ENGLISH NATURE

Information note

Common ragwort Senecio jacobaea

Towards a ragwort management strategy

Introduction

The following Information Note has been prepared to help inform the debate as to the policy that should be adopted for a 'common ragwort *Senecio jacobaea* management strategy' in the UK.

English Nature has particular interest in common ragwort as it is a native plant found in many natural and semi-natural habitats. It also supports many species of other wildlife, especially invertebrates which depend on it for their survival.

English Nature believes that 'prevention' of infestations by good pasture management backed up by appropriate 'management' techniques and operations where appropriate, is the correct strategy in terms of both human and animal health, logistics and economics.

1. Wildlife and nature conservation value

Common ragwort is a natural component of some semi-natural grasslands and may in particular be present on dry, well-drained sites. Common ragwort is widespread throughout Europe, especially on dry, sandy ground. It should be expected that some common ragwort will continue to occur in such swards and will fulfill its role in the ecological dynamics of well-drained grassland ecosystems.

It is the food of at least 77 species of insect herbivore: 27 species of moth, 22 species of thrip, 13 species of bug, nine species of flies and six species of beetle. The most famous is the cinnabar moth whose yellow and black banded larva can defoliate entire plants.

The number of species feeding on ragwort nectar is not known but is several hundreds of species. (177 species of insects have actually been **recorded** using common ragwort as a source of nectar or pollen).

Pollen provided by common ragwort, in its season, aids the pollination of other plants, both wild and domestic, over a foraging range of at least a 1km radius by bumblebees *Bombus* spp., solitary bees *Lasioglossum* spp., drone-flies *Eristalis tenax* and the carrion flies. The use of common ragwort by carrion-associated species demonstrates the role in supporting the decomposition cycle in the local area.

The number of predators and parasites dependent on the invertebrate resource supported by common ragwort stands is incalculable.

The invertebrates referred to in above include five 'red data book' and eight 'nationally scarce' species.

Common ragwort has been observed as host to the Common Broomrape and 14 species of fungi.

Apart from common ragwort there are also other species of native ragworts that occur widely in the UK. Two that occur in semi-natural habitats which are used by livestock are hoary ragwort *Senecio erucifolius* which can occur in neutral and calcareous grasslands, and marsh ragwort *Senecio aquaticus* which can occur locally on wet grasslands. Management of these may be acceptable. However, there are also some rare ragworts such as the Great Fen ragwort *Senecio paludosus* which have considerable conservation status. Some other plants not of the ragwort *Senecio* family (i.e. genus) may also look similar to common ragwort, eg St John's wort *Hypericum* spp. or field fleawort *Tephroseris integrifolia*. The field fleawort does closely resemble common ragwort and is also nationally scarce so potentially vulnerable. Any management strategy should prevent unintended removal of the rarer ragwort species and similar looking plants. Anyone in doubt about identification should request confirmation before removal. Please refer to Appendix 3 for further details of Ragworts and similar plants.

As a native plant common ragwort has been studied for many years by scientists and naturalists.

2. Biology of ragwort

It is essential to understand the biology of common ragwort so that this can inform any management strategy. The following points are relevant:

2.1 Periodicity

It is considered to be a biennial but can become a (short-lived) perennial. The early removal of flowering stems is a trigger to the plant to continue growing either that year or in the following year in order to complete successful seeding, after which it will die. It normally dies after flowering.

2.2 Seed

The ragwort seed-bank can be large but is very short-lived, reducing to only 1% survival after 4-5 years near the soil surface and 10-16 years at more than 4cm.

Recruitment into a sward and seedling abundance are not related to flower or seed production (except on open sand dunes), or to cinnabar moth abundance in previous years. Recruitment is related to local weather conditions (autumn and spring rainfall, early-winter frosts), soil disturbance (propagation microsite creation). (Crawley &Gillman 1989).

Common ragwort germinates in autumn or in spring. It cannot establish in a closed sward but requires patches of bare ground in which to germinate. Rabbit scrapes or other bare ground areas are ideal. Common ragwort is a poor competitor in a sward and dense vegetation easily suppresses ragwort seedlings or vegetative propagation from older rosettes.

Each seed is contained within an achene (ie a fruit containing one seed). The central achenes are lighter, more numerous and have a pappus facilitating dispersal by the wind and trichomes facilitating dispersal by animals. They are released as soon as they are mature, germinate quickly and show a high percentage of successful establishment (about 80%

success). The marginal achenes are fewer, heavier, lack dispersal structures and are retained by the parent plant for many weeks after maturity. Germination of seed from these marginal achenes is delayed and there is lower percentage successful establishment. Light is required for germination but germination of seeds on the soil surface is very poor. Seeds buried more than 2mm deep are similarly unlikely to germinate. Consequently seed germination is adapted to a system subject to unpredictable, local disturbance which exposes the soil at the time of seed-fall (eg grazing, rabbit scrapings).

No viable seeds have been obtained from bird droppings but seeds do survive through the digestive tract of sheep.

Seeds can germinate in water and dispersal by streams and rivers is likely.

2.3 Rosettes

A first-year vegetative rosette is normally 5-15cm in diameter. They may be smaller in dry soils and in drought years.

Normal fluctuations in population density can be as much as 13 fold from year to year.

2.4 Flowering

The flowering stalk is 0.5 to 2m tall and can produce 5,000 – 200,000 seeds from mid-August to December. It usually flowers in July/August. After flowering the whole plant dies and only rarely produces a new vegetative shoot (or propagule).

Defoliation does not increase plant death rates and annual defoliation does not result in a decline in ragwort density. Defoliated or damaged plants can produce weak re-growth comprising flowering stems which in some circumstances continue flowering into the autumn. Defoliated plants are capable of extensive vegetative reproduction.

Pollination is achieved by bumblebees *Bombus* spp., solitary bees *Lasioglossum* spp., by the drone-fly *Eristalis tenax* and the carrion flies *Lucilia caesar*, *L. sericata*, and *Calliphora erythrocephala*. Pollinating insects prefer different plants in different seasons, from spring to autumn. Hence the pollen provided by common ragwort, in its season, aids the pollination of other plants, both wild and domestic, over a foraging range of at least a 1km radius. The use of common ragwort by carrion-associated species demonstrates the role in supporting the decomposition cycle in the local area. Honey bees were noted **not** to take **pollen** from ragwort though this is at odds with information contained in MAFF's Food Surveillance Information Sheet Number 52 1995 *Surveillance of pyrrolizidine alkaloids in honey*.

3. Prevention and management of common ragwort

Common ragwort occurs on many National Nature Reserves and Sites of Special Scientific Interest and other sites where wildlife may be valued. These sites are managed by a large number of voluntary and government organisations or private landowners. Management may be approved or undertaken in various situations: as part of a 'good-neighbour policy'; to comply with a legal duty or the provisions of the Weeds Act 1959 (where applicable – see Appendix 1); as part of corrective action to address previous management regimes that may have led to the infestation, or to remove the risk of poisoning on sites where grassland management objectives for the wildlife interest require grazing by cattle or ponies. A wide range of management measures are used according to local circumstances. As common ragwort is a native species 'reduction' is normally preferred to 'eradication'.

3.1 Management issues

- prepare both ‘preventative’ and ‘reactive’ management strategies suited to the management circumstances and resources available on your site(s)’;
- consider combining more than one management technique;
- especially review the various management options in winter and consider out of season reduction techniques;
- be prepared - don’t wait for ragwort to start seeding before removal!

Prevention is better than cure! Good pasture management and elimination of rabbits helps prevent infestations. The longevity of a common ragwort population depends on the nature of the disturbance event which allowed its colonisation and the subsequent management of the site.

Once established, common ragwort will be present until the sward is returned to a better management regime. Proper grazing management may result in more manageable levels of common ragwort density. Common ragwort’s occurrence can be prolonged and its density dramatically increased by over-grazing or other localised disturbance impacts. Conversely a reduction in grazing levels will allow the sward to grow over exposed soil preventing seed germination and establishment.

Especially eliminate rabbits to reduce scratchings that provide ideal conditions for germination leading to infestations. Scratching activity by rabbits and the fact that they do not eat common ragwort provides two advantages which helps common ragwort establish and flourish on rabbit grazed sites. It has been shown that common ragwort can be eliminated in about four years if rabbits are excluded through either rabbit fencing or control operations.

Seedling mortality is the most important factor determining common ragwort density. Consequently, killing the rosettes or reducing/eliminating the germination sites are the only realistically achievable means of reducing common ragwort density. It may be possible to reduce the germination sites by implementing management that encourages closure of the sward, though the technique of applying fertilisers to encourage the growth of competitive grasses is not normally acceptable on semi-natural habitats. Common ragwort may still germinate on molehills as well as in worm casts but the population density is likely to be significantly reduced.

Use of herbicides must be undertaken with care because this may result in killing of other plants and exposing the soil surface for common ragwort germination and some herbicides give increased palatability to the plants that survive.

Cutting of the plants and defoliation will prolong the lives of common ragwort plants. They are also unlikely to have much impact on future common ragwort density without radical changes to the management of the site.

Be aware and have regard to the wildlife value of common ragwort and the many less common species of ragwort that occur in the UK and the varied insect life that depend on them.

It is to be expected on wildlife sites that some common ragwort will continue to occur in the sward and will fulfill its role in the ecological dynamics of well-drained grassland ecosystems.

3.2 Management strategies

The following list presents techniques which are used singly or in combination to reduce either of the two species of ragwort commonly found in pastures. Management strategies also need to vary according to whether the infestation is of common ragwort *Senecio jacobaea* or marsh ragwort *Senecio aquaticus*. The latter is more normally found in wet meadows and grasslands especially where lying water creates bare ground. Emphasis is always placed on 'preventing' infestations by good management of pastures, rather than trying to 'remove' them once they have occurred! Benefits are short lived unless pasture is well managed, as re-infestation will inevitably result.

3.2.1 Management techniques (in suggested order for consideration)

Good pasture management, including prevention of over-grazing and poaching and reduction of bare ground by grazing control – can all contribute to prevent [re]-infestation. (NB bare ground can be a valued component of many semi-natural habitats). Prevention is better than cure! Due to the biennial life cycle of common ragwort results of good pasture management will not be apparent for at least two seasons, and then needs to be maintained in perpetuity.

Good pasture management by using a combination of grazing species (eg cattle + sheep) to give good control of sward structure. Sheep (and goats) may quite naturally eat some ragwort rosettes and flowers during normal grazing activities especially where hardy/native breeds are used, but for animal welfare reasons it is important to ensure there is a choice of alternative herbage for them to select. This is normally the case on semi-natural grassland habitats. Cattle and ponies preferentially avoid common ragwort unless it has been cut and left in a wilted condition. (See 'Welfare Guide' reference).

Hand pulling (wearing gloves) and disposal: labour intensive but generally effective especially when soils are damp, if started earlier enough when plants are in green/yellow bud. Some weak re-growth may occur from fractured roots. Plants cut in previous years and turned into large, spreading perennial growth forms may be difficult to pull and may leave patches of bare ground which may provide germination conditions for new seed.

Hand tools (levering out) and removal: allows all year round management, especially out of the flowering season when other flowering plants are dormant; labour intensive, eg Lazy Dog Tool[s]; Lazy Dog removal contract service; Rag-Fork.

Machine pulling and removal: eg 'Eco-Puller' tall weed pulling machine - requires height differential and plants to be taller than 25cms. See also hand-pulling above. (Also pulls other tall weeds including thistles and nettles).

Flame (burn) with hand held spot burners: eg Hoaf machine; applicable at rosette stage of growth; rapid re-growth may occur if growth initiation areas are not killed.

Cut/flail and remove: prevents seeding but turns plant from a biennial into a perennial habit. Plants get bigger each year. Not to be recommended except as an emergency procedure to prevent flowering.

Biological controls: Cinnabar moth larva feed on ragwort and can give some defoliation depending on population numbers; naturally occurring cinnabar numbers fluctuate year by year and from site to site and are subject to natural predation which limits population numbers and the effects of their defoliation. (See Appendix 2 for an interim assessment of artificial enhancement of cinnabar populations). There are no other biological control methods currently approved for use in the UK.

Herbicide spot treatments: labour intensive; herbicides may be broad spectrum, killing other plants as well; some herbicides may enable early season (even winter) treatment of rosettes, eg 'Barrier H'.

Herbicide weed-wiping: requires height differential between ragwort and non-target species; narrow spectrum herbicides preferred; ragwort may be difficult to wipe effectively due to small curled leaves on some growth forms and plants become more resistant to some herbicide as the plants approach flowering phase. Some wipe machines are especially designed for traversing rough terrain sites, eg 'Weedswiper', Allman 'Eco-Wipe'.

Spraying herbicides: a reduction of common ragwort can be obtained by use of herbicides; most herbicides are unselective and will kill other broad leaved herbs.

4. Health & safety

Attention is drawn to the toxic properties of ragwort to some grazing animals and potentially to human health from management operations. Managers should seek and refer to authoritative advice and carry out a risk assessment. The following points may need to be taken into account.

A 'precautionary' approach would assume that all ragwort species and all growth stages of the plants (*Senecio* spp.) contain pyrrolizidine alkaloids (PAs) which have toxic properties to animals and man. PAs remain toxic in wilting, dried or dead plants in feed or forage.

Toxic effects are most apparent in the liver and though PAs themselves may not be hepatotoxic the PAs may be metabolised by being bound to pyrrole derivatives.

Many grazing animals are at risk from the toxic effects of consuming ragwort by grazing the plant and consuming it in forage. Horses are especially susceptible. Cattle, sheep, goats and pigs, especially of adapted breeds, will avoid eating ragwort when it is growing but are more at risk when plants are wilted or dying.

Signs of ragwort poisoning may be slow to develop and may not become apparent for several days, weeks or months. Signs may appear after consumption of the plant has ceased.

Poisoning can develop quickly and animals can die within a few days of showing clinical symptoms. Liver damage is irreversible and there is no effective treatment.

Human exposure: Exposure of PAs to humans is via contaminated foods mainly in economically disadvantaged countries and risk to humans in the UK is generally considered to be insignificant. There is concern about the risk to human health associated with hand pulling of ragwort plants. It is not known if PAs can be absorbed through the skin although anecdotal evidence suggests that it can. It is advised that protective gloves be worn. There may also be a concern with any flailing operations if this produces an aerosol effect. (See also Appendix 1 - *).

5. References

5.1 Research references

A preliminary search for references revealed that at least 55 papers on ragwort/cinnabar moth interactions have been published since 1978. Not all papers could be consulted in the preparation of this note.

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5.2 Management references

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Also:

DEFRA Animal Welfare Codes.
Machinery sales leaflets: (eg Allman Eco-wipe; Alvan Blanch Eco-Puller; Lazy Dog Tool Co; Rag-Fork).

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(This Information Note may be subject to revision).

Appendix 1. Responsibilities under the Weeds Act 1959

Ragwort is covered under the provisions of the Weeds Act 1959. The Act is designed to prevent the spread of listed weeds on to adjacent land. It is not unlawful for the listed species to be present on a piece of land.

Defra officials are responsible for investigating complaints arising from the Weeds Act and for implementing its provisions. Defra currently only has responsibility to investigate the spread of weeds to land that is used for farming activities. Defra will not investigate the spread of weeds to land that is used for grazing horses or ponies for recreational or leisure purposes.

Defra also recognises that proper management of vegetation is an essential part of SSSI or Nature Reserve management. In such cases Defra will determine appropriate actions in consultation with English Nature.

Guidance notes on *Preventing the spread of harmful weeds* and *Methods that can be used to control harmful weeds* are available from Defra.

Ragwort is of particular concern because it contains a hepatoxic alkaloid poison (*) (ie liver poison). The effects are cumulative and there are no antidotes. Death may not occur until 1-5 months after ingestion of a lethal dose. Symptoms of poisoning may not appear until a week before death.

(* Pyrrolizidine Alkaloids are distributed throughout the plant and can be cumulatively ingested, inhaled [pollen, dust or aerosol], or absorbed through the skin. Grazing animals normally avoid common ragwort but when cut or dried in hay or when dying after herbicide treatment then they may not smell it and consume it accidentally. Some animals are more susceptible than others).

Appendix 2. An interim assessment of using enhanced population levels of cinnabar moths to control common ragwort

Recent interest has been aroused in using enhanced levels of cinnabar caterpillars to defoliate and control common ragwort. The following information is of relevance in consideration of this approach and is presented as an initial assessment based on some published scientific research papers.

Cinnabar moth

The Cinnabar moth is univoltine, occurring as an adult from late May to July. The yellow eggs are laid in batches of up to 150 on the undersides of the lower leaves of ragwort especially those on plants which are bolting. The eggs hatch after 5-10 days. The larvae feed in June to August at first on the buds, flowers and upper leaves of the plant. It is here that both nitrogen for protein production and pyrrolizidine alkaloids for defence are concentrated. The alkaloids are sequestered by the larvae as a protection against predation. Laboratory trials have shown that larvae fed exclusively on buds and flowers produce larger adults. The larval stage lasts about four weeks.

Egg predation is minimal. Egg parasitism has not been demonstrated under experimental captive conditions. Larval mortality is about 25% per instar and this increases when the larva leaves the host plant. Larval parasitism, which involves at least 14 species of Hymenoptera and one species of Diptera can be as much as 12% per instar in outbreak years. Overall larval mortality of 60% by parasitism is not unusual. Larvae can disperse to at least 10 metres from oviposition site. Larval predation can be as much as 97% in four days if predatory ants forage across the site. Parasitism of the pupa is achieved by at least four species of Hymenoptera and three species of fungi. Pupal mortality by parasites is usually 16-20%. Moles are thought to be the main predators of Cinnabar moth pupae and mortality from this cause can be as much as 60%.

Normal population density fluctuations are in the region of eight-fold and fluctuations have been recorded to follow one year behind Ragwort population fluctuations. Research in Britain and in the Netherlands has indicated that there is a 5-6 year cycle of abundance in local populations but that some populations are out of phase with the rest. Cinnabar moth recovery is related to available Ragwort biomass and to other factors. Cinnabar survival is low when:

a. spring is late and the plants are small at oviposition;
b. egg batch density is high and few plants are available.

Cinnabars, as any other defoliant, will remove foliage rendering the ragwort density less conspicuous. This can result in perennialisation and re-growth of tillers from the base in the following year. Cinnabars may have a role in ragwort 'management' with longer term success being achieved if the management also allows the sward to close over the exposed soil, thus preventing ragwort germination.

Risk assessment to wild populations of cinnabars

The following risks need to be considered:

1. Risk of introducing non-native and non-local genetic strains, or deleterious genetic traits (acquired through in-breeding or 'retained' because captivity does not select against them) on to the release site.

2. Risk of the captive breeding and release programmes introducing viral, fungal or other diseases on to the release site which could adversely affect any native population of cinnabar.

3. Need to assess any impact of wild collection of larva on donor site.

4. Need to ensure that the genetic vigour of stock is maintained by periodic collection of new stock.

5. *Senecio jacobaea* is a common plant. However there are other quite rare ragworts. It is thought likely that cinnabars will feed on these less common species of ragwort. Therefore sites with these species should not be targeted for release programmes. If identification is uncertain then advice should be sought.

6. Any advantage of biological control methods over other management techniques which may have associated harmful environmental effects (e.g. use of herbicides).

Summary

1. Any proposal to release stock on to an SSSI must have prior approval under the consents procedures required in the Wildlife & Countryside Act 1981 (as amended). Following a review of this technique and the issues presented in this Information Note English Nature is unlikely to support the introduction of captive stock of the cinnabar moth on SSSIs or nature reserves unless special reasons can be justified.

2. English Nature observes that some defoliation of ragwort plants results from naturally occurring populations of cinnabar moths but also observes that this is often insufficient to prevent flowering and seeding of all plants. Available information written up in the scientific literature indicates that introduced populations of cinnabars are likely to be subject to similar controlling influences as native populations, however increased defoliation is likely to occur if released eggs or larva successfully survive predation and parasitism. Published research papers currently available from studies carried out in other countries have shown that where cinnabar moths have been released to 'control' ragwort, they have not had a major impact on ragwort density in subsequent years. English Nature is prepared to review these statements in the light of further researched evidence being provided.

3. English Nature supports good pasture management as the prime means of preventing colonisation by ragwort. Where infestation occurs then control measures may be necessary either to comply with the Weeds Act 1959, as a good neighbour policy or to prevent poisoning of livestock.

NB. This Appendix has been approved by Butterfly Conservation.

5 June 2003

Appendix 3.

***Ragworts (Senecios)* and other similar plants.**				
English name	**Latin name**	**Distribution**	**Status**	**5.2.1 Decline**
Fen Ragwort	Senecio paludosus	Declining, Rare, only in Cambs + 6 introduction sites	Critically Endangered, BAP sp	C18th and 19th drainage
Field Fleawort	*Senecio integrifolius (Tephroseris integrifolia subsp integrifolia)*	Very local in S England, north to Cambridge	Scarce	Native - decreased since 1960 from lack of management and agricultural improvement
	Subspp maritimus	Only West Britain, confined to coastal sites on Holy Island, Anglesey	Endemic (i.e. occurring in a district).	Populations appear to be stable
Common Ragwort	*Senecio jacobaea*	Widespread	Notifiable weed, Weeds Act, 1959	Occurs virtually throughout
Marsh Fleawort	*S. congestus (Tephroseris palustris)*	Extinct – formerly E Anglia	Extinct	Last native record Norfolk in 1899. Drainage and agricultural changes probably caused its demise.
Marsh Ragwort	*S. aquaticus*	Throughout	Widespread	Decline since 1950s probably due to drainage of wet meadows and agricultural intensification
Hoary Ragwort	*S. erucifolius*	Locally common in E+W, rare in Scotland and Ireland	Locally common	Little change since 1962 Atlas but may have declined in E Midlands and on its northern edge of range
Oxford Ragwort	S. squalidus	Widespread		1st recorded in 1794 as an escape from Oxon Botanic Gardens
Welsh Ragwort/Welsh Groundsel	S. cambrensis	Very rare – restricted to Denbighshire, Flintshire, Shropshire and S Scotland	Near Threatened, Endemic	
Other tall yellow plants that could possibly be confused with common ragwort.	Groundsel on margins and bare disturbed ground (annual) and not forgetting Britain's "newest" plant - York groundsel (Senecio eboracensis); St John's wort family (*Hypericum*); other yellow flowered composites; e.g. Yellow Loosestrife (*Lysimachia vulgaris*), Mullein (*Verbascum spp*), Tansy (*Chrysanthemum vulgare*), Fleabane (*Pulicaria spp*), Agrimony (*Agrimonia eupatoria*)			

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