

Aegopinella nitidula (Draparnaud, 1805) (Gastropoda: Zonitidae) in British Columbia – first confirmed North American record

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Abstract: The European land snail, *Aegopinella nitidula* (Draparnaud, 1805), is reported for the first time from British Columbia, from three sites in the city of Vancouver. These new records are the only documentation of the species in North America, except for two old records that are probably erroneous and have been ignored in recent literature. Comparisons are made between *A. nitidula* and similar native and introduced species. Information about its ecology in Europe is summarized.

Key Words: introduced land snails, Pulmonata, Vancouver, Canada

Many species of European terrestrial snails and slugs have proven particularly well suited for introduction by humans to other parts of the world, and in North America 45 species are introduced and apparently established (compiled from Turgeon *et al.*, 1998; Forsyth, 1999; Reise *et al.*, 2000; and this paper). In general, these species tend to be synanthropic and opportunistic. Most of the slugs and some of the larger snails are important economically because of damage that they inflict upon crops. Also of great concern is the potential long-term impact that carnivorous species may have on native fauna. Frest & Rhodes (1982), for example, suggested a connection between the predatory snail *Oxychilus draparnaudi* (Beck, 1837) and a reduction in a local population of native snails in Iowa. The New World predatory snail *Euglandina rosea* (Férussac, 1818) has certainly caused the extinction of several snails endemic to Pacific islands (Civeyrel and Simberloff, 1996).

The land snails and slugs of British Columbia have historically been neglected, and introduced species in particular have been poorly documented (but see Rollo and Wellington, 1975). Recently Forsyth (1999) updated the published record of nine exotic land snails in the province, and Reise *et al.* (2000) reported the first known North American records of the worm slug, *Boettgerilla pallens* Simroth, 1912 from near Victoria, British Columbia. The present paper reports for the first time the European zonitid *Aegopinella nitidula* (Draparnaud, 1805) from three sites in Vancouver, British Columbia, and confirms the existence of this species in North America (Fig. 1). It seems likely that old records of this species from California and Great Slave

Lake, Northwest Territories (Dall, 1905; Pilsbry, 1946) were erroneous, as discussed below.

MATERIALS AND METHODS

RGF has made extensive collections of land snails from 80 sites in the urban areas of Vancouver and Victoria (Forsyth, 1999) and from more than 400 sites throughout British Columbia, mostly since 1995. In addition JMCH and HR spent two weeks in July 1998 collecting land mollusks in southern British Columbia, paying particular attention to synanthropic habitats. Specimens were collected by hand from under wood, logs, rocks and leaf litter. Most material was preserved in 70% ethanol and specimens are deposited in the Royal British Columbia Museum (RCM), Victoria, B. C., or the Staatliches Museum für Naturkunde Görlitz (SMNG), Görlitz, Germany. Additional material is in the private collection of RGF. Our determination of *Aegopinella nitidula* was based on comparison of shell and anatomical characters with European specimens and was confirmed by A. Riedel (Warsaw).

RECORDS OF *AEGOPINELLA NITIDULA* IN VANCOUVER

Aegopinella nitidula was found at only three localities, all in the city of Vancouver:
Path at north end of Blanca Street, Vancouver, B.C.

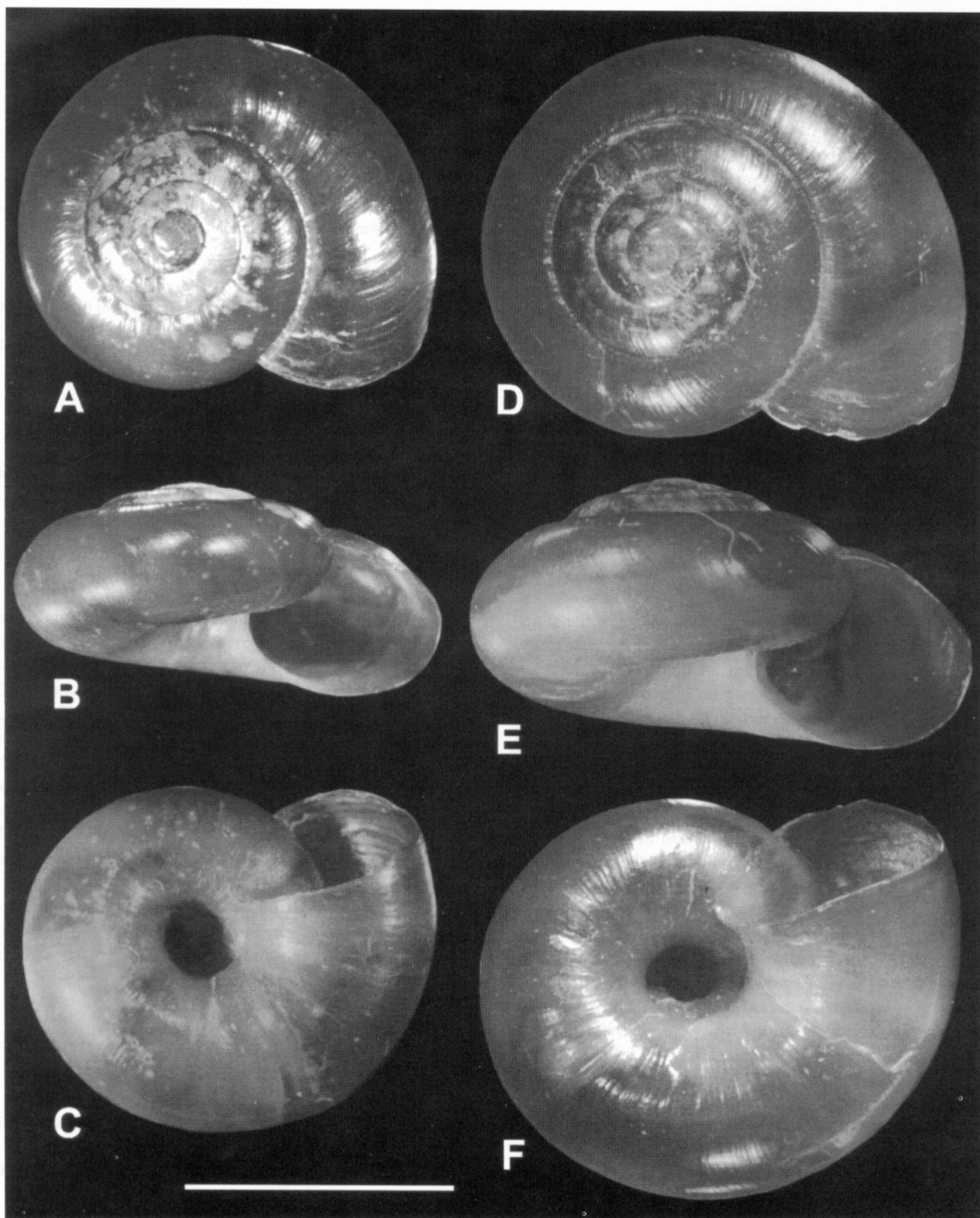


Fig. 1. *Aegopinella nitidula* (Draparnaud, 1805). A-C. Specimen from Stanley Park, Vancouver, British Columbia, Canada; 17 July 1998 (SMNG p5982). D-F. Specimen from Leigh Delamere motorway services, Wiltshire, England; 19 April 2000 (SMNG p8023). Scale bar = 5 mm.

(49°16.5'N, 123°12.8'W). RGF, collector. 24 November 1997. Forsyth Collection, 1 specimen, dry.

Ibid., T. J. Forsyth and RGF, collectors. 30 December 1998. RBCM 999-00029-002, 6 specimens, 70% ethanol.

Vicinity of the park drive at 33rd Avenue, Queen Elizabeth Park, Vancouver, B.C. (49°14.5'N, 123°06.9'W). HR and JMCH, collectors. 18 July 1998. SMNG p5981, 12 specimens, 70% ethanol.

Vicinity of Stanley Park Drive and Lagoon Drive, between road and golf course, west of Lost Lagoon, Stanley Park, Vancouver, B.C. (49°17.6'N, 123°08.7'W). HR and JMCH, collectors. 17 July 1998. SMNG p5982, 32 specimens, 70% ethanol.

At the Blanca Street site, *Aegopinella nitidula* was found in association with five other species of gastropods: *Deroceras reticulatum* (Müller, 1774); *Arion hortensis* complex Férussac, 1819; *Lauria cylindracea* (da Costa, 1778); *Oxychilus draparnaudi* (Beck, 1837); and *Cochlicopa lubrica* (Müller, 1774). The site was at the end of a road in a residential neighborhood adjacent to a wooded bank. At the top of the bank, in the area where specimens were found, plants were mostly exotic ornamentals mixed with some native trees and shrubs. Regular dumping of garden waste was apparent and most specimens were found on the ground under leaf material and brush.

In Stanley Park *Aegopinella nitidula* was common in flower beds and under planted shrubs in a more cultivated part of the park. *A. nitidula* was associated with *Cochlicopa lubrica*; *Oxychilus alliarius* (J. S. Miller, 1822); *Arion subfuscus* (Draparnaud, 1805); *Arion hortensis* complex; *Limax maximus* Linnaeus, 1758; *Deroceras reticulatum*; and *D. panormitanum* (Lessona and Pollonera, 1882).

The habitat of *Aegopinella nitidula* in Queen Elizabeth Park was very similar to where we found the species in Stanley Park. Associated mollusks were *Cochlicopa lubrica*; *Lauria cylindracea*; *Arion subfuscus*; *A. distinctus* Mabille, 1868; and *Vitrea contracta* (Westerlund, 1871).

Although Forsyth (1999) has made extensive collections of land snails in similar habitats elsewhere in British Columbia, *Aegopinella nitidula* was collected only at these three sites within the city of Vancouver. Associated terrestrial mollusks are all ultimately of European origin, except for *Cochlicopa lubrica*, a native, Holarctic snail with a strong tendency to be synanthropic (Roth and Pearce, 1984). In Europe *A. nitidula* is often in habitats disturbed by human activities (Kerney and Cameron, 1979) and, therefore, is a prime candidate for foreign introduction. Rollo and Wellington (1975) and Forsyth (1999) suggested that the movement of garden waste from one site to another

is very important in the spread of terrestrial slugs and snails in urban areas. The paucity of records for this species relative to certain other exotic land snails and slugs (see Forsyth, 1999; Rollo and Wellington, 1975) perhaps suggests a more recent introduction.

DISTRIBUTION AND ECOLOGY IN EUROPE

Aegopinella nitidula is native to Europe, with a northwestern distribution (Kerney *et al.*, 1983; Riedel, 1970). The most northern records are along the Atlantic coast of Norway, and it occurs as far south as Spain. The slanting southeastern border to its distribution keeps mostly north of such mountain ranges as the Carpathians, Alps, Juras, and Pyrenees as well as north of the Mediterranean region.

Aegopinella nitidula is catholic in its habitats, found under leaf-litter in coniferous and deciduous woodland, damper grassland, river banks, the base of rocks and walls, hedgerows, waste ground and gardens (Kerney and Cameron, 1979). It is tolerant of a wide range of soil pH (even pH = 4.8, Hermida *et al.*, 1995). Within parts of Europe *A. nitidula* is encountered frequently and can occur at quite high densities (e.g. average densities of 8, 14, 16 and 18 per m² in different woodlands – Mason, 1970; Mordan, 1977; Cameron, 1982; Corsmann, 1990).

Two studies in British woodlands have found a biennial life cycle in this species (Mordan, 1978; Cameron, 1982). The numbers of the smallest juveniles peaked in autumn at one site, but the peak started earlier at the other site, and continued into late winter at a site in Germany (Corsmann, 1990). In Mordan's population, snails became sexually mature by December of their second year, dying off the following summer or autumn. Egg numbers peaked in summer but some were recorded in most months.

Fecal analysis indicated that most of the diet is dead plant material, but 10% of feces contained some molluscan tissue (Mordan, 1977). Behavioral observations have confirmed that *Aegopinella nitidula* preys on other snails up to 4.5 mm in diameter and slugs up to 17 mm long (Frömming, 1954; Mordan, 1977). They attack other zonitid snails initially through the shell aperture, but obtain further flesh by later drilling a hole through the shell, usually from the underside (Mordan, 1977). Circumstantial evidence suggests that predation by *A. nitidula* might even affect the density and distribution of other snail species (Mordan, 1977). Its introduction to North America could, therefore, have repercussions on the native mollusk fauna. Earthworms and Enchytraeidae are also readily depredated by *A. nitidula*, at least in captivity (Frömming, 1954).

SIMILAR SPECIES AND THE IDENTIFICATION OF *AEGOPINELLA NITIDULA*

The shells of zonitids are in general thin, more or less glossy and often somewhat translucent. The aperture lacks denticles and the outer lip is unthickened. *Aegopinella nitidula* has a thin, light yellowish-brown shell having a distinctive waxy appearance. Fully grown shells measure 8-10 mm in diameter and have roughly 4½ whorls (Kerney and Cameron, 1979). Under a high magnification fine spiral incised lines and incremental lines are evident on the shell's surface. The width of the umbilicus is approximately 20-25% that of the shell. Around the umbilicus, the shell is more opaque than elsewhere and distinctly whitish (Fig. 1). The animal is dark gray with a slight bluish tinge on top, with paler flanks and tail, and a pale sole.

In Europe there are many *Aegopinella* species similar in external appearance to *A. nitidula*. In most cases dissection is necessary for species identification (Riedel, 1957, 1983; Forcart, 1959; Kerney and Cameron, 1979). The critical structures are the male genitalia, although these often show much intraspecific variation. In most species there is a considerable length of tubular structure (often called epiphallus) between the main swollen part of the penis and the insertion of the retractor muscle. This is not the case in *A. nitidula* and *A. nitens* (Michaud, 1831), in which the retractor appears to insert near the end of the penis. These two species overlap in their distribution, but *A. nitens* occurs further to the south, generally in the mountains. *A. nitens* has a larger, firmer penis. One character often given for their separation is that *A. nitens* has a bipartite penis, but this can be misunderstood because in *A. nitidula* the attachment of the short thick epiphallus to the bulbous part of the penis also suggests a bipartite structure. In *A. nitens* the constriction is nearer the atrium.

The shell of *Aegopinella nitidula* might be confused with other zonitid genera. Four species of *Oxychilus* have been introduced into North America from the Palearctic (Turgeon *et al.*, 1998), and three of these (*O. alliarius*, *O. cellarius* and *O. draparnaudi*) occur in British Columbia (Forsyth, 1999). These lack the fine spiral lines of *Aegopinella*, appear glossy rather than waxy, and have proportionally smaller umbilici. *O. alliarius* is the *Oxychilus* species most likely to be confused with *A. nitidula*, but the smell of garlic usually produced by the animal when irritated is distinctive. *Zonitoides arboreus* (Say, 1816) and *Z. nitidus* (Müller, 1774) have smaller shells that are more coarsely sculptured and without the paler area around the umbilicus. *Z. arboreus* usually has very fine spiral striae (evident only with at least 50x magnification) but these are much weaker than spiral striae on the shell of *A. nitidula*. The animal of *Z. arboreus* is light grayish or nearly white

with darker gray pigment dorsally and on the tentacles. The shell of *Z. nitidus* lacks spiral striae, and the animal is all black. *Nesovitrea* is a Holarctic genus that is sculpturally unlike *Aegopinella*; the axial sculpture consists of more or less regularly and widely spaced grooves.

OCCURRENCE IN NORTH AMERICA

There are two old records of *Aegopinella nitidula* from North America. A report of *A. nitidula* (as *Retinella nitidula*) from gardens in Oakland, California was discussed by Pilsbry (1946) who doubted the identification and suggested that the record was based on misidentified *Oxychilus alliarius* or *O. cellarius*. B. Roth (pers. comm., 1999) has subsequently confirmed that this record was based upon specimens of *O. alliarius*. Pilsbry also doubted the other old record of *A. nitidula*, from the Northwest Territories, Canada, which dates from the checklist of Dall (1905: 39) who cited "*Vitrea nitidula*" from "Fort Resolution (!) Great Slave Lake". As a convention of his checklist, Dall made use of the exclamation mark to indicate that he had personally examined and verified the record, and further wrote that the locality and identification were "indubitable". Our inquiries into the existence of the material upon which Dall based his identification have not been successful, so this record remains unconfirmed and perhaps should remain thought of as probably erroneous.

With the exceptions of Taylor (1908) and Ellis (1969), who repeated these old records, the literature has ignored the old records of *Aegopinella nitidula* on the authority of Pilsbry (La Rocque, 1953; Turgeon *et al.*, 1998). However, the existence of this species in North America can now be firmly established with the discovery of *A. nitidula* in Vancouver, British Columbia.

For the purposes of the American Fisheries Society list of common names of mollusks (Turgeon *et al.*, 1998), "waxy glass-snail" is suggested. This name is already in use in the literature (Pfleger and Chatfield, 1983) and is favored over other published common names that are misleading or less diagnostic.

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