens. The present records formally extend its recorded distribution to all six of the largest Hawaiian Islands. It is now one of the most widespread snail species in the Islands.

Subulinidae

**Allopeas clavulinum** (Potiez & Michaud) (Fig. 1H) **New island records**

Subulinidae are notoriously difficult to identify and a number of species have been introduced widely in the islands of the Pacific, including the Hawaiian Islands (Cowie, 2001). Their geographical origins are somewhat obscure but *Allopeas clavulinum* is thought to be native to East Africa (Kerney & Cameron, 1979). It was first recorded in the Hawaiian Islands, from the Island of Hawai‘i, in 1906 (Cowie, 1997). Cowie et al. (2008) extended the recorded distribution to Kaua‘i, O‘ahu, and Maui without reference to voucher specimens and Hayes et al. (2007) did not include those records so they are provided here. The subspecies *hawaiiense* Sykes is probably a junior synonym (Cowie, 1997), although it has not been formally synonymized, and had been recorded from Kaua‘i, O‘ahu, Moloka‘i, Maui and Hawai‘i over a century ago by Pilsbry (1906–1907). This is the first formal record from Moloka‘i and the first vouchered records from Kaua‘i, O‘ahu, and Maui.


Valloniidae

**Vallonia pulchella** (Müller) (Fig. 1I) **New state record**

The native range of this species is considered Holarctic (Kerney & Cameron, 1979), although including only Europe and eastern and central North America (Forsyth, 1999). It has been introduced to many places throughout the world (Gerber, 1996; Robinson, 1999). The only two localities at which the species has found in the Hawaiian Islands were close together and were also the only two localities at which *Bulimus guadalupensis* was found (see above).


**Acknowledgments**

We thank all the people named in the lists of material examined for help with collecting, and the landowners for permitting access. We especially thank Stephanie M. Joe, Vincent Costello and all the personnel of the O‘ahu Army Natural Resources Program for logistical support and collecting specimens from U.S. Army land. We are grateful to Betsy Gagné and Cynthia King of the Department of Forestry and Wildlife for their assistance with permitting and access to state lands. Regina Kawamoto helped us with depositing the specimens in the Bishop Museum, and Dylan Ressler assisted with photography, and Joaquin Ramirez provided the photograph of *M. gagates*. This work was supported by grants from the U.S. Department of Agriculture, Cooperative Agricultural Pest Survey (CAPS) program, and we thank Yolisa Ishibashi of that program.
Literature Cited


