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The Role of *Aculus schlechtendali* (Apple Rust Mite) in Orchard Pest Management Strategies in Northern Ireland

[1]Andrew G.S. Cuthbertson and [2]Archie K. Murchie
[1]Central Science Laboratory, Sand Hutton, York YO41 1LZ, UK
[2]Agri-Food and Biosciences Institute, Newforge Lane, Belfast BT9 5PX, UK

The apple rust mite, *Aculus schlechtendali* (Nalepa) (Prostigmata: Eriophydiae) has a worldwide distribution (Easterbrook, 1979). It was first recorded in Britain by Massee (1928) on wild crab apple and cultivated apple. Since then, the mite has become more widespread and numerous in commercial orchards, probably due to a gradual change from fungicides such as lime sulphur, which are toxic to the mite, to non-acaricidal compounds (Easterbrook, 1979; Cuthbertson and Murchie, 2003).

Adult rust mite are up to 0.18 mm long (Alford, 1984). Males are smaller than protogynes (Easterbrook, 1979). Their body is orange/brown, darkening with age (Easterbrook, 1979). Deutogynes overwinter in groups under loose bark or bud scales (Herbert, 1974; Alford, 1984). The mites emerge and invade the opening fruit buds to feed. They also feed on the leaf and flowers of the plant (Alford, 1984). Eggs are deposited on the green tissue of both fruit and vegetative buds and a generation of males and protogynes appears in May (Alford, 1984). Mites can also be found on the sepals at petal fall, but they do not feed on developing fruitlets, unlike *Epitrimerus piri* (Nalepa) on pear (Easterbrook, 1978). Breeding of the mites continues throughout the spring and summer, forming several overlapping generations of primary forms (Fig. 1). New deutogynes appear in increasing numbers from late June or early July onwards. The population growth is rapid; egg to adult can occur in 1-2 weeks with warm summer temperatures (Alford, 1984). Easterbrook (1979), working in England, found a mid-summer decline in population was correlated with prolonged temperatures above 35°C and relative humidity near 20%. The mite numbers begin to decline as the new deutogynes enter hibernation during autumn time and breeding ceases (Easterbrook, 1979).

Mites occur on the underside of the leaves and their feeding produces a patchy felt-like malformation on leaf surface and yellowing of hairs. The upper surface of foliage appears speckled,

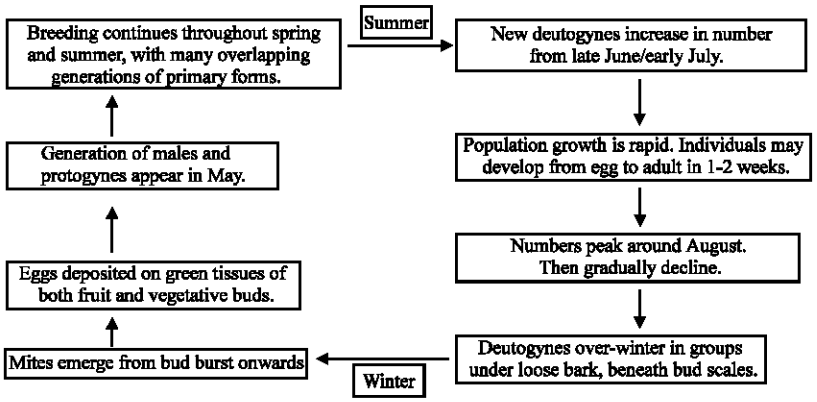

Fig. 1: Life cycle of apple rust mite, *Aculus schlechtendali*

Corresponding Author: Dr. Andrew G.S. Cuthbertson, Central Science Laboratory, Sand Hutton, York YO41 1LZ, UK
Tel: +44 (0) 1904 462201 Fax: +44 (0) 1904 462111

dull and faded. Heavily infested leaves are silvery before turning brown and shrivelling (Easterbrook, 1979). Control of *A. schlechtendali* within Northern Irish Bramley apple orchards is normally derived from *Panonychus ulmi* (Koch) control. Acaricides applied to control *P. ulmi* also have a detrimental effect on *A. schlechtendali*. However, within Northern Irish orchards, 76 spray hectares were specifically sprayed with the acaricide pirimiphos-methyl for rust mite control in 1996 (Kidd *et al*., 1996).

Aculus schlechtendali, although a pest, is an important part of integrated pest management (IPM) programmes in the USA (Hoyt, 1969; Croft, 1975). This species is available as food for phytoseiids such as *Phytoseius macropilis*, *Amblyseius finlandicus*, *Typhlodromus rhenanus* (Herbert, 1959; Burrell and McCormick, 1964) earlier than *P. ulmi*, which does not begin hatching until early May (Cranham, 1973). Later in the year, phytoseiids, or other predatory species, which have reduced *P. ulmi* populations to low levels maintain themselves on *A. schlechtendali*. Therefore, if *A. schlechtendali* is allowed to remain in orchards to provide food for predators that then also feed on *P. ulmi* it is important to know the population levels that can be tolerated without damage to the tree (Easterbrook, 1979). Populations of up to 300 per leaf have been stated to cause little crop damage (Hoyt, 1969). In Michigan, there was a tolerance level of 200 per leaf for 10-14 days before fruit production or tree vigour were adversely affected (Croft, 1975). In Northern Irish orchards Cuthbertson and Murchie (2006) recorded numbers of *A. schlechtendali* up to 160 per eight leaf sample with no visible damage being recorded. However, population development of these mites can be very rapid and so even on trees of low nutrient status and in the presence of predacious mites, they are capable of attaining levels that can cause damage. This means that selective sprays may sometimes be necessary to reduce *A. schlechtendali* populations in an IPM programme (Easterbrook, 1979).

The presence of alternative prey species in the orchard does not necessarily reduce a predators' effectiveness against the main pest species (Collyer, 1964; Putman and Herne, 1964). *Anystis baccarum* (L.) (Prostigmata: Anystidae), the most commonly occurring predatory species in Northern Irish orchards (Cuthbertson and Murchie, 2005a), is known to be a predator of various invertebrate species (Baker, 1967) and when juvenile or during times of low alternative prey numbers, will feed on *A. schlechtendali* (Cuthbertson *et al*., 2003a). The potential of *A. baccarum* to control pest species such as *A. schlechtendali* in the Bramley orchards may be underestimated. Northern Ireland's apple growers are unaware that this mite occurs in their orchards (Cuthbertson, 2004, 2005; Cuthbertson and Murchie, 2005b). Within the United Kingdom and indeed the world, most research on biocontrol within the apple sector has concentrated on *Typhlodromus pyri* Scheuten (Acari: Phytoseiidae) as the major predator of apple pests and its potential within IPM programmes. *Typhlodromous pyri* does occur in Northern Irish orchards, but in smaller numbers compared to English orchards (Cuthbertson and Murchie, 2005a). With *A. baccarum* commonly occurring in local orchards (Cuthbertson and Murchie, 2005a), this mite needs to be considered in any IPM programmes developed within the Bramley orchards. *Anystis baccarum* has shown much potential in aiding the control of economically important pests (Cuthbertson *et al*., 2003a, b; Cuthbertson and Murchie, 2004). This generalist predator may well survive by feeding upon *A. schlechtendali* when other prey items are scarce. Therefore, the presence of *A. schlechtendali* within the Bramley orchards, though classed as a pest (Cuthbertson and Murchie, 2006), may well have a more important role in sustaining the populations of predatory species and in particular *A. baccarum*.

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