Scarlet (or Red) Lily Beetle

Summary of following articles: (C. West, June 2010)

"This beetle reproduces rapidly and can strip a lily plant in full flower in a matter of days." This beetle affects Asiatic, Oriental, Turk's cap lilies & fritillaria bulbs. Daylilies, aren't affected. To control these dastardly beetles you need diligence, especially in the first 2 seasons you spot it. It's possible to get them under control in your garden with diligence.

Prevention

Soak all new bulbs in bleach & water (1:10) for 30 min., rinse well before planting. Spread is very rapid with the marketing of pre-potted plants. Since they can fly a great distance, you still have to check your plants.

Hand Pick Adults, Larvae, Remove Eggs

Handpick and kill adults, eggs and larvae. Usually they're on the leaf's underside, starting with the bottom leaves. Adults quickly flutter or slide off the plant belly-up and crawl into the dirt when disturbed, so cup the beetle top and bottom and squish on the cement. If there are large numbers of beetles, you can place white paper towels under the plant and shake. The larvae can slide off as well. I wear disposable gloves and knock the beetle and larvae into a bowl of soap mix to drown. I use a stick, which I also use to bend the leaf back to see the underside. Wipe leaves with eggs on both sides with a soapy cloth. Check each day after the first cleaning of leaves. Missed eggs and larvae become adults again in 3-6 weeks.

Spray Alternative

If handpicking is not possible, spray every 5 days for a month after first siting the beetle, alternating spraying for larvae and beetles (see below). According to White Flower Farm, in NE adults that re-emerge from the soil (starting about mid-June) do not lay eggs in July's heat but feed until they hibernate under ground in the fall. Resume picking if you see any of this second generation. Note: all the sprays, except Neem are harmful to bees.

Spray for Eggs, Larvae
Spray Neem oil or, if ineffective, spinosad [like Monterey Garden Insect Spray] immediately. A female can lay up to 450 eggs in her lifetime of two seasons.

Spray for Adult Red Beetles
Imidacloprid [like Merit] (URI), Pyrethroid [like Permethrin] (UMass Extension), or 5% Rotenone (White Flower Farm).

Pre-emergence

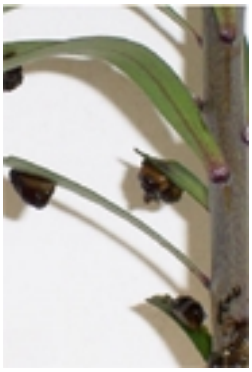
When lilies are 1" above the soil in spring, saturate the soil around the drip line with Merit (to penetrate about 3" into the soil). This will get adults before they emerge. 20% ammonia solution may be an alternative. Check and treat immediately if you spot leaf holes or evidence of the beetle.

If your lily leaves have holes, you probably have scarlet lily beetles, a scourge in the UK since 1940, and here on the East Coast of the U.S. since arriving in 1992 in Cambridge.

Do not wait to take action. The scarlet beetle reproduces rapidly and can strip and kill a plant in days. Months cited here are based on beetles in Connecticut.

Adult beetles look like narrow ladybugs. They emerge from the soil in spring (March-May), mate and lay eggs, usually in May.

Eggs, usually on the underside of the leaf, hatch within 7 days or less, starting orange and turning brown right before they hatch.



The eggs develop into larvae that eat the leaves (for ~16-22 days) and cover themselves in their own poop to avoid their few predators (wasps).

The pupae then go underground for 20 days before the beetle re-emerges in mid-June. Eggs are possible then, but less likely.

White Flower Farm
PLANTSMEN SINCE 1950

Growing Guide

Lily Leaf Beetles

The lily leaf beetle is a serious pest of Lilies. Left unchecked, it can devastate a planting with frightening speed. The beetle is believed to be native to Asia, but it is now common in many parts of Europe. It made its way to the Boston area in 1991 or 1992, possibly as a stowaway on bulbs shipped from Holland. The beetle is becoming common in Boston and neighboring towns, and sightings on Cape Cod, in Worcester, and in southern New Hampshire confirm fears that the infestation is spreading. There are also reports that the beetle is in the Montreal area.

Identification

The adult beetle is strikingly beautiful. Its body is bright scarlet, its head, antennae, legs, and underside jet black. It measures 1/4–3/8in long. If squeezed gently, the beetle makes a squeaking sound, which is probably intended to scare off predators.

In contrast to the adults, the larvae (immature beetles) are ugly. They have swollen orange, brown, yellow, or green bodies and black heads, and they have the repulsive habit of carrying their excrement on their backs. They look more like bird droppings than beetle grubs. The larvae are smaller than the adults, but they cause much more damage. They generally begin eating at the base of the plant and work their way up, devouring all but the midribs of the leaves. They also feed on the buds and flowers. Where populations are high, the larvae and adults, working together, reduce Lilies to little more than naked stalks in short order. A plant may not be killed outright by an attack, but without foliage, it cannot sustain itself for more than a year or two.

Lilies and Fritillaria are the preferred food of the lily leaf beetle, and it will only lay eggs on these plants, but there are reports that it will feed on other plants (albeit less heavily). They include Polygonatum (Solomon's Seal), Potatoes, Alcea (Hollyhock), Hosta, Convallaria (Lily-of-the-Valley), Campanula (Bellflower), and Nicotiana (Flowering Tobacco).

Life cycle

If you determine that you have lily leaf beetles in your garden, you need to understand the life cycle of the insect before you take action. The beetles overwinter as adults in the soil and in plant debris and emerge in spring (sometime in late March or April). As temperatures warm in May, the females begin laying orange-red eggs, 4–10 at a time, in irregular lines on the undersides of the lower leaves. The eggs hatch in a matter of days, and the voracious larvae begin eating immediately. The larvae feed for about 20 days, then enter the soil to pupate (transform themselves into adults), which takes another 20 days. The new adults emerge and feed until fall, but the females among them will not lay eggs until the following spring. At the approach of cold weather, the beetles seek cover for the winter. They reemerge in spring, and the cycle begins anew.

It's important to note that lily leaf beetles do most of their damage between late May and mid-July. The adults prefer cool temperatures; they stop laying eggs in July, and they feed less heavily in the heat of summer.

Control

If you have only a few Lilies in your garden, we recommend that you try hand-picking the colorful adults, pushing them off the leaves into a jar of soapy water, where they soon drown. (Most people recoil at the thought of touching the slimy larvae, but if you want to wear rubber gloves and handpick them, by all means, do so.) Begin picking the adults on a weekly basis as soon as they appear in spring and keep picking until they become scarce in summer. Unless the beetles are all over the neighborhood, you should be able to eradicate them from your garden in a year or two.

If you grow a lot of Lilies and hand-picking isn't practical, you can spray your plants with insecticides. The least toxic and most environmentally friendly control for the lily leaf beetle is Neem, a newly developed insecticide made from extracts of the Neem tree, which is native to parts of Asia. Neem kills the larvae and repels the adults. It is most effective on newly hatched larvae and must be applied every 5–7 days after the larvae begin to appear. An alternative to Neem is 5% Rotenone, which is also a botanical insecticide. It is effective against both the larvae and the adults. (Apply all pesticides in strict accordance with the package instructions.)

E-mail to West End Gardeners from C. West, 6/23/10

Hi Gardeners-
The second generation of red beetles are back (they attack Fritillaria as well). Toni and Mildred have found several, and I have found one. The second generation doesn't usually lay eggs (because of summer heat) - just eats and goes into the ground in the fall, ready to emerge in late March-early April.

White Flower Farms has the best short explanation of this that I've seen: above, or click .
NOTE from WFF: "Unless the beetles are all over the neighborhood, you should be able to eradicate them from your garden in a year or two." So don't give up on lilies just yet.

If you can't pick the beetles and drown the larvae on your lilies in April-May, here is spray info that I came back from Nature Works organic garden. I was told to alternate spraying the tops and bottoms of leaves w/ these, alternating every 5 days for the period of a month from first spotting the red beetle, in order to break the cycle:

- Pyrethin - for the adult beetles
- Monterey Garden Insect Spray - [spinosyn A and spinosyn D] for the larvae (saturate ground around drip line of leaves, as well.)

You can try Neem oil (Nature Works hasn't had success w/ Neem Oil). If that doesn't work, WFF recommends 5% Rotenone, which is also a botanical insecticide. It is effective against both the larvae and the adults, or try the Nature Works formula, above.

At this second-cycle point we have the choice of:

- pick off the beetles and squish (cup the beetle or it will tumble to the ground or flutter away), or
- 5% Rotenone, or Pyrethrin – both harmful to bees. See end for info on these insecticides.

Please pass this along to any gardeners you know - especially in the neighborhood. Perhaps we can achieve minimal red beetles here.
Carolyn

Other Sources:

URI Factsheets: Lily Leaf Beetle
http://www.uri.edu/ce/factsheets/sheets/lilyleafbeetle.html

IVillage Garden Web
http://faq.gardenweb.com/faq/lists/neweng/2002040522017914.html

Scarlet lily beetle Lilioceris lilii
http://www.bbc.co.uk/gardening/advice/pests_and_diseases/nonflash_index.shtml?scarlet_lily_beetle

The Lily Leaf Beetle
http://www.google.com/url?q=http://www.bbc.co.uk/dna/h2g2/A13857014%26clip%3D1&sa=X&ei=S5MBTKLbBsL48Abnn7nfDQ&ved=0CBcQzgQoADAA&usg=AFQjCNEjpLzWvuI6eduKgS9f22_5Kq4QKw

Scarlet lily beetle
From Wikipedia, the free encyclopedia http://en.wikipedia.org/wiki/Scarlet_lily_beetle

Lily Beetle Survey
http://www.rhs.org.uk/science/plant-pests/lily-beetle

Controlling Red Lily Leaf Beetles
http://www.vpr.net/episode/48541/

Red Lily Beetle
Down Garden Services: http://www.dgsgardening.btinternet.co.uk/lilybeetle_red.htm

Control of Lily Beetles
http://lilybeetle.co.uk/Control/Control.html

Lily Beetles Forum
http://forums.gardenweb.com/forums/load/cangard/msg0319182528924.html

Scarlet lily beetle Lilioceris lilii

http://www.bbc.co.uk/gardening/advice/pests_and_diseases/nonflash_index.shtml?scarlet_lily_beetle

Look for

These bright red beetles are very distinctive and therefore quite easy to spot on affected plants. Also, look for holes in leaves, stems and flowers, left by the small slimy black larvae.

Plants affected

- They're highly destructive to lilies (Lilium), and fritillaries (Fritillaria).

About Scarlet lily beetle

- These bright red beetles, with distinctive black legs and antennae, are an invasive species which was first recorded in the UK during the 1940s.
- They're also known as red lily beetles and are now commonly found across the south-east of England, and have recently been reported in parts of Scotland, Wales and Ireland.
- When disturbed, adults emit a high pitch squeak, perhaps as a warning to other beetles.
- Adults overwinter in the soil and emerge in late-March to early April.
- Adults will continue to mate and feed from spring until autumn.
- After mating, females will lay small groups of bright orange eggs on the underside of leaves.
- Larvae hatch a few days later as red or orange-coloured grubs with black heads and three pairs of legs on their upper body.
- As they feed, the larvae cover themselves in their own sticky black excrement.
- Red lily beetle larvae are usually found on the underside of leaves where they feed from the tip and work back to the stem.
- Any larvae which survive to become adults will drop to the soil in late autumn to overwinter, and emerge again the next spring.

Treatment

Chemical

Products containing the following chemical ingredients are all effective on Scarlet lily beetle

- Imidicloprid
- Bifenthrin
- Pyrethrum
- Natural fatty acids
- Surfactant-based products

Note: It is important to read manufacturer's instructions for use and the associated safety data information before applying chemical treatments.

Organic

- Inspect plants carefully in early spring and remove any adults and larvae by hand to prevent infestations becoming established.
- Use netting and fleece to contain the pests and stop adults moving between plants.

- Replant pot-grown lilies and fritillarias using fresh compost in early spring before the overwintering adult beetles emerge from the soil.
- There are no natural enemies commercially available, although a range of native parasites and predators will feed on both adult and larval stages. So encourage these by establishing a natural balance of wildlife in your garden and avoid using chemicals.

Prevention

- Check plants regularly for signs of infestation and deal with them as soon as they appear.
- Encourage insect-eating birds by putting up feeders in winter and provide nesting boxes in spring.

The Lily Leaf Beetle

http://www.google.com/url?q=http://www.bbc.co.uk/dna/h2g2/A13857014%26clip%3D1&sa=X&ei=S5MBTKLbBsL48Abnn7nfDQ&ved=0CBcQzgQoADAA&usg=AFQjCNEjpLzWvuI6eduKgS9f22_5Kq4QKw

This pretty little beetle, *Liliocertis lilii* - with its bright scarlet body and black underside - can be a nightmare to any gardener growing lilies or fritillaria.

A native to Europe, the lily beetle made its debut in Montreal, Canada in 1945 - finally reaching the USA in 1992. It is believed the beetles found their way into some bulbs that were imported from mainland Europe. The same is thought to have happened in the UK, where the beetle is now thriving and becoming a real garden pest.

The adult beetles, which grow up to 9mm, appear in spring. They will taste most members of the lily family including - Solomon's seal and bluebell, but their preferred food is species lilies and fritillaria. These are also the plants on which they choose to lay their eggs. The eggs are laid on the underside of leaves in a line; they are orange in colour and hatch from between a week and ten days later. A female can lay up to 450 eggs in her lifetime of two seasons.

The larvae look like small slugs and come in a wide range of colours: orange, brown, yellow or green with a black head. It's not recommended that you touch the larvae with bare hands, as they cover their backs with their own excrement in order to deter any predators. The excrement is not toxic, but is just very unpleasant. The larvae will do the most damage to your lilies, feeding for 16 - 24 days before pupating underground.

The pupae are bright orange in colour; 22 days later the new adult will emerge. They overwinter[1] in the ground or under dead leaves, sheltered from the cold weather until spring. Then the cycle of mating and breeding begins again.

In France and Switzerland the beetle has been brought under control by four species of parasitic insects which attack the eggs and larvae. One of these European species has already been released in Boston, USA with good results. Experiments are being conducted at the Plant and Sciences Department of Rhode Island University, on other 'host-specific' insects - hopefully leading to a further release in the USA.

What do I do if I find them on my Lilies?

The best way to deal with these beetles is to pick them off and dispose of them. (No! Not into your neighbours garden!) Remember, they can lay a lot of eggs, which will come back as adults and eat your lilies. The beetles are harmless and don't bite - though they do emit a squeaking sound if you hold them firmly. As a defence, if disturbed, the beetle will drop to the ground belly-side-up, so it cannot be seen. When all danger has passed, it will climb back onto the plant. Squash any eggs you find and wear protective gloves to pick off any larvae. If you

cannot bring yourself to touch the beetles, try using a garlic barrier spray to help prevent them from feeding and breeding on your plants. They can also be treated with insecticides available at garden centres.

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[1] This is sometimes called 'hibernation'.

Lily beetle

Symptoms

Lily leaves are shredded and may be covered in brown-black droppings.

Find it on: lilies, fritillaries and Solomon's seal

Time to act: spring, summer, autumn

Scarlet beetles (6mm - 8mm long) with black heads eat the leaves, flowers and seedpods of lilies and other members of the lily family. Don't mistake them for ladybugs. Between April and September the beetles lay eggs on the undersides of leaves. After a week they hatch into reddish-brown maggot-like grubs, and feed on the same parts of the plant as the parents. Possibly to deter predators or disguise themselves, the larvae cover themselves in their own wet, black excrement.

Solution

Organic

Pick off the grubs and adults as soon as you see them. The adults will drop to the ground at the slightest touch, so spread newspaper under the plants to catch them. Be quick and crush them under foot or they'll fly off.

Chemical

At the first sign of attack, spray plants with imidacloprid, thiacloprid or sunflower oil. Treatment is more effective on larvae than adults.

Scarlet lily beetle

From Wikipedia, the free encyclopedia **http://en.wikipedia.org/wiki/Scarlet_lily_beetle**

The **scarlet lily beetle** (*Lilioceris lilii*), or **red** / **leaf lily beetle**, is a leaf beetle that eats the leaves, stem, buds and flower of lilies, fritillaries and other members of the family Liliaceae. They mainly lay their eggs on *Lilium* and *Fritillaria* species. Observed in absence of *Lilium* and *Fritillaria* species, the numbers of eggs laid were significantly less and the survival rate of eggs and larvae were lowered.[1] It is now a pest in most temperate climates where lilies are cultivated.Lily leaf beetles overwinter in the soil and come out early in spring whereas adults stay in moist environments .[2]

[edit] Identification

Lily leaf beetles (*Lilioceris lilii*), belong to the Order Coleoptera, Family Chrysomelidae. In general, adult lily leaf beetles are around 6 to 9 mm (¼–⅜ in) in length. The adult's elytra (harder forewings) are shiny and bright scarlet in colour. The lily leaf beetle's underside, legs, eyes, antennae and head are all pitch black, greatly contrasting the bright red colour of the wings. They have large eyes, a slim thorax (neck) and a wide abdomen.[3] Their antennae are made up of 11 segments. Furthermore, they have notched eyes and two apparent grooves on their thorax.[4]

They are often confused with the cardinal beetles as they also have a black underside and wings that are spotless and red in colour. However, the lily leaf beetles have wings that are shinier with tiny dimples on them, they are more rounded in shape compared to the dull, narrow, flattened and elongated cardinal beetle.[5]. Another difference between the two is their food preference. Lily leaf beetles are herbivores and are usually found on lily plants eating their leaves whereas the cardinal beetles are usually found on tree bark and flowers and feed on flying insects.Lastly, the cardinal beetle has a comb-like antennae.[6]

Lily leaf beetles are fast fliers and hide very well. Additionally, when disturbed, they make a squeaky noise to deter predators.They could also be confused with unspotted ladybirds. Lily leaf beetles however are much slimmer than ladybirds.[3]

[edit] Natural history

[edit] Distribution

The lily leaf beetle was indigenous to Europe and Asia. It has thought to been introduced to North America through the importation of bulb plants around 1945. First spotted in Montreal, it has spread throughout Canada and eastern United States within decades.[4] It has also become an invasive alien insect in the United Kingdom, where it has established itself after its introduction in 1943. It has since spread from Surrey to as far north as Glasgow.[7]

[edit] Life cycle

During the winter, adult lily leaf beetles rest in an undisturbed protective environment, normally shaded, cool and moist. Lily leaf beetles overwinter in soil or plant debris underneath the lily leaf plants they fed on during the previous summer and sometimes in gardens or woods quite a distance away from their host plants. In early spring, they emerge to feed on young lily leaves and mate.[3] Females can lay up to 450 eggs each season by laying about 12 eggs on the underside of an individual lily/fritillaria leaf in irregular lines along the midrib to conceal them. Hatching of the eggs occurs in about 6 days. The larvae begin to feed underneath the leaf and working up to the rest of the plant, feeding for up to 24 days. They then burrow themselves in the ground to pupate in a cocoon formed by saliva and small particles of soil. In about 20 days, they emerge as adults and continue to feed until winter. In some cases, they are able to go through this cycle more than once in a single year.[8]

[edit] Behaviour

Not only are the eggs laid underneath the leaf to stay hidden but they are also covered with a thick sticky brown substance for further protection. As larvae, they use their own frass to make a protective shield,

allowing protection from the sun and predators. However, the fecal shield is not an adequate protection against the parasites. It actually acts as a chemical cue for the parasites to locate the larvae. [9] As adults, a sense in danger can trigger a defense mechanism, thanatosis. The beetle becomes motionless, folds up its appendages and falls with its black under surface facing up; helping it camouflage with the ground to get away. If it is unable to escape, they are also able to 'squeak', by rubbing two parts of its body together, used to startle the attacker.[10] This process is known as stridulation and could even shock a bird or any other predator that may attack the lily leaf beetle.[3]

[edit] Human Impact

Lily leaf beetles leave considerable damage on host plants. Managing the ornamental lilies have become difficult in regions where lily leaf beetles have established. Damage to the leaves and flowers can also leave the plants weakened and susceptible to diseases such as Lily grey mold. [11]

Maritime Provinces of Canada, especially *Fritillaria* and *Lilium* gardens in Halifax, are largely affected by lily leaf beetles. A garden in Waverly, Nova Scotia has reported decline of lily species and cultivars from 50 in 1996 to only one species in 2006. [12] A newly discovered lily species in 2007, *Lilium canadense*, has raised the concern for protection of this Canadian native lily and control of leaf lily beetle.

[edit] Mechanical and chemical control

There are no registered chemicals for lily leaf beetle control, and handpicking of larvae and adults prove to be most effective. [4] However, best strategy for lily leaf beetle control is to avoid planting susceptible plants in the first place.

Although there are no specific chemicals to control lily leaf beetle, domestic insecticides registered for general leaf beetle control containing carbaryl, methoxychlor, malathion and rotenone have proven useful in controlling the populations. [4] However, malathion and carbaryl, effective on adults and larvae, are toxic to bees and other insects, respectively. [13] Products based on Neem extracts are useful in killing very young larvae and repelling adults without comparable harm to other insects. Neem products should be applied every 5 to 7 days after egg hatch. [13]

Mechanical control involves mainly handpicking and crushing the larvae and eggs on the underside of foliage and removing the adults in the soil to avoid the introduction. Drowning the beetle in soapy water can be as effective as handpicking. Floating row cover has been effective in preventing the adults from feeding and laying eggs in the spring. [14] Handpicking is deemed more effective than use of Neem-based products. [15]

[edit] Biological control

There are no natural predators or parasites of lily leaf beetle in North America. In 1996, University of Rhode Island began testing the effectiveness of biological control of lily leaf beetle using six natural parasitoids in Europe. CAB International Bioscience Switzerland Center has also participated in this project from 1998 till 2001. [16]

Total parasitism rate in the last instar stage averages about 90% on wild lily *Lilium martagon*, 75% in gardens and 60% in cultivated lily fields in Europe. Most of lily leaf beetle parasitoids are wasps that lay eggs inside the host and effectively kill all infected individuals. Parasitoid wasp, *Diaparsis jucunda* Holmgren (Hymenoptera: Ichneumonidae), dominates over 90% of the parasitoid infections in lily leaf beetle. However, in gardens and commercial fields, *Tetrastichus setifer* (Hymenoptera: Eulophidae) and *Lemophagus pulcher* (Szepligeti) become the dominant parasitoids in the later season. [16]

University of Rhode Island experimented with release of European parasitoid wasp, *Tetrastichus setifer*, in Massachusetts from 1999 to 2001 to control for the lily leaf beetle population. The experiment had shown reduction of the beetle population. Population decline was also observed at another experiment site in Rhode Island. [17] In 2003, another parasitoid, *Lemophagus errabundus*, was also released in Massachusetts and is now established in the region. [12] Similar attempts of parasitoid release have been made in Boston with positive results. [18]

Lily Beetle Survey

http://www.rhs.org.uk/science/plant-pests/lily-beetle

The red or scarlet lily beetle (*Lilioceris lilii*) has become the lily growers' nemesis. Both the adults and larvae can defoliate lilies (*Lilium* and *Cardiocrinum*) and fritillaries (*Fritillaria*).
Adults are 8mm long, bright red with a black head and legs.
Eggs are 1mm long and orange-red, found in groups on the underside of lily leaves.

Larvae have orange bodies with black heads but are

normally covered with their own slimy black excrement. The fully grown larvae are 8-10mm long. The pupal stage is in the soil.

The beetle became established in Surrey in 1939 and it remained confined to south east England until the late 1980s. By the end of 2009 it has become widespread in England and Wales and is spreading in Scotland and Northern Ireland.

Life cycle

Adult lily beetles emerge from the soil from late March to May. They feed and lay eggs on the underside of leaves of host plants from late April until early September. The eggs hatch after approximately a week. Beetle larvae can be found feeding on the foliage between May and the end of September. After about two weeks, when the larvae are fully grown, they pupate in the soil. Two to three weeks later new adults emerge. Despite claims in some literature, this beetle has only one generation a year. The beetles overwinter as adults in sheltered places, often in the soil but not necessarily near lilies or fritillaries.

Host range

Both adults and larvae damage lilies (*Lilium* and *Cardiocrinum* spp and hybrids) and fritillaries (*Fritillaria* spp.) primarily by defoliation, but in heavy infestations the flowers, seed capsules and stems will also be eaten. Although adult beetles have been found occasionally feeding on other plant species, only lilies and fritillaries are true hosts, on which eggs are laid and larvae develop.

The lily beetle has been observed on 73 hybrid *Lilium*, 30 *Lilium* species, one *Cardiocrinum* species and six *Fritillaria* species.

Download the lily beetle host list

As part of RHS research, the susceptibility of six different lilies was assessed (one species and five hybrids). Results from the trial indicated that the species lily *Lilium regale* was less susceptible than the hybrids. The results from the trial have been published - see Salisbury A, Clark S J, Powell W, and Hardie, J. 2010. Susceptibility of six *Lilium* to damage by the lily beetle, *Lilioceris lilii* (Coleoptera; Chrysomelidae). Annals of Applied Biology 156: 103–110.

Distribution

The lily beetle is not native to the UK; it has been accidentally imported into Britain on several occasions. It was first noticed at the end of the 19th century, with a handful of short-lived infestations reported from England and Wales. However, it was not until 1939 that an established colony was discovered in a private garden at Chobham, Surrey.

By the late 1950s the beetle had become widespread in Surrey and was also found in Berkshire. Later, an analysis of records held by the RHS Entomology section up to 1989, and the results of an appeal in 1990 in the RHS magazine *The Garden* for records of the beetle, indicated that the beetle's range had expanded into Hampshire, Middlesex, Wiltshire, Dorset, Hertfordshire and Oxfordshire. During the 1990s the beetle continued to be reported from new areas of England and Wales and by the end of 2007 this pest had been found in almost every English county. In

2002 the beetle was reported for the first time from Glasgow and Belfast. Continued reports to the RHS indicate that the beetle is now established and spreading in Scotland and Northern Ireland.

The lily beetle is native to Eurasia, although it is currently impossible to know exactly where. It is now found almost anywhere that lilies are grown, and has become established in North America where it is spreading. The increase in the distribution of lily beetle over the past two decades has been coupled with a rise in its frequency as an enquiry made to the RHS Members' Advisory Service. Before 1980 lily beetle enquiries made up less than one percent of all pest enquiries received, but during the past two decades the proportion of enquiries has increased to more than three percent.

Controlling Red Lily Leaf Beetles

http://www.vpr.net/episode/48541/

Friday, 05/14/10 1:04pm and Saturday, 05/15/10 8:57am

By Charlie Nardozzi

Photo by David Daly
Courtesy National Park Service, Longfellow National Historic Site

I'm Charlie Nardozzi and this is the Vermont Garden Journal. For years lilies have been the carefree darlings of many perennial gardens. But then came the red lily leaf beetle. This European native found its way to Massachusetts in 1992 and has been spreading around New England ever since. If you grow Asiatic, Oriental, or Turk's cap lilies or fritillaria bulbs, you know these beetles. Daylilies, luckily, aren't affected.

The overwintering bright red adults emerge to feed in spring as soon as your lily plants start growing. In May they start laying bright orange eggs on the underside of the leaves. The eggs hatch within 1 week and the black, slug-like larvae start feeding. What's even worse is the larvae pile their own excrement on their back as a defense mechanism. Yuck. The larvae feed for up to 3 weeks causing damage to lily leaves, buds, and flowers.

To control these dastardly beetles you need diligence. Hand pick and kill the adults. Spray Neem oil or spinosad organic controls once you see signs of the eggs. These controls are most effective against the young larvae and will need to be reapplied weekly after eggs are spotted.

Red Lily Beetle

Down Garden Services: http://www.dgsgardening.btinternet.co.uk/lilybeetle_red.htm

Scientific name: *Lilioceris lilii*
Other names: Scarlet Lily Beetle, Lily Leaf Beetle or Asiatic Lily Beetle.


The two adults shown above were found in the mulch at the base of an old lily stalk when doing some autumn tidying, and were probably settling in for the winter.

The bright red body, black legs and head make Red Lily Beetles very striking in appearance, but these little beasts are very destructive to bulbous plants and in particular *Lilium* such as Turk's cap lilies, Asiatic lilies, Oriental lilies, Tiger lilies and some *Fritillaria* species. From spring to autumn the adults and larvae feed on the foliage, flowers and stems. The removal of the leaves deprives the plant of food production which severely weakens it and may prevent flowering the following year, or in severe cases kill the plant.

The Lily Beetle is native to mainland Europe and Asia, but not the British Isles. First reported in Southern England in the nineteenth century, it is believed that they did not become established until the 1940s. They had been confined to the south, but the recent increase in average temperatures has allowed them to move northward, and the specimens pictured here were found in a garden near Newtownards, County Down in October 2006 - the first reported find in Northern Ireland was in a garden in Belfast in June 2002. They have also moved to North America, first reported in Canada in 1945 and now spreading south in the eastern states of USA.

Bright orange lily beetle eggs

Two first instar larvae, and two eggs.

In the spring the adults climb out of the soil and after mating the female lays her oblong, bright orange eggs in lines under the leaves of Lily plants or Fritillaries. The orange larvae emerge after 7 to 10 days and begin feeding - first instars from underneath and later ones eat through the foliage, working from the tip to the stem. They cover themselves with their sticky black excrement to act as a deterrent to predators, so the orange colour disappears and they are more difficult to spot.

A larva with its coat of sticky excrement

a 'naked' specimen.

The larvae cause most of the damage and spend two to three weeks stripping the foliage, then the flower buds before dropping to the ground to pupate. After two to three weeks the bright orange pupae have metamorphosed into new adults which climb into the plants to continue the cycle. Mating can occur from spring until autumn and surviving adults move to the ground to spend the winter, not necessarily close to potential host plants. Despite temperatures as low as minus twelve this winter I found two adults in surface debris while doing the spring tidy-up The adults have been found on other plants including Lily of the Valley, Soloman's seal and Day Lilies. The larvae have only been found on bulbous Lilies and Fritillaries.

Treatments

The recommended method of removal is to check affected plants regularly picking off and crushing any adults, eggs or larvae. The adults tend to drop to the ground with their black undersides showing when the plant is disturbed so they are easier to find if a light-coloured material is placed there first.
Due to the difficulty in spotting the larvae a follow-up treatment with an insecticide is advisable - one containing *Imidacloprid such as Bio Provado Ultimate Bug Killer (Imidacloprid and Sunflower Oil) - sold as Merit in the USA.

As a preventative the insecticide can be applied to the soil in the spring to eliminate the overwintering adults before the lilies start into growth.

A more "friendly" insecticide made from extracts of the Neem tree is also effective when applied to the early stages of larvae. It kills them and deters the adults. There are no biological controls, but they are attacked by parasites in their native areas. Some research has been done with a parasitic wasp.

There are a few preventative measures which can be taken, such as checking new bulbs for larvae before planting. Probably the most likely method of spread is the recent trend of buying established lilies in pots. It used to be that we bought bulbs and planted them, but the marketing of "added value" products means that the horticulture industry can make more money by potting them for us. They are grown in warmer places in close proximity to each other so the pests have a better chance to thrive. So check any such purchases carefully before introducing them to your garden.

*Imidacloprid is a neonicotinoid compound and these have been suggested as as causative agents of colony collapse disorder (CCD) in Honeybees.

Control of Lily Beetles

http://lilybeetle.co.uk/Control/Control.html

Adults

Inspect plants during the early spring when lily shoots begin to appear and remove any adult beetles. Removing these adults before they begin to reproduce will prevent the establishment of infestations. It is recommended to hold a bucket of soapy water under the infested plant to catch any beetles that nosedive when provoked in an attempt to escape. This method will also help catch adults that may also attempt to play dead, a behavioural response where the beetle folds its legs into its body, falls off the plant and becomes camouflaged against the soil. Be aware that the red lily beetle will make a squeaking noise when captured, known as stridulation, used to startle birds or other predators.

Eggs and larvae

Eggs and larvae must also be removed from the underside of leaves. Leaves bearing rows of orange eggs can be removed or have the eggs squished and although unpleasant, removal of larvae is also essential. If you do not want to get your hands dirty, using a small paintbrush and dabbing each beetle with a drop of white spirit, such as paint thinner or turpentine, has a fatal effect on the insects without causing any damage to the plant.

Persistence

Inspecting your plants periodically and dealing with any infestation immediately will help prevent outbreaks. A season or two of persistent manual removal should be sufficient to prevent establishments in the long term, reducing plant damage in later seasons.

Several cultural methods have been found to help reduce the survival and dispersal of the red lily beetle. A combination of these can be carried out simultaneously for greater effectiveness

• Netting and fleece can be wrapped around lilies in order to contain the infested plants and prevent migration of red lily beetles between plants

• Pot-grown lilies and fritillaries can be replanted into fresh compost in early spring to prevent overwintering adult beetles emerging

• Feeders can also be used to encourage insect-eating birds during the winter and nesting boxes can be provided in the spring for these birds

If an established and more widespread infestation needs to be controlled, then it is perhaps better to consider chemical methods of control. Beetle larvae are particularly susceptible to chemical sprays so you must concentrate your control efforts appropriately. However, because many chemical products are non-specific and do not target one particular insect species, sprays must be applied conservatively as bees, ladybirdss and other beneficial insects are likely to be killed by any general pesticide application.

The RHS recommend the use of products that contain imidacloprid and sunflower oil, acetamiprid or thiacloprid although products that contain active ingredients azadirachtin, bifenthrin, pyrethrum, natural fatty acids and those that are surfactant-based have also been shown to be effective. Some commercially available chemical pesticides include:

- Scotts Bug Clear Ultra concentrate
- Provado Ultimate Bug Killer Ready To Use

Warning: It is important to follow manufacturer's instructions before use and safety information before chemical application.

Parasitoids are Hymenoptera (wasps) and Diptera (flies) species that lay their eggs inside their living host in which they will hatch and feed on, killing the host. Much research has been carried out to identify parasitoids that can be reared and released to predate on the red lily beetle, but there is little chance of any biological control agents becoming commercially available in the UK. However, two wild parasitoid species of the red lily beetle have been identified in the UK, which show promise in reducing lily beetle numbers

The distribution of *L. errabundus* and *T. setifer* parasitoids in the UK, October 2007. Taken from Salisbury (2008)[1]

Lemophagus errabundus

L. errabundus is an example of a parasitoid of the red lily beetle. It kills the beetle during the pre-pupal stage, killing up to 23% of lily leaf larvae and is active early in the season, overwintering as an adult in the host cocoon. *L. errabundus* was originally reared from lily beetle larvae collected from Essex in 1998, and has since been recorded in Sussex, Surrey and Middlesex[1].

Tetrastichus setifer

T. setifer is a parasitoid that targets all four larval stages. It overwinters in the host inside its cocoon from which up to 21 adults emerge from each lily beetle larva in spring. The parasitoid is active throughout the summer, killing up to 7% of lily beetle larvae. *T. setifer* have been recorded in Essex, Surrey, Sussex, Kent, Middlesex, Cambridge, Berkshire, Suffolk and Yorkshire[2].

Aliens

The two parasitoid species are considered established alien insects; they cannot be native to the UK as they are host specific to the *Lilioceris* genus of which the red lily beetle is the only representative in the UK. It is possible that as the two parasitoid species spread in distribution in the UK, they will exert a larger predation force on the red lily beetle population.

[1]Salisbury, A. 2008. Impact, host range and chemical ecology of the lily beetle, *Lilioceris lilii*. PhD thesis, Imperial College, London

[2]Haye, T., and M. Kenis. 2004. Biology of *Lilioceris* spp. (Coleoptera: Chrysomelidae) and their parasitoids in Europe. Biological Control 29: 399-408.

RE: Lily Beetles

http://forums.gardenweb.com/forums/load/cangard/msg0319182528924.html

- Posted by sydseeds 5A /ON (My Page) on Wed, Jun 7, 06 at 16:28

Check out your local hydroponic gardening suppliers - they'll have Neem Oil on the shelf (one good brand name is Einstein Neem Oil) in concentrated form that needs water & a little dish soap to allow the oil to mix with water.

I put on a pair of dollar store wool gloves overtop of a pair of dishwashing gloves and soaked the gloves in the neem mix, I coated the underside of every plant leaf with this solution by simply cupping the gloves together with the stem in the middle of my cupped gloved hands, and this gets each underside leaf wet with the solution as well as dislodging any eggs, starting from the bottom/base and moving up the plant in a cupping-like fashion.

I dip the gloves into more solution for each plant, coated the leaves and dripped the excess on the ground near the base of each lily and move on to the next plant.

My lilies were decimated last year but this year, I've killed about 40 adults and with the wet-glove treatment, manage to eliminating the underside of the leaves of eggs. I have maybe 6 leaves with slight damage from the initial adults that I've subsequently squashed and I repeat the neem oil glove trick every two weeks to keep the underside of the leaves 'egg free'.

I may slow down and only do this treatment monthly now as there hasn't been a slug or adult in sight since I started doing this in early May..I have approximately 60 lilies stalks out there so it takes about 1/2 hour to do this 'stem in wet gloved hand' trick. But if it means I'm reducing the overall population and keeping the eggs from developing into slugs - I'm happy and so are my lilies.

Neem Oil Successful with my 200 Lilies

- Posted by Gary Peterborough(tukto_ca@yahoo.ca) on Sat, Jul 22, 06 at 9:01

Hello. I am an avid gardener who enters the garden competitions. I have over two hundred Asian Lillys in my front garden. In the past years I have fought Lilly Beatles with a vengance. Watching the plants and killing each bug one at a time and still I would lose the battle. But not this year. I mix 15 ml of Neem Oil and 15 ml of Insecticidal Soap in a one litre spray bottle of warm water. Then after spraying all of my plants and the neighbours as well. I kept looking for the elusive little critters and if I saw even one I sprayed again. Now I have beautiful growth and no holes in the leaves. I haven't lost any of my plants. I now use the Neem Oil mixture on my whole garden to take care of a host of unwanted insects. It can also be used on your indoor plants as well. It is non toxic. I purchase the product at the Co Op. And have found that by mixing it stronger than the container states. I have had great success in overcoming the problem.

Here is a link that might be useful: Neem Oil

Neem Oil Mixture

- Posted by lilybugsqasher (My Page) on Wed, May 6, 09 at 19:15

The little red lily beatles showed up in my garden last spring, I had never seen nor heard of them before. They completely destroyed my lilies last summer. This year I have been doing some research on them and have found that if you pick them off and squish them and then aply a mixture of neem oil , dish detergent in warm water, shaken well that should keep them off ,so far this seems to be working I have not seen a beatle in days. The Neem oil can be found in most Indian food grocery stores.

Vegetable and Oil Spray

- Posted by joyce51 (My Page) on Thu, Jul 9, 09 at 22:55

Don't get rid of your lillies. I have come up with a good solution to get rid of the beetles, that won't cost the earth.
I went out last Sat. to buy the spray at a garden center. I noticed on one that 1 ingredient was cooking oil, on the other was soap. I went to the grocery store and bought vegetable cooking oil and Sunlight dish soap. Erwigs do not like Sunlight soap, so why not mix up some cooking oil with my sunlight and spray my lily plants? It works! I use:

- 1 cup cooking oil, 1/2 cup sunlight dish soap put in 1 liter spray bottle fill with water. Shake well and spray all those bugs on your lilies.

Within 2 sec. the big beetles were dead. It will also kill the larva. I'm keeping an eye on the eggs to see if it kills them, too. I have also been spraying the ground around all my lily plants.
Try this and see what you think? It works for me. Good luck with your lilies. I just love mine and refuse to get rid of them.

About These Insecticides

Pyrethrin

From Wikipedia, the free encyclopedia

Jump to: navigation, search

Pyrethrin I, R = CH_3
Pyrethrin II, R = CO_2CH_3

The **pyrethrins** are a pair of natural organic compounds that have potent insecticidal activity. Pyrethrin I and pyrethrin II are structurally related esters with a cyclopropane core.[1][2] They differ by the oxidation state of one carbon. They are viscous liquids that oxidize to become inactivated. They are non-persistent, being biodegradable, and break down on exposure to light or oxygen. The chemical structure of pyrethrins is the basis for a variety of synthetic insecticides called pyrethroids such as bifenthrin, permethrin and cypermethrin.

The pyrethrins are contained in the seed cases of the perennial plant pyrethrum (*Chrysanthemum cinerariaefolium*), which is grown commercially to supply the insecticide. Although extracts of the plant were already used as insecticide, the structure was first published by Hermann Staudinger and Lavoslav Ružička in 1924.[3] Pyrethrins are neurotoxins that attack the nervous systems of all insects. When present in amounts not fatal to insects, they still appear to have an insect repellent effect. Pyrethrins are gradually replacing organophosphates and organochlorides as the pesticide of first choice.

The majority of the world's supply of pyrethrin and *Chrysanthemum cinerariaefolium* comes from Kenya. The flower was first introduced into Kenya and the highlands of Eastern Africa during the late 1920s. Now, Kenya produces as much as 70% of the world's supply of pyrethrum.[4] A substantial amount of the flowers are cultivated by small-scale farmers who depend on it as a source of income. It is a major source of export income for Kenya and source of over 3,500 additional jobs.

[edit] Toxicity

Pyrethrins are used in many varieties of insecticide, fogging products and in some pet products. Care should be taken when using this substance around humans and animals. Overdose and toxicity can result in a variety of symptoms, especially in pets, including drooling, lethargy, muscle tremors, vomiting, seizures and death.[5] Toxicity symptoms in humans include asthmatic breathing, sneezing, nasal stuffiness, headache, nausea, lack of coordination, tremors, convulsions, facial flushing and swelling, and burning and itching sensation.[6]

Pyrethrins are extremely toxic to aquatic life, such as bluegill and lake trout while it is slightly toxic to bird species, such as mallards. Toxicity increases with higher water temperatures and acidity. Natural pyrethrins are highly fat soluble, but are easily degraded and thus do not accumulate in the body. These compounds are also toxic to bees.[6]

Rotenone

From Wikipedia, the free encyclopedia

Rotenone is an odorless chemical that is used as a broad-spectrum insecticide, piscicide, and pesticide. It occurs naturally in the roots and stems of several plants such as the jicama vine plant.

[edit] History

Emmanuel Geoffroy first isolated rotenone from a specimen of *Robinia nicou*, now called *Lonchocarpus nicou*, while traveling in French Guiana.[1] He wrote about this research in his thesis, published posthumously in 1895 after his death from a parasitic disease.[2] Researchers later determined that the substance which Geoffroy termed *nicouline* was identically rotenone.

[edit] Uses

Rotenone is used in solution as a pesticide and insecticide.

It is commonly used in powdered or emulsified liquid form in fisheries management to remove unwanted fish species,[3] such as the eradication of exotic fish from non-native habitats. People catch fish by extracting rotenone from plants and releasing it into water. Poisoned fish come to the surface and are easily caught. This method was first practiced by various indigenous tribes[4] who smashed the roots. Fish caught this way can be eaten because rotenone is very poorly absorbed by the gastrointestinal tract of humans, whereas it is lethal to fish because it readily enters the blood stream of the fish through the gills.

Small-scale sampling with rotenone is used by fish researchers studying the biodiversity of marine fishes to collect cryptic, or hidden, fishes, which represent an important component of shoreline fish communities. Rotenone is the most effective tool available because only small quantities are necessary. It has only minor and transient environmental side-effects.[5]

Rotenone is also used in powdered form to reduce parasitic mites on chickens and other fowl. In the United States and in Canada, all uses of rotenone except as a piscicide (fish killer) are being phased out.[6][7]

Rotenone is an excellent organic pesticide dust for the garden . It kills potato beetles, cucumber beetles ,flea beetles, cabbage worms, raspberry bugs and asparagus bugs to name a few. Rotenone bio-degrades naturally in a few days so there is no harmful residue. A light dusting on the leaves of plants will control insects for several days. It is not harmful to humans when used properly.

[edit] Method of action

Rotenone works by interfering with the electron transport chain in mitochondria. Specifically, it inhibits the transfer of electrons from iron-sulfur centers in complex I to ubiquinone. This prevents NADH from being converted into usable cellular energy (ATP). This is much like the action of amytal.

[edit] Toxicity

Rotenone is classified by the World Health Organization as moderately hazardous.[11] It is mildly toxic to humans and other mammals, but extremely toxic to insects and aquatic life including fish. This higher

toxicity in fish and insects is due to the fact that the lipophilic rotenone is easily taken up through the gills or trachea, but not as easily through the skin or through the gastrointestinal tract.

The lowest lethal dose for a child is 143 mg/kg. Human deaths attributed to Rotenone are rare because its irritating action causes vomiting.[12] Deliberate ingestion of rotenone can be fatal.[13]

The compound breaks down when exposed to sunlight and usually has a short lifetime of six days in the environment.[14] In water rotenone may last six months.[*citation needed*]

Rotenone is classified by the USDA National Organic Program as a nonsynthetic and was allowed to be used to grow organic produce until 2005, when it was added to the list of prohibited substances due to concerns about its safety. However, it has since been re-approved.[15]

[edit] Parkinson's disease

In 2000, it was reported that injecting rotenone into rats causes the development of symptoms similar to those of Parkinson's disease (PD). Rotenone was continuously applied over a period of five weeks, mixed with DMSO and PEG to enhance tissue penetration, and injected into the jugular vein.[16] The study does not directly suggest that rotenone exposure is responsible for PD in humans but is consistent with the belief that chronic exposure to environmental toxins increases the likelihood of the disease.[17]

In addition, studies with primary cultures of rat neurons and microglia have shown that low doses of rotenone (below 10 nM) induce oxidative damage and death of dopaminergic neurons[18] and it is these neurons in the substantia nigra that die in Parkinson's disease. Other studies have also described toxic action of rotenone at low concentrations (5 nM) in dopaminergic neurons from acute rat brain slices.[19]

It had been known earlier that the neurotoxin MPTP causes PD-like symptoms (in humans and other primates, though not in rats) by interfering with Complex I in the electron transport chain and killing dopaminergic neurons in the substantia nigra. However, further studies involving MPTP have failed to show development of Lewy bodies, a key component to PD pathology. Therefore, the mechanism behind MPTP as it relates to Parkinson's Disease is not fully understood.[20] Because of these developments, rotenone was investigated as a possible Parkinson-causing agent. Both MPTP and rotenone are lipophilic and can cross the blood-brain barrier.

In 2010, a study was published detailing the progression of Parkinson's-like symptoms in mice following chronic intragrastric ingestion of low doses of rotenone. The concentrations in the central nervous system were below detectable limts, yet still induced PD pathology.[21]

Imidacloprid

From Wikipedia, the free encyclopedia

Imidacloprid is a neonicotinoid, which is a class of neuro-active insecticides modeled after nicotine. A patented chemical, imidacloprid is manufactured by Bayer Cropscience (part of Bayer AG) and sold under trade names Kohinor, Admire, Advantage(Advocate), Gaucho, Merit, Confidor, Hachikusan, Premise, Prothor, and Winner. It is marketed as pest control, seed treatment, an insecticide spray, termite control, flea control, and a systemic insecticide.

Studies on rats indicate that the thyroid is the organ most affected by imidacloprid. Thyroid lesions occurred in male rats at a Lowest Observed Adverse Effect Level of 16.9 mg/kg/day[2]

In France, its use (as Gaucho) has become controversial due to a possible link to derangement of behavior in domesticated honeybees. See Imidacloprid effects on bee population. In relation to this, Germany has banned seed treatment related to neonicotinoids, in May 2008, due to negative effects upon bee colonies.[3]

[edit] History

On January 21, 1986 a patent was filed for, and granted on May 3, 1988 for, Imidacloprid in the United States (U.S. Pat. No. 4,742,060) by Nihon Tokushu Noyaku Seizo K.K. of Tokyo, Japan.[4]

On January 26, 2005, the Federal Register notes the establishment of the '(Pesticide Tolerances for) Emergency Exemptions' for imidacloprid. It use was granted to *Hawaii (for the) use (of) this pesticide on bananas(,) and the States of Minnesota, Nebraska, and North Dakota to use this pesticide on sunflower*. [5]

[edit] Biochemistry

A chlorinated analog of nicotine, the compound therefore belongs to the class of neonicotinoid insecticides, and acts on the nicotinic acetylcholine receptor; the chlorination inhibits degradation by acetylcholine-esterase. Imidacloprid is notable for its relatively low toxicity to most animals other than insects due to its specificity for this type of receptor, which is found more often in insect nervous systems and zooplankton than that of other animals (exceptions exist, earthworms and a few species of fish, for example). This potentially allows for lower concentrations (e.g., 0.05–0.125 lb/acre or 55–140 g/ha) to be used for insect control than other neurotoxins (particularly organophosphates) and enables its use in applications as diverse as flea treatments for pets, control of beetle larvae in lawns, eradication or prevention of termite infestation in buildings, and other uses where animals and people may be exposed. Imidacloprid is, for example, present as a main (or the sole) active ingredient in concentrations between five and ten percent in three out of the four most widely used flea treatment and preventative topical treatments for dogs in the United States; these manufacturers claim an effective killing persistence of at least four weeks. The compound is also used for flea treatment on cats, whose livers have only limited detoxification ability compared with dogs and humans.

Imidacloprid has low vapor pressure. The chemical breaks down to inorganic molecules by both photolysis and microbial action. Photolysis in water results in a half-life of 1.4-10 days in water, while microbial action results in a half-life of 30-150 days in water/sediment systems and 106-193 days in soil. In soil under aerobic conditions, imidacloprid exhibits moderate to very high persistence.[6] The manufacturer maintains that, when applied according to instructions, such long-term contamination is only found as the result of "repetitive application over several years" and its spread to populations of beneficial insects is minimal. In the body, 96% of the chemical is eliminated within 48 hours; the most important degradation product in the body is 6-chloronicotinic acid, another nicotinic neurotoxin with similar properties. Imidacloprid has, however, been reported to degrade into toxic, persistent, 2-chloropyridine.[7]

[edit] Toxicology

Imidacloprid is rated as "moderately toxic" acutely by the World Health Organization and the United States Environmental Protection Agency (class II or III, requiring a "Warning" or "Caution" label), and a "potential" ground water contaminant. It is rated as an "unlikely" carcinogen by the EPA (group E), and is **not** listed for endocrine, reproductive, or developmental toxicity, or as a chemical of special concern by any agencies. It is not banned, restricted, cancelled, or illegal to import in any country. It has, however, been banned for use as a crop pesticide in France since 1999. See Pesticide toxicity to bees. Tolerances for Imidacloprid residue in food range from 0.02 mg/kg in eggs to 3.0 mg/kg in hops.

Animal toxicity is similar to that of the parent compound, nicotine exhibited as fatigue, twitching, cramps, and weakness leading to asphyxia. The oral LD_{50} of imidacloprid is 450 mg/kg body weight in rats and 131 mg/kg in mice; the 24-hour dermal LD_{50} in rats is greater than >5000 mg/kg. It is not irritating to eyes or skin in rabbits and guinea pigs (although some commercial preparations contain clay as an inert ingredient, which may be an irritant). The acute inhalation LD_{50} in rats was not reached at the greatest attainable concentrations, 69 milligrams per cubic meter of air as an aerosol, and 5,323 mg/m^3 of air as a dust. In rats subjected to a two year feeding study, no observable effect was seen at 100 parts per million (ppm). At 300 ppm females showed decreased body weight gain and males showed increased thyroid lesions, while females showed increased thyroid lesions at 900 ppm. In a one-year feeding study in dogs, no observable effect was seen at 1,250 ppm, while levels up to 2,500 ppm led to hypercholesterolemia and elevated liver cytochrome p-450 measurements. Reproductive studies in rats resulted in no observable effect at 100 ppm and decreased pup weight at 250 ppm; developmental toxicity studies in rats showed no observable effect at 30 (mg/kg)/day and skeletal anomalies at 100 (mg/kg)/day, while in rabbits no observable effect was detected at 24 (mg/kg)/day and skeletal abnormalities at 72 (mg/kg)/day. Imidacloprid was negative for mutagenicity in 21 out of 23 different laboratory tests, but was positive for chromosomal changes in human lymphocytes and for genotoxicity in CHO cells. No carcinogenicity was seen in rats fed up to 1,800 mg/kg of imidacloprid for two years.[8]

[edit] Overdosage

Persons who orally ingested acute overdoses experienced emesis, diaphoresis, drowsiness and disorientation. Blood imidacloprid concentrations may be measured to confirm diagnosis in hospitalized patients or to establish the cause of death in postmortem investigations.[9]

[edit] Uses

The most widely used applications for imidacloprid in California are pest control in structures, turf pest control, grape growing, and head and leaf lettuce growing. Other widespread crop uses are rice, grains/cereals including corn (maize), potatoes, vegetables, sugar beets, fruit, cotton, and hops. Target insects include sucking insects (e.g., aphids, whiteflies, leafhoppers and planthoppers, thrips, scales, mealybugs, bugs, psyllids, and phylloxera), beetles (*e.g.*, longhorn beetles, leaf beetles, Colorado potato beetles, rice water-weevils, wireworms, grubs, and flea beetles), and others (e.g., lepidopterous leafminers, some diptera, termites, locusts, and fleas).

As an insecticide spray, it is used on citrus, coffee, cotton, fruits, grapes, potatoes, rice, soybeans, sugarcane, tobacco and vegetables. It is also marketed for termite control, for flea control on pets, and for household cockroach control.

[edit] A systemic insecticide

Imidacloprid is taken up by plant roots and diffuses in the plant via the xylem; its systemic properties then rely on insects ingesting the insecticide (e.g., by sucking plant fluids). The products Confidor and Admire are intended for application via irrigation, application to the soil, or on foliage, while Gaucho is intended for use as a seed dressing, applied to the seed before sowing.

Seed-applied insecticides are often used to deal with numerous insects, as they are easy to use and comparable in cost to most traditional insecticides used at sowing time. Some also indicate that it might be better for the environment because less chemical is required than for broadcast or banded applications, or at least because less chemical is sprayed in the air. However, some note that the use of seed-applied insecticides at each season implies the chemical is used whether there is need to fight insects or not.

Imidacloprid is receiving increased attention as a possible factor in colony collapse disorder, a mysterious condition that causes sudden death of honey bee populations. Mass die-offs of bees threaten pollination of food crops in the USA and Europe.

Spinosad

From Wikipedia, the free encyclopedia

Spinosad (spinosyn A and spinosyn D) are a new chemical class of insecticides that are registered by the United States Environmental Protection Agency (EPA) to control a variety of insects. The active ingredient is derived from a naturally occurring soil dwelling bacterium called *Saccharopolyspora spinosa*, a rare actinomycete reportedly collected from soil in an abandoned rum distillery on a Caribbean Island in 1982 by a scientist on vacation[1] . It has not been found in nature since that time, and was subsequently described as a new species. The bacteria produce compounds (metabolites) while in a fermentation broth. The first fermentation-derived compound was formulated in 1988. Spinosad has since been formulated into insecticides that combine the efficacy of a synthetic insecticide with the benefits of a biological pest control organism.

[edit] Mode of action

Spinosad kills susceptible species by causing rapid excitation of the insect nervous system. Due to this unique mode of action, Spinosad is valued in resistance management programs. Spinosad must be ingested by the insect, therefore it has little effect on sucking insects and non-target predatory insects. Spinosad is relatively fast acting. The insect dies within 1 to 2 days after ingesting the active ingredient. There appears to be 100% mortality.

[edit] Use

It is used to control a variety of insect pests, including fruit flies, caterpillars, leafminers, thrips, sawflies, spider mites, fire ants, and leaf beetle larvae. Spinosad is recommended for use in an Integrated Pest Management program for commercial greenhouses since it will not harm most beneficial insects or predatory mites. Spinosad does not significantly affect beneficial organisms including ladybugs, green lacewings, minute pirate bugs, and predatory mites.

[edit] Products

Spinosad has been formulated into two commercial products registered for use in commercial agriculture, including DowAgros' Conserve SC, and Entrust. Entrust is approved for use on USDA certified organic produce.

There are several home garden products manufactured for use in the United States including Monterey Garden Insect Spray manufactured by Lawn and Garden Products, Inc. and 'Borer, Bagworm, Tent Caterpillar & Leafminer Spray' manufactured by Ferti-Lome. Bonide Products has introduced spinosad in its Captain Jacks Dead Bug Brew insect control product line.

The products have practically no odor. Its soil absorption is moderately strong and it degrades rapidly in the environment primarily through photolysis.

Spinosad is also the active ingredient in Comfortis[2], a chewable flea medication for pets.[3]

[edit] Safety

Its "Caution" signal word indicates a reduced risk to applicators and workers. There are no specific worker protection requirements, even though applicators and handlers should wear a long-sleeved shirt, long pants, shoes and socks.

Spinosad shows low toxicity when ingested by mammals (male rat LD50 = 3738 mg/kg) and no additional adverse effects from chronic exposure. Studies on spinosad show slight toxicity to birds, moderate toxicity to fish, and slight to moderate toxicity to aquatic invertebrates. However, it is highly toxic to bees (honey bee LC50 = 11.5 ppm) and is highly toxic to oysters and other marine mollusks. Applications to areas where bees are actively foraging should be avoided. After the residues have dried, it is much less toxic to bees.

It is important to note that toxicity is based on the active ingredient tested; formulations of spinosad in common use today have a very small amount of spinosad active ingredient. In addition, non-target sensitivity is mitigated by the environmental characteristics of spinosad, including rapid dissipation in the water column, sorption and binding of residues with sediment and lack of bioaccumulation in living tissues.

Beneficial Trichogramma and Braconid wasps are harmed by the chemical, but it has much less effect on such insects as lacewings and beetles like the ladybug and spares predatory bugs such as damsel bugs and the big-eyed bug.[4]

Spinosad does not have any phytotoxicity on ornamentals [*citation needed*] and is non-phytotoxic for most crops. It has a 4-hour Worker Protection Standard reentry interval (REI).

Do not apply Spinosad more than 10 times in a 12 month period inside a greenhouse to prevent possible insect pesticide resistance.

Neem oil

From Wikipedia, the free encyclopedia

Neem oil is a vegetable oil pressed from the fruits and seeds of neem (*Azadirachta indica*), an evergreen tree which is endemic to the Indian subcontinent and has been introduced to many other areas in the tropics. It is perhaps the most important of the commercially available products of neem for organic farming and medicines.

[edit] Characteristics

Neem oil is generally light to dark brown, bitter and has a rather strong odour that is said to combine the odours of peanut and garlic. It comprises mainly triglycerides and large amounts of triterpenoid compounds, which are responsible for the bitter taste. It is hydrophobic in nature and in order to emulsify it in water for application purposes, it must be formulated with appropriate surfactants.

Neem oil also contains steroids (campesterol, beta-sitosterol, stigmasterol) and a plethora of triterpenoids of which azadirachtin is the most well known and studied. The azadirachtin content of neem oil varies from 300ppm to over 2500ppm depending on the extraction technology and quality of the neem seeds crushed.

Average composition of neem oil fatty acids		
Common Name	**Acid Name**	**Composition range**
Omega-6	Linoleic acid	6-16%
Omega-9	Oleic acid	25-54%
Palmitic acid	Hexadecanoic acid	16-33%
Stearic acid	Octadecanoic acid	9-24%
Omega-3	Alpha-linolenic acid	?%
Palmitoleic acid	9-Hexadecenoic acid	?%

[edit] Methods of extraction

The method of processing is likely to affect the composition of the oil, since the methods used, such as pressing (expelling) or solvent extraction are unlikely to remove exactly the same mix of components in the same proportions. The neem oil yield that can be obtained from neem seed kernels also varies widely in literature from 25% to 45%.

The oil can be obtained through pressing (crushing) of the seed kernel both through cold pressing or through a process incorporating temperature controls.

Neem seed oil can also be obtained by solvent extraction of the neem seed, fruit, oil, cake or kernel. A large industry in India extracts the oil remaining in the seed cake using hexane. This solvent-extracted oil is of a lower quality as compared to the cold pressed oil and is mostly used for soap manufacturing. **Neem cake** is a by-product obtained in the solvent extraction process for neem oil.

[edit] Uses

Neem oil is not used for cooking purposes, but in India and Bangladesh, it is used for preparing cosmetics (soap, hair products, body hygiene creams, hand creams) and in Ayurvedic, Unani and folklore traditional medicine, in the treatment of a wide range of afflictions. The most frequently reported indications in ancient Ayurvedic writings are skin diseases, inflammations and fevers, and more recently rheumatic disorders, insect repellent and insecticide effects.[1]

Traditional Ayurvedic uses of neem include the treatment of Acne, fever, leprosy, malaria, ophthalmia and tuberculosis. Various folk remedies for neem include use as an anthelmintic, antifeedant, antiseptic, diuretic, emmenagogue, contraceptive, febrifuge, parasiticide, pediculocide and insecticide. It has been used in traditional medicine for the treatment of tetanus, urticaria, eczema, scrofula and erysipelas. Traditional routes of administration of neem extracts included oral, vaginal and topical use. Neem oil has an extensive history of human use in India and surrounding regions for a variety of therapeutic purposes. Puri (1999) has given an account of traditional uses and therapeutic indications and pharmacological studies of this oil, in his book on *neem*.

Formulations made of neem oil also find wide usage as a bio-pesticide for organic farming, as it repels a wide variety of pests including the mealy bug, beet armyworm, aphids, the cabbage worm, thrips, whiteflies, mites, fungus gnats, beetles, moth larvae, mushroom flies, leafminers, caterpillers, locust, nematodes and the Japanese beetle. Neem oil is not known to be harmful to mammals, birds, earthworms or some beneficial insects such as butterflies, honeybees and ladybugs. It can be used as a household pesticide for ant, bedbug, cockroach, housefly, sand fly, snail, termite and mosquitoes both as repellent and larvicide (Puri 1999). Neem oil also controls black spot, powdery mildew, anthracnose and rust (fungus).

Neem seed oil has also been found to prevent implantation and may even have an abortifacient effect similar to pennyroyal, juniper berries, wild ginger, myrrh and angelica. The effects were seen as many as ten days after fertilization in rats though it was most effective at no more than three days. (Sinha, et al., 1984); (Lal et al., 1985). In a study on rats, neem oil was given orally eight to ten days after implantation of the fetus on the uterine wall. In all cases, by day 15, the embryos were all completely resorbed by the body. The animals regained fertility on the next cycle showing no physical problems. Detailed study of the rats revealed increased levels of gamma interferon in the uterus. The neem oil enhanced the local immune response in the uterus.(Mukherjee, 1996) Post coital use of neem oil as birth control does not appear to work by hormonal changes but produces changes in the organs that make pregnancy no longer viable (Tewari, 1989) (Bardham, 1991).

Studies done when Azadirachtin (the primary active pesticidal ingredient in neem oil) was approved as a pesticide showed that when neem leaves were fed to male albino rats for 11 weeks, 100% (reversible) infertility resulted.

Neem oil and other neem products such as neem leaves and neem tea should not be consumed by pregnant women, women trying to conceive, or children. Long-term use can cause liver damage. [*citation needed*]

Neem oil is also an effective treatment for the common parasitic skin problems in pet Guinea pigs.