

Wrinkled Dune Snail (*Candidula interseca*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, June 2015



Photo: Mark Hitchcox, USDA-APHIS.

1 Native Range, and Status in the United States

Native Range

From White-McLean (2011):

“Western Europe”

Status in the United States

From USDA-APHIS-PPQ (2012):

“Reported introduction site(s) and year(s) detected—Detroit, MI (2004; eradicated 2005); Port of Seattle, WA (2006); Port of Tacoma, WA (2006) (C. Campbell, personal comm.); Coos Bay, OR (2006); Curry Co., OR (2006).”

From Hitchcox (2007):

“Detection of populations of the exotic snail *Candidula interseca* in Oregon, February, 2007.”

Means of Introductions to the United States

From Hitchcox (2007):

“*Candidula intersecta* are frequently intercepted at the Port of Portland on cargo containers from Italy, Colombia, and Chile and are considered “Actionable” by PPQ (PIN-309 database; D. Robinson, USDA).”

Remarks

From Hotopp et al. (2013):

“This snail is introduced globally, including South America, Australia, and the West and East Coasts of North America. In Virginia, specimens have been found on the southern coast.”

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2015):

“Kingdom Animalia
 Subkingdom Bilateria
 Infrakingdom Protostomia
 Superphylum Lophozoa
 Phylum Mollusca
 Class Gastropoda
 Order Stylommatophora
 Family Hygromiidae
 Genus *Candidula*
 Species *Candidula intersecta* (Poiret, 1801)”

“Taxonomic status: valid”

Size, Weight, Age

From Hotopp et al. (2013):

“Width: 7 - 13 mm; Height: 5 - 8 mm; Whorls: 5.0 - 6.5.”

Environment

From Welter Schultes (2014):

“Usually at the soil in dry and open habitats, under stones, at low plants, often in dunes. Occasionally it climbs trees at the edges of woods. Tolerates cultivation, often found in corn stubble.”

Climate/Range

From CABI (2015):

“*C. intersecta* can tolerate a range of temperatures (from cool European climates in the UK to dry and hot conditions in southern Australia). It is found at altitudes from 0 to 800 m.”

Distribution Outside the United States

Native

From USDA-APHIS-PPQ (2012):

“Known primarily as a western and northwestern European species; native from southern Sweden, Denmark and south through Germany, the Netherlands, Belgium, France, the British Isles, to Spain and Portugal.”

Introduced

From USDA-APHIS-PPQ (2012):

“The species is established as an invasive in New Zealand, and southern Australia.”

“PPQ interceptions from South America indicate the species may also have established populations in Colombia and Chile, but this requires confirmation.”

From Welter Schultes (2014):

“Considered as probably introduced to Britain, there are no medieval fossils, but today widespread in S Great Britain and S and central Ireland, mainly coastal in N Great Britain.”

Means of Introduction Outside the United States

From CABI (2015):

“Many European snail species in the family Helicidae have been deliberately introduced and released to many parts of the world for development and harvest as “escargot” (Cowie and Robinson, 2003). Other species in the related families Hygromiidae and Cochlicellidae have been introduced inadvertently, in or on shipping containers or via the export of roof terracotta tiles (Robinson, 1999). Most of these species are European in origin with Italy (30%) and Spain (7%) accounting for many of the interceptions (Robinson, 1999). The same author listed 50 hygromiid species intercepted by US quarantine officials in the period 1993-98, including *C. intersecta* (Cowie, 2001).”

“Meissner et al. (2009) report that in November 2007, four species of molluscs were detected on a single shipment of ceramic tiles from Spain at the port of San Juan, Puerto Rico (CBP, 2007). Tiles contain calcium carbonate that the snails use for building their shells. The cool, dark, and humid conditions in ocean transport allow large numbers of hitchhikers to survive.”

“As a hitchhiker species it can seal itself on the hard surfaces of containers, machinery and vehicles and crawl into dark and cool crevices.”

Short description

From Welter Schultes (2014):

“Shell whitish or yellowish with brown bands or spots, colour and patterns very variable, overall impression greyish brown to brown, finely striated, 5 convex whorls, aperture simple without lip, margin slightly reflected near umbilicus, umbilicus open and variably wide.”

Biology

From Welter Schultes (2014):

“Eggs (diameter: 1 mm) are laid between May and October.”

From CABI (2015):

“Land snails including *C. intersecta* are hermaphrodites (Godan, 1983). Many species can store sperm and produce fertile eggs for several weeks after mating. Land snails usually mate and lay eggs in the autumn as conditions are getting cooler and wetter. In temperate climates, the egg stage can be the overwintering period in the life cycle of land snails.”

“*C. intersecta* populations can reach high numbers and exhibit massing behaviour: large numbers of snails become arboreal, and climb up branches of trees and shrubs, and stems of cereals, to eat, mate, or aestivate and to escape from the ground heat. They are also attracted to cool, dark and humid places and favour environments where calcium is available.”

Human uses

None reported.

Diseases

From USDA-APHIS-PPQ (2012):

“Temperate terrestrial gastropods can: ... Transmit pathogens to humans indirectly when humans consume vegetables and fruits contaminated by snails and slugs; Transmit pathogens of both plants and livestock in their feces”

Threats to humans

From USDA-APHIS-PPQ (2012):

“Temperate terrestrial gastropods:

- Cause damage by feeding on agricultural and horticultural crops as well as native plants, thereby lowering crop yield and quality,
- Transmit pathogens to humans indirectly when they consume vegetables and fruits contaminated by snails and slugs,

- Transmit pathogens of both plants and livestock in their feces”

From CABI (2015):

“No economic impact has been reported in the state of Oregon from the infestations of *C. intersecta* (Hitchcox, 2007).”

3 Impacts of Introductions

From White-McLean (2011):

“Apart from the direct, reduced market value of the fruit, *C. intersecta*’s type of feeding damage allows for secondary infections to the fruit and tree. In some instances, the tree may die from such infections. This species also feeds on both the seeds and the seedlings of cereal crops.”

“*C. intersecta* has the propensity to aggregate on vertical structures. They often pose a contamination risk to cereal grains during harvest, as well as allow for secondary infestation by fungal pathogens, which may make the grain toxic. In field cropping systems, this species is able to survive cultivation, therefore making it difficult to manage.”

From USDA-APHIS-PPQ (2012):

“*Candidula intersecta* (Poiret) is a recognized pest of fruit farms (apples, pears, plums and peaches), damaging fruit and, while still on the tree, making them open to attack by fungi such as *Monilia*. The species causes feeding damage to seeds, seedlings and young plants of spring grain in southern Germany (Godan, 1983).”

“Temperate terrestrial gastropods can ... displace native species of snails and slugs.”

4 Global Distribution

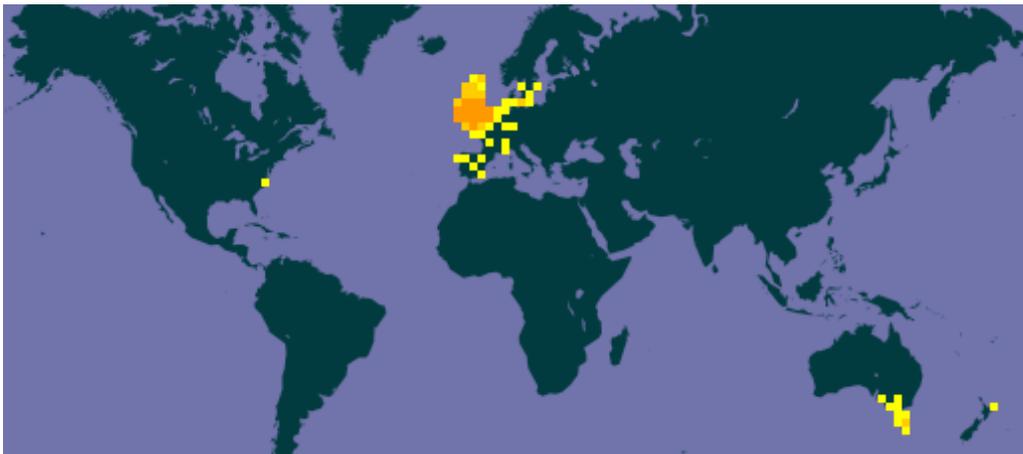


Figure 1. Known global distribution of *C. intersecta*. Map from GBIF (2015). Location in Virginia (U.S.) was not used in climate matching (Sec. 6) because it does not represent an established population.

5 Distribution within the United States

2014

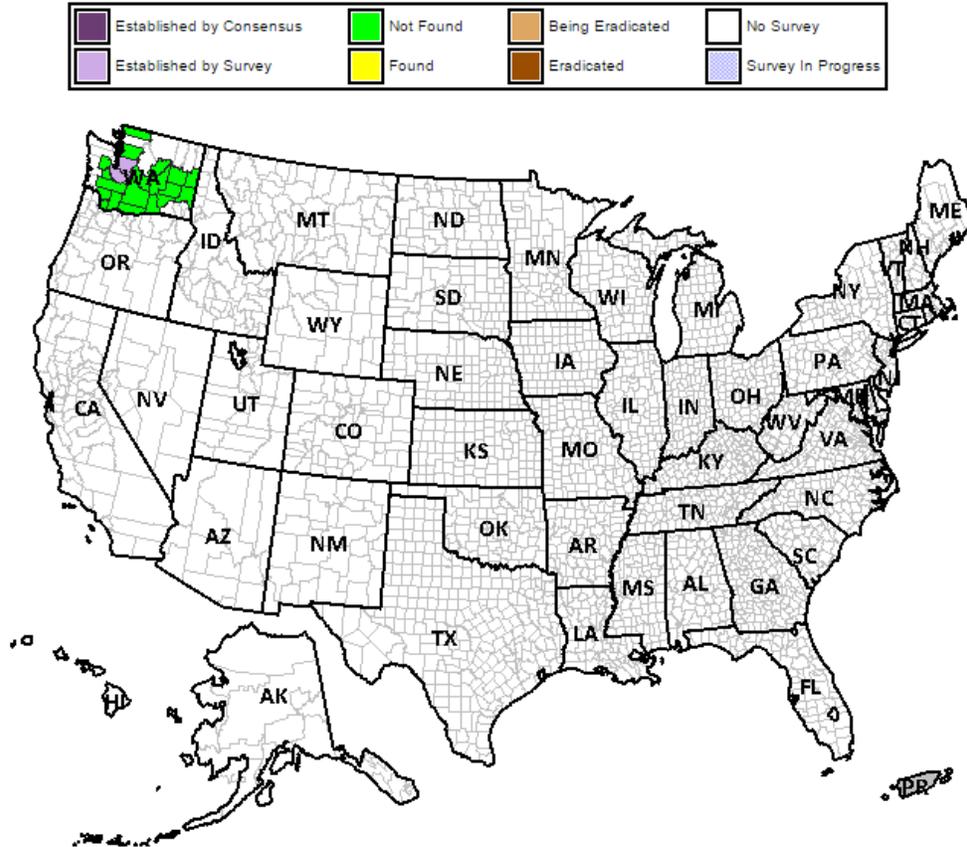


Figure 2. Distribution of *C. intersecta* in the U.S. Map from NAPIS (2015).

6 Climate Match

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean distance) is high in western Washington, especially around Seattle and the Olympic Peninsula. Climate match is also medium to high through most of California and in parts of Oregon, Nevada, and Arizona. Climate match is medium in parts of the Great Lakes region, on Cape Cod, and in the Appalachian region from North Carolina to New York. Climate match is generally low throughout the eastern two-thirds of the contiguous U.S., apart from the areas mentioned above. Climate 6 score indicates that the contiguous U.S. is a medium climate match for *C. intersecta*. The range for a medium climate match is 0.005 to 0.103; the Climate 6 score for *C. intersecta* is 0.078.

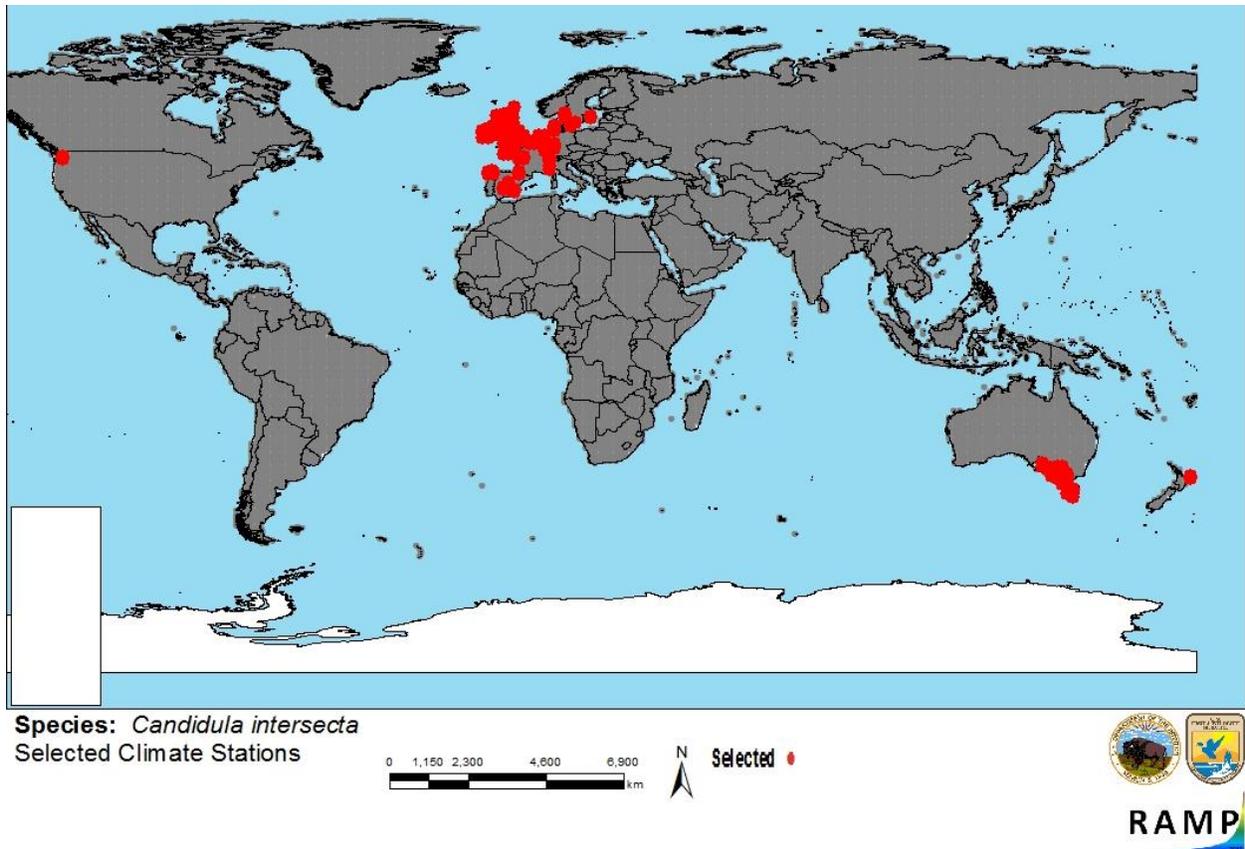


Figure 3. Map of RAMP (Sanders et al 2014) showing weather stations selected as source locations (red) and non-source locations (gray) for *C. intersecta* climate matching. Source locations from GBIF (2015) and NAPIS (2015).

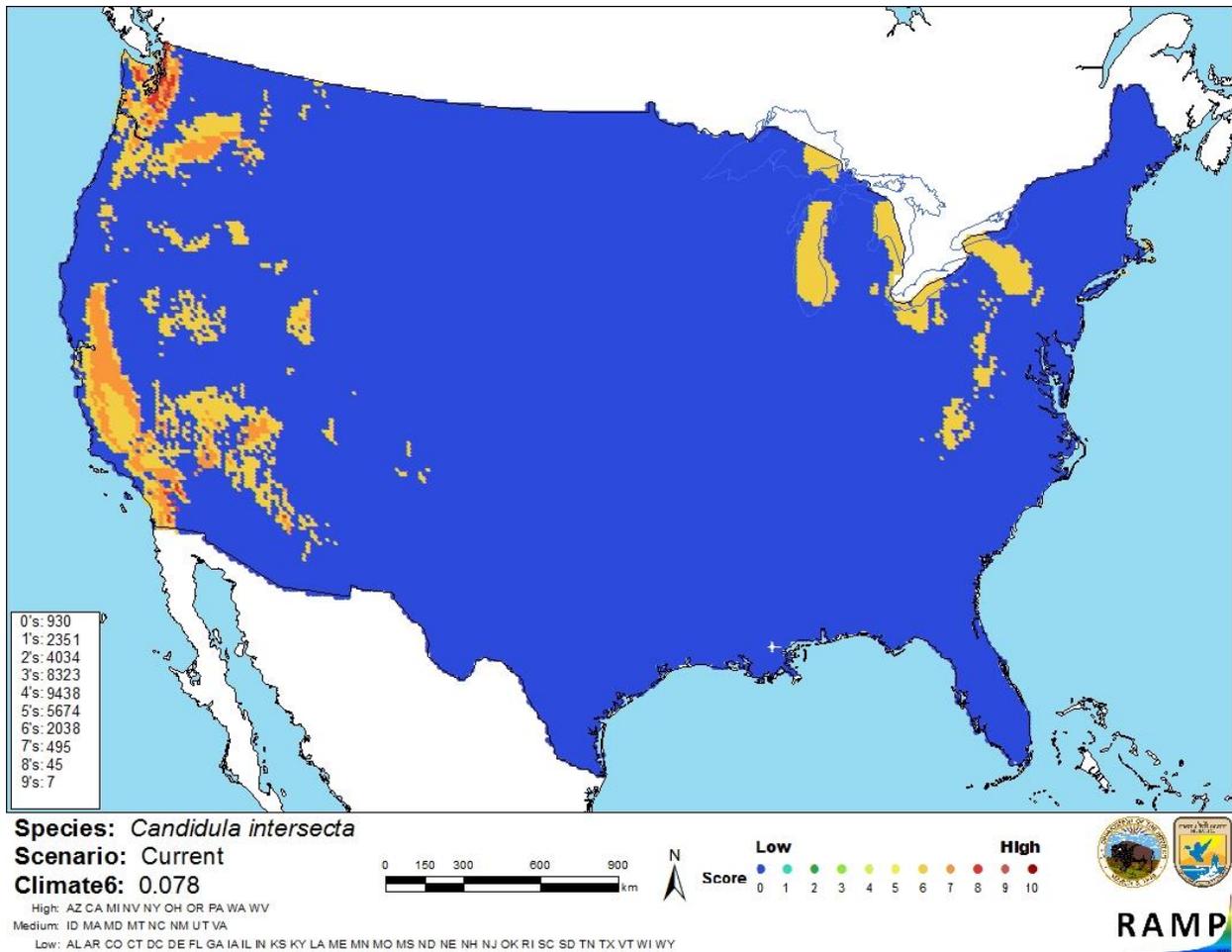


Figure 4. Map of RAMP (Sanders et al. 2014) climate matches for *Candidula intersepta* in the continental United States based on source locations reported by GBIF (2015) and NAPIS (2015). 0= Lowest match, 10=Highest match. Counts of climate match scores are tabulated on the left.

7 Certainty of Assessment

The biology and ecology of *C. intersepta* are reasonably well-known, although some uncertainty about the species distribution is apparent from the literature. Negative impacts from introductions and spread of this species are documented, but would benefit from further study. In particular, little is known about impacts to native species. Certainty of this assessment is medium.

8 Risk Assessment

Summary of Risk to the Continental United States

Candidula intersepta is native to Western Europe and has become established in Australia and New Zealand as an agricultural pest. Within the United States, *C. intersepta* was reported from Michigan, Oregon, Virginia, and Washington, with established populations only in the Pacific Northwest. Economic impacts have yet to be reported in the United States, but globally, *C.*

intersecta can damage fruit and cereal crops, facilitate secondary infections in fruit trees, and contaminate the harvested produce. It has also displayed a tendency to amass on vertical objects when population levels rise. Climate match with the United States is medium. Overall risk for this species is high.

Assessment Elements

- **History of Invasiveness (Sec. 3):** High
- **Climate Match (Sec. 6):** Medium
- **Certainty of Assessment (Sec. 7):** Medium
- **Overall Risk Assessment Category: High**

9 References

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

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of Florida. Available:
<http://idtools.org/id/mollusc/factsheet.php?name=Candidula%20intersecta>. (July 2015).

10 References Quoted But Not Accessed

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

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Cowie, R. H. 2001. Can snails ever be effective and safe biocontrol agents? *International Journal of Pest Management* 47(1):23-40.

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Meissner, H., A. Lemay, C. Bertone, K. Schwartzburg, L. Ferguson, and L. Newton. 2009. Evaluation for pathways for exotic plant pest movement into and within the greater Caribbean region. USDA, Raleigh, North Carolina.

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