

The Australian species are arboreal and live in a wide range of terrestrial habitats. They have been collected from the leaves of mangrove trees, in tropical and subtropical rainforest, and in the vine thickets of eastern Queensland, northern and north-western Australia.

Whether the Australian species are accidental introductions and hence synonyms of widespread species, or whether they are true endemics, remains to be determined. *Tornatellinops* and *Elasmias* species are often found living together, but the lack of more detailed studies makes it difficult to comment on species ranges and overlap.

The family is represented in the fossil record by *Anthracopupa* (Solem & Yochelson 1979) which is recorded from the Upper Carboniferous of North America. If this interpretation is correct it indicates that a major shift in distribution of the family has taken place since the Palaeozoic.

Superfamily CIONELLOIDEA

Cionelloideans are small to large terrestrial snails that usually have a dextral shell (occasionally sinistral) which is usually ovate-conic or high-spired and turreted. The shell is either glossy and monochrome or dull with distinct colour patterns. The aperture may contain columellar lamellae. The lip is either simple or prominently thickened. The radula has a narrow, tricuspidate central tooth, the laterals are bicuspidate with a quadrate basal plate, and the marginals are multicuspidate. The ureter is recurved at the tip. An epiphallus and flagellum, or caecum, are present on the penis. The penial retractor muscle is simple and inserted on the penis. Cionelloideans are hermaphroditic, oviparous or ovoviviparous.

Two families are recognised. The Amastridae are restricted to the Hawaiian Islands. The Cionellidae are endemic to North Africa and Central Europe, but have been introduced to Australia and other parts of the world.

Family Cionellidae

This family of terrestrial snails is native to northern Europe and North America. Cionellids have small, elongate, glossy shells up to 7 mm in length. One species, *Cionella lubrica*, has been introduced into southern Australia (Smith 1992). It was first recorded in southern Western Australia by Kendrick & Sedgwick (1973) and subsequently recorded from several localities in south-eastern Australia by Smith & Kershaw (1979).

The shell is dextral, small and elongate. The aperture is ovate with a steeply sloping parietal wall, the columella is straight and the lip is not expanded or thickened within (Fig. 17.41A). These two latter characters help to separate *Cionella lubrica* from the only Australian species of the Ferrussaciidae, which is otherwise very similar. The shell is smooth and glossy and light horn-coloured. The animal is dark in colour with no peripedal groove or caudal gland.

Cionella lubrica is a detritus-feeder. The jaw is arcuate and closely plaited. The radula has few teeth; the tricuspidate central tooth is narrow, the bicuspidate laterals have a quadrate basal plate and the marginals are multicuspidate (Fig. 17.41B). The pericardium is much shorter than the kidney, which is narrowly triangular and long, and passes into a direct ureter. The pulmonary cavity has fine capillary reticulation, without visible branches in the principal pulmonary vein (Boss 1982).

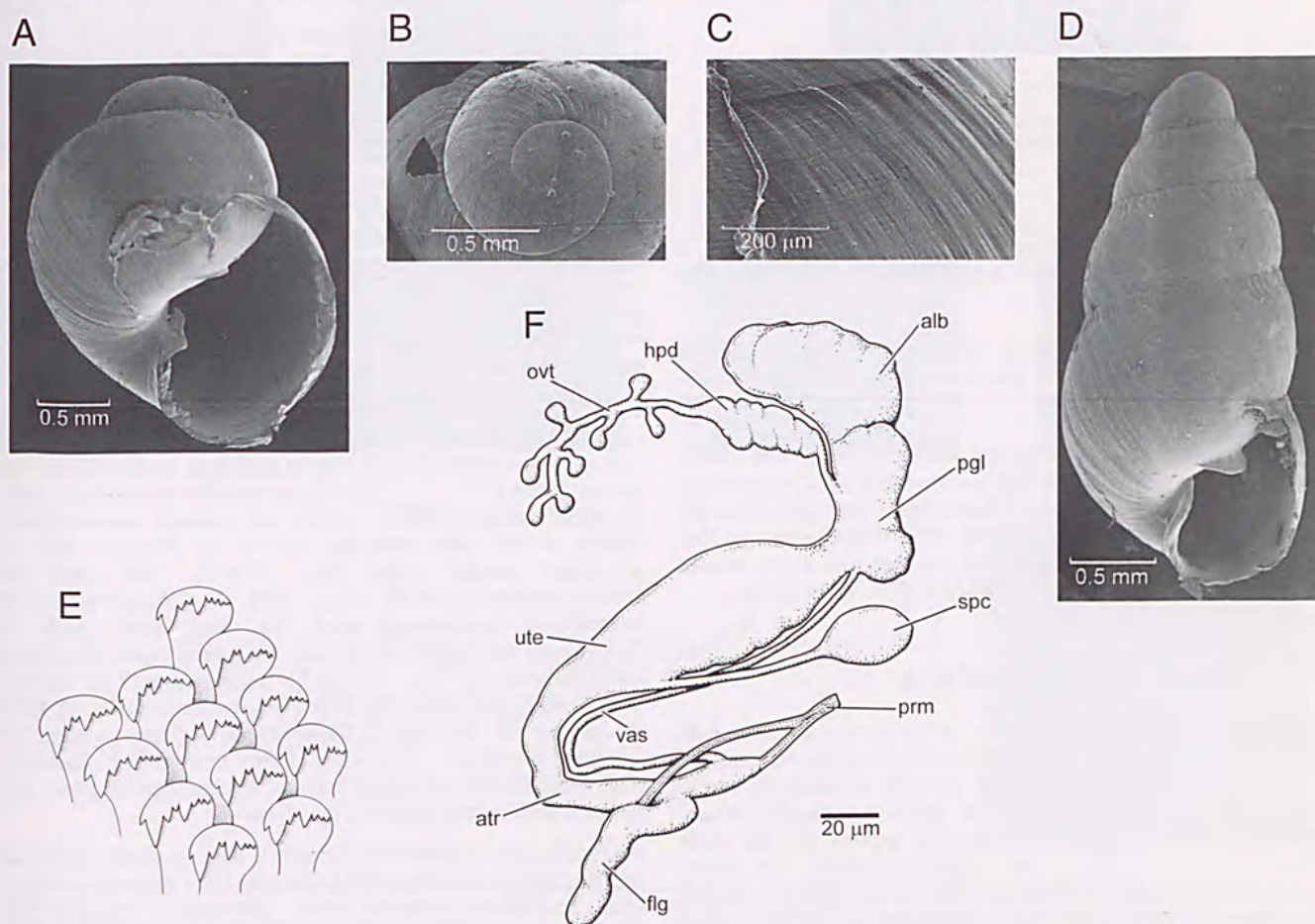


Figure 17.40 Family Achatinellidae. A–C, *Elasmias wakefieldiae*: A, shell, apertural view; B, apical shell sculpture; C, shell sculpture of a mature specimen. D, *Tornatellinops jacksonensis*, shell, apertural view. E, F, *Tornatellinops variabilis*: E, portion of radula showing some teeth which are arranged in V-shaped rows; F, reproductive tract. alb, albumen gland; atr, atrium; flg, flagellum; hpd, hermaphroditic duct; ovt, ovotestis; pgl, prostate gland; prm, penial retractor muscle; spc, spermatheca; ute, uterus; vas, vas deferens. (E, F, after Odhner 1922)

[A–D, Queensland Museum; E, C. Eadie; F, B. Scott]

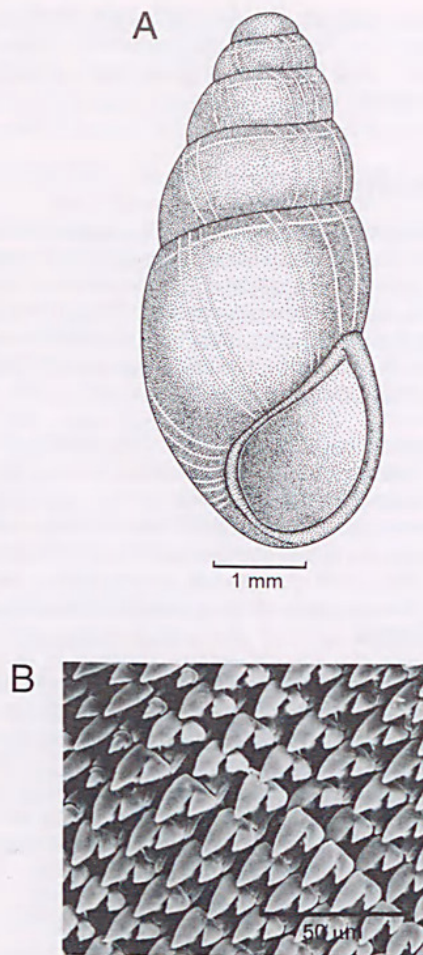


Figure 17.41 Family Cionellidae. *Cionella lubrica*: A, shell, apertural view; B, portion of radula showing lateral teeth. [A, C. Eadie; B, B.J. Smith]

Cionellids are protandric hermaphrodites. The penis has a well-developed epiphallus with a non-forked retractor muscle; a penial appendix is present.

Cionella lubrica is confined to moist, very sheltered areas in well-established gardens in a few scattered localities in southern Australia.

There is some confusion over the name by which this family should be known. Workers in Europe use the name Cochlicopidae (Kerney & Cameron 1979), but Cionellidae is used here following Pilsbry (1948) and Burch (1976b). The family contains four genera, all Palearctic in distribution, but with one or two species introduced into various other temperate regions of the world.

Superfamily PUPILLOIDEA

Members of this superfamily are terrestrial snails with small shells that vary in shape from pupiform to elongate-turreted and subdiscoidal. The aperture is often partially occluded by one to many lamellae and denticles. The shells are usually dextral although sinistrality is common in some groups, and the lip is either sharp or thickened and slightly reflected. The radula consists of tricuspidate central and bicuspidate lateral teeth which are similar in size, and multicuspidate marginals that have a broad basal plate. The triangular kidney is tapered anteriorly and the ureter is recurved at the tip, sometimes as an open groove (Pilsbry 1948). The penis usually has an appendix and epiphallus. Pupilloideans are hermaphroditic and ovoviviparous or viviparous.

The superfamily includes four families. Of these, the Pupillidae as defined by Pilsbry (1948), is the largest; it is cosmopolitan and is represented in Australia by three subfamilies. The Strobilopsidae occur on the fringes of eastern Asia, and North and Central America. The Holarctic Valloniidae and the Euro-Mediterranean Pleurodiscidae, have been introduced into Australia.

The earliest pupilloidean has been identified from the Lower Pennsylvanian of Nova Scotia by Solem & Yochelson (1979).

Family Pupillidae

The Pupillidae are a group of very small (up to 5 mm in shell height), mainly terrestrial land snails with ovate-conic to cylindrical shells (Fig. 17.42A–H). Usually the aperture has a number of denticles and lamellae (Fig. 17.42I). Shell sculpture (Fig. 17.42L–O) consists of fine growth ridges, spiral lines, malleations and dimples. The aperture is ovate to round with a strongly reflected or simple lip. The shell is usually umbilicate.

Pilsbry (1916–1918, 1919–1920, 1920–1921, 1922–1926, 1927–1935) monographed the world pupillids and placed the Australian taxa in a global context. Although he worked with little Australian material, his approach is preferred to that of Iredale (1930, 1937a, 1937c, 1939, 1940b, 1944a, 1945) who isolated the Australian pupillid fauna taxonomically by the introduction of new taxa. Solem (1981a, 1986a) reviewed pupilloid land snails from arid areas of south, mid-west and northern Australia. Later Solem (1988b) extended his coverage to include pupillids from the Kimberley and the Northern Territory. Central and eastern Australian species have yet to be revised comprehensively. In addition to expanding distribution limits and introducing new species, Solem (1986a, 1988a) assigned the species to broader, more widespread genera (Smith 1992).

Solem (1988b) recorded a number of extralimital species in the Australian fauna for the first time. Some were merely range extensions from nearby landmasses, whereas others, such as *Gastrocopta pediculus* and *G. servilis*, were species which he considered had been introduced, probably during the 19th Century.

Dry vine thickets, open forest, strand lines and limestone outcrops are the preferred habitats of the group. Only species of *Nesopupa* occur in moist forests. Most species aestivate by sealing to objects such as rocks, leaves, the underside of logs and other shells. In contrast, *Pupisoma* species are found on the underside of the branches of trees and bushes (Solem 1988b). The shells of most species are usually covered with adherent dirt particles which can make location in the field difficult.

Shells of Australian pupillids show considerable interspecific variability in shape, sculpture and apertural dentition. *Pupisoma* species have a comparatively simple shell with an unreflected lip and no barriers (Fig. 17.42G); *Glyptopupoides egregia* has well-developed radial ribs (Fig. 17.42D) and complex microsculpture (Solem 1988b), and Australian species of *Pupoides* have a prominent angular tooth (Fig. 17.42C). The shell in *Cylindrovertilla* species is sinistral (Fig. 17.42A), as is that of *Nesopuparia norfolkensis*, which has many teeth. Shells of *Gastrocopta* and *Pumilicopta* species have many apertural barriers and a reflected lip (Fig. 17.42E, F), whereas prominent barriers (Fig. 17.42B), a reflected lip and malleated sculpture (Fig. 17.42N) are present in *Nesopupa*. *Gyliotrachela* includes species of limestone-associated snails which have 'trumpet-like' apertures (Fig. 17.42H), with prominent barriers, a subperipheral sulcus and complex shell microsculpture (Fig. 17.42L–O).

Pokryszko (1996) presented anatomical data on some Australian species. Studies on extralimital pupillids have reported a radula with tricuspidate central tooth, bicuspidate laterals and multicuspidate marginals (Fig. 17.42P; Gittenberger 1973; Pokryszko 1990).

Pupillids aestivate through dry periods and produce mucoid, rather than calcareous, epiphagms. Warburg (1965) studied the water retention capabilities of *Pupoides adelaidae*. This species was



Smith, Brian J. 1998. "Pulmonata: Family Cionellidae." *Mollusca: The Southern Synthesis [Fauna of Australia. Vol. 5]* 5, 1081–1082.

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