NURSERY PAPERS
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SNAILS AND SLUGS IN NURSERY PRODUCTION

SUMMARY

- Snails and slugs produce damage similar to caterpillars and other chewing insect pests.
- Snails and slugs are easily transported in and on container plants within Australia and internationally.
- They thrive in human-modified environments with high moisture but many species can survive long, dry periods, becoming active in favourable conditions.
- Key management actions include reducing or altering irrigation to reduce wetness in the nursery, managing weeds, keeping the growing area clear of hiding places and using baits appropriately.

Common garden snail (*Cornu aspersum*). Originally from Europe, been in Australia for over 100 years. Most common and widespread of pest snails. Typically associated with urbanised areas. Photo by Joseph Berger, Bugwood.org

- Many snail species represent a significant biosecurity threat if introduced and established in Australia, e.g. giant African snail. Other species have movement restrictions or quarantines as they are only present in certain regions of Australia, e.g. green snail in Western Australia.

BACKGROUND

There are around 2500 species of native terrestrial Australian snails and slugs. Native species tend to prefer eating dead and decaying organic matter, not living plants, and some feed on lichen or are even carnivorous. However, introduced species of snails and slugs are most commonly observed in Australia, some of which are major agricultural, landscape and nursery pests. Such species are introduced by 'hitch hiking' on potted plants, soil and fertilisers, pallets, and shipping containers on cargo and freight, arriving as adults, juveniles, or eggs.

Succinea snail damaging kangaroo paw (top), *Deroceras* slug damage on cordyline (bottom).

Snail feeding on plants results in ragged holes on leaves that may be circular or in a line. Most plant organs can be damaged including leaves, growing tips, flowers, flower buds, fruit, seed pods and seeds. With severe damage whole leaves, flowers or buds can be removed.

Snails and slugs are problematic following wet winters and springs. However, production nurseries tend to be ideal environments for snails and slugs allowing them to be a pest all year round. The impact on nurseries includes loss of saleable stock and the cost of cultural and chemical management practices. With that said, cultural practices that reduce populations of snails and slugs also assist in reducing other pests and diseases.

Greenlife Industry Australia

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BIOLOGY

Snails and slugs move by gliding along a muscular foot which constantly secretes mucus to facilitate movement. This slime dries into the silvery trails observed on leaves, growing media, pots and nursery pathways. They also produce distinctive spiral shaped excrement. Snails can move up to 1m/hr, therefore relatively large distances can be covered over a 24-hour period. Snails and slugs have similar biology and lifecycles. They are hermaphrodites (have both male and female sexual organs), but do not self-fertilise; when two individuals mate, both are fertilised.

Life cycle

Snails and slugs are most active when it is cool and wet. During winter and spring eggs hatch and juvenile snails feed and grow. In summer, when it is hot or dry, they go into dormancy (aestivation). Activity starts again in autumn where feeding and mating resumes. Eggs are laid in batches within a week of fertilisation. In regions with mild winters snails and slugs are active throughout the year. Life-spans range 1-5 years depending on species. It takes slugs 3-6 months to mature, while snails can take up to 2 years to mature and become reproductively active.

The lifecycle may be slightly different in production nursery settings, particularly in protected cropping structures that alter climatic conditions. The relatively moist conditions favour snails and slugs, This should be taken into account when investigating the lifecycle of specific species from non-nursery settings for the purposes of informing nursery management.

Habitat

Moisture availability is a key regulator of snail and slug populations, especially for slugs as they have no shell for protection. Snails and slugs are most active at night and on cloudy or foggy days. On sunny days they seek hiding places out of the heat and sun, therefore leaf litter and dark moist places are ideal habitats. In production nurseries, this may include under pots and benches, under the lips of containers and within protected areas of plants. During cold weather, snails and slugs hibernate in the topsoil. During hot, dry periods, snails seal themselves off with a parchment-like membrane and often attach themselves to hard surfaces (e.g. pots, tree trunks, fences, or walls). Weeds and woody plants can act as refuges during summer months. Calcium is important for shell construction, therefore calcium-rich environments are a preferable microhabitat for snails.

Deroceras slug damaging cordyline. This individual was hiding within the growing point of the stem.

INTEGRATED PEST MANAGEMENT

No single practice effectively controls snails and slugs. A combination of preventative and active management strategies is recommended to mitigate damage and reduce population numbers.

Regular monitoring for snails and slug pests and damage is very important to estimate the numbers present prior to and after applying control measures. The best time to look for slugs and snails is on moist, warm, and still nights. During bright days, search dark sheltered areas where it is damp, on or near plants that have received damage. Slugs tend to be found underneath containers, under the lip of containers and in the media. Snails can hide under leaves at the stem node and can shelter in weeds and under the edges of nursery mats. They can also be inside areas of the plants that may hold moisture, e.g. within the central whorl of plant growth of plants such as cordylines and bromeliads.

Simple traps can be made (***https://ucanr.edu/sites/CalSnailsandSlugs/Management/Traps/***) or purchased online and can also help monitoring. Place molluscicide pellets underneath a board slightly raised off the ground and count every few days. Snails and slugs will gather under the trap as it offers shelter during the day. You can also fill a container underneath the board with various food sources (e.g. beer, bread dough, citrus fruit halves, or leafy vegetable matter). Leave overnight and dispose of trapped snails and slugs in the morning.

Cultural and physical management

- Natural predators exist such as birds, rats, frogs and beetles.
- Alter irrigation practices as required during infestations to reduce free standing water in growing areas and allow surfaces and plant foliage to dry.
- Remove as many potential shelters and keep growing areas clean as possible as this will make the growing area less hospitable. This includes proactively managing weeds. Even ornamental woody plants and grasses provide excellent shelters for snails.
- Clean growing areas between crop cycles to reduce organic matter in the areas. Consider copper applications to generally disinfest the growing area between crop cycles.
- Incorporate traps when needed.

IDENTIFICATION

Snails and slugs have a number of features that can be used to identify them. For snails, the most important feature is the shell (e.g. shell colour, shell type, the number of whorls). Some slugs are more difficult to identify morphologically than snails as colouration can be variable within the species. For the grower or backyard enthusiast, the **Terrestrial Mollusc ID Tool** (***http://idtools.org/id/mollusc/index.php***) is a handy identification website. However, if in doubt about the identification, it is recommended to send a sample to a diagnostic laboratory. All production nurseries receive 6 free samples per year through the pest and disease diagnostic service **Grow Help Australia** (***https://www.daf.qld.gov.au/business-priorities/biosecurity/plant/health-pests-diseases/grow-help-australia-sample-submission-form***). While not mollusc experts, we use molecular techniques to sequence specific gene regions that can be used to identify the species.

Amber snail (*Succinea* spp.) on Syzygium. Difficult to distinguish morphologically between species. Found across Australia.

Cellar glass snail (*Oxychilus cellarius*). Prefers modified habitats like greenhouses. Also carnivorous. Present in Tas, SA, Vic, and NSW. Image © Roy Anderson http://www.habitas.org.uk/molluscireland/

Grey field slug (*Deroceras reticulatum*). Very destructive to seedlings and succulents. Present across Australia. Photo by Joseph Berger, Bugwood.org

Three-band/Greenhouse slug (*Lehmannia valentiana* = *Ambigolimax valentianus*). Considered a serious pest in greenhouses. Present eastern Australia.

- Some physical barriers may be of use to protect vulnerable plants. The most effective is copper banding. Copper works by reacting to slime which generates a small electric shock to the snail or slug. This approach does require some upkeep as it can tarnish and not all copper bands appear to be effective. If using this approach, choose products that have a high percentage of copper alloy and ensure width of banding is sufficient (at least 4-5cm wide). Test the product (***https://www.growlikegrandad.co.uk/in-the-garden/pests-diseases-in-the-garden/copper-tape-stop-slugs-snails-heres-video-evidence.html***) before investing a large amount of money.

Chemical management

Molluscicides are typically delivered as pellets. Those available in Australia are either methiocarb, methidathion, metaldehyde or iron based. Be aware that metaldehyde is toxic to other animals too, including native snail and slug species that are not plant pests. Small, even sized pellets or granules will give better coverage, increasing the likelihood of slugs finding the baits. Under humid or wet conditions, metaldehyde baits are less effective as slugs can rehydrate. Some slug species are naturally tolerant to methiocarb. Although slower acting, iron chelate baits appear to be more consistent in their effects than methiocarb or metaldehyde baits.

Baits will only work if snails and slugs are mobile and looking for food. Place them on pathways or areas where the snails cross to reach plants. Light irrigation in the afternoon will improve baiting success, as it encourages snails and slugs to come out of hiding to forage. Be aware that when baits become moist, they will disintegrate and be ineffective. Therefore, baits in growing areas with overhead irrigation may not be as effective but may still be useful in non-irrigated and or non-growing areas..

BIOSECURITY

It is important to report suspect exotic snail pests as they snails could have a devastating impact on agricultural, livestock, nursery industries and native biodiversity if they become established in Australia. If you see suspect exotic pests **call the Exotic Plant Health Hotline on 1800 084 881**.

The Giant African snail (*Achatina fulica*) can grow six times larger than the common garden snail. It has a distinctive conical shell twice as long as wide and is typically 5-10cm long (but can be up to 20cm). Over 500 plant species are at risk if introduced to Australia, including fruit and vegetable crops, rice, and ornamental and native nursery plants. It could also have a devastating impact on natural ecosystems if not contained.

The Golden apple snail (*Pomacea canaliculata*) is mainly an aquatic snail pest of rice, but it would also have a substantial ecological impact in Australia as it feeds on grasses and wetlands plant species. Originating from South America, it has now spread throughout South-East and East Asia. Photo by Florida Division of Plant Industry, Bugwood.org

The Green snail (*Cantareus apertus*) has interstate quarantine regulations imposed as it is currently present in Western Australia. It prefers to feed on leafy vegetables, native plants, cereal crops, and pasture grasses. Photo by Pia Scanlon, DPIRD.

FURTHER INFORMATION

Terrestrial Mollusc ID Tool: ***http://idtools.org/id/mollusc/index.php***

Facts About Snails: ***https://factsaboutsnails.com/***

Atlas of Living Australia: ***https://www.ala.org.au/***

Giant African snail: ***https://www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/plant/giant-african-snail***

Green snail: ***https://www.agric.wa.gov.au/plant-biosecurity/green-snail-declared-pest***

Golden apple snail: ***https://www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/golden-apple-snail***

Past editions of nursery papers are available online on the Greenlife Industry Australia website: ***https://www.greenlifeindustry.com.au/communications-centre***

This nursery paper was written by Joy Conroy and Andrew Manners, Queensland Department of Agriculture and Fisheries, as part of the Hort. Innovation and Levy funded project 'Resourcing, supporting, and assessing biosecurity in nursery production (NY20000)' in 2022.