

Marsh Lousewort as an Ecosystem Engineer in Oxfordshire Fen Restoration Projects
Judith A Webb, June 2020

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Marsh lousewort (*Pedicularis palustris*) is a pink-flowered, biennial relative of yellow rattle (*Rhinanthus minor*) which has much-divided ferny leaves. It lives in calcareous fens but, in Oxfordshire, used to be most common in wet floodplain meadows (according to botanist G. C. Druce in his Flora of Berkshire, 1897). It has declined markedly in the county, to such an extent that it is now on the Rare Plants Register (published as Oxfordshire's Threatened Plants, 2018). It was known also as 'Red Rattle' according to one of the earliest botanical texts - Gerard, 1633, who said 'it groweth in moist and moorish medowes'. Explaining the name, Gerard says it is named in Latin after the louse, *Pediculus*, because 'it filleth sheep and other cattel that feed in medowes where this groweth full of lice'. Of course it is not actually the cause of lice infestation in animals.

Whilst only one floodplain meadow still has it near Oxford, survival has been slightly better in fens. Even so, most fens in the county have lost it; luckily it can still be seen at Cothill Fen SSSI & SAC in Parsonage Moor and in Cothill Fen NNR (Ruskin Reserve) and also in the Lye Valley SSSI fen in Oxford. Its survival at Cothill is favoured by cutting and raking management combined with light pony grazing, but at Lye Valley cutting and raking alone maintains it. Like the yellow rattle, it is a root-parasite of plants nearby. For such root-parasite plants, after germination, each young plant does not thrive unless its roots meet other species' roots underground. Forming a connection (haustorium) to other plant's roots, the marsh lousewort then withdraws water, organic carbon compounds and mineral nutrients from the 'host' plant. It is only a partial parasite, as it does have green leaves that make foods such as sugar and starch by photosynthesis.



Marsh lousewort *Pedicularis palustris*, in the Lye Valley fen, note bumble bee feeding.

Photos J A Webb.

Many host plants of marsh lousewort have been recorded, but it seems to prefer to parasitise the roots of sedges (*Carex* spp.) and rushes (*Juncus* spp.). The host plants cannot grow as vigorously as normal due to limited food and are often much stunted in height and reduced in biomass. Yellow rattle parasitizes mainly the roots of grasses and so stunts their growth in haymeadows. With growth of grasses reduced, the diversity of other flowers can be much increased in a meadow. In this way semi-

parasites like yellow rattle control the ecological balance in meadow plant communities. Marsh lousewort behaves in a similar fashion, controlling the plant community in fens and wet meadows, reducing dominant species and increasing diversity of smaller plants, ones that it does not parasitise. I have observed that grass-of-Parnassus, marsh arrow-grass and bog pimpernel in particular seem to thrive in the presence of marsh lousewort, as it reduces species that would compete with them by over-shading such as blunt-flowered rush. Competition between root systems underground may also be reduced.

Workers in the Netherlands published their research on marsh lousewort (Declerck et al, 2013) and discuss its role as 'ecosystem engineer' in hastening the reduction of previously dominant monocotyledon plants, such as reed, sedge and rush. They suggested it might usefully be introduced as part of fen restoration programmes to promote plant diversity. After reading this I have been experimenting with this idea in the Lye Valley SSSI fen in Oxford. I collected marsh lousewort seed, spread it to new areas and observed the results. I observe it did best in very wet areas and was extremely effective in reducing blunt-flowered rush dominance.

I also observed that, as marsh lousewort is a biennial, plant death after the second year leaves a patch of bare peat, which is then ideal for seed germination and seedling survival of other plants with little competitive ability, like devil's-bit scabious. An additional benefit is that marsh lousewort flowers are much enjoyed as a nectar and pollen source by bumble bees of all types – indeed, it is dependent on them for pollination and seed-set.

Whilst marsh lousewort's parasitism of rush and lesser pond sedge has been known since it was first observed by Druce (1897) just looking at a clump of strongly growing marsh lousewort plants in Lye Valley, I noticed a marked reduction in height of the reed stems in a zone around the plant. This seemed to indicate it parasitizes reed (a grass); but it was student Will Millard of Oxford Brookes University, working for his undergraduate project on marsh lousewort in the Lye Valley fen, who actually proved this by looking into the peat and finding a connection (haustorium) between a marsh lousewort plant root and the rhizome of reed growing adjacent to it (Millard, 2018).

Marsh lousewort is now abundant in Lye Valley fen due to regular scything, raking and seed-spreading by several volunteer groups (mainly Friends of Lye Valley) with permission and help from Oxford City Council staff and Natural England. The regular cutting weakens any reed re-growth, making it more susceptible to marsh lousewort's effects. The marsh lousewort seed is collected every summer and autumn by volunteers and spread into areas that have just been scythed and raked. In this way a large population of this semi-parasitic species has been built up and overall floristic diversity is greatly increased. Areas of previous monoculture reed have been transformed over a few years to species-rich shorter fen, abundant with flowers and nectar-seeking invertebrates. Lye Valley fen is a long way on the path to restoring the full area of high grade rare NVC M13 calcareous, alkaline, short-turf fen vegetation for which it received its SSSI designation.

Experience shows that, if introduced to an area that used to have really strong, dominant reed (probably not having been cut at all for many years) the young first-year marsh lousewort plants do best if there is an early fairly-high scythe cut over their heads in late April to early May, just when the reed shoots have emerged and are growing strongly upwards at about 40-50cm tall. This knocks the reed back and weakens subsequent re-growth, giving the marsh louseworts more light and less competition. But this treatment is not essential.

These actions have proved marsh lousewort can indeed be used as a very useful 'tool' for helping reduce reed re-growth and thus minimise the cutting and raking burden (at least twice annually) on volunteers who manage such fens in the absence of stock grazing. Using this knowledge and working with the Wild Oxford Project of the Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT) led by Andy Gunn; a few years ago we introduced marsh lousewort seeds from Lye Valley to the previously reed-dominated alkaline fen restoration area at Chilswell valley Local Wildlife Site. Here there is no stock grazing and volunteer scything and raking twice a year is the restoration

management. By 2019 the positive results were obvious - a spectacular reduction in reed growth and a steep increase in total species diversity in the monitored fen restoration area that had been in receipt of marsh lousewort seed (my reports on this project are available in the Wild Oxford section of the BBOWT website)



Chilswell Valley LWS fen restoration area, Wild Oxford Project. Young marsh louseworts growing in their second year in foreground and reducing growth of reed around them, note taller reed in the distance, where marsh lousewort plants absent. Photo J A Webb, 2019.

Learning from these experiences I encouraged Natural England staff and volunteers at Cothill Fen NNR (Part of Cothill fen SSSI and SAC) to help me collect seed from the dying marsh lousewort plants in August 2019 and immediately scatter it in other fen areas with over-dominant reed and rush. The reed-rich areas had previously had several cuts by scythe, and all cut reed was raked off before the lousewort seed spreading occurred. The quick method used was to pull up the whole dead plants and then rub the seeds out of the pods over the new restoration fen area, perhaps with light treading-in. We await the results this year. First year marsh lousewort plants are small and usually do not flower; surprisingly I observe these small plants can still reduce rush and reed growth nearby by parasitism. The second year plants can grow to a metre tall and it is these that cause the really marked reduction in height of nearby host plant species. They then flower abundantly before dying as early as midsummer.

The principle of marsh lousewort seed introduction at an early stage of fen restoration from dominant reed has been adopted by the Oxfordshire Fens Project (hosted by the Freshwater Habitats Trust and grant funded from various sources (Trust for Oxfordshire's Environment, Grondon and an EU Water Environment Grant). With the collaboration of landowners, this project is now working on restoration of five previously neglected alkaline fens (four SSSI and one LWS) in Oxfordshire. Funding has enabled work by contractors, combined with volunteer work in scrub reduction, scything and raking of reed and rush. The abundance of marsh lousewort seed from Lye Valley fen has meant that there is plenty spare to donate to help these other sites. Hinksey Heights fen Local Wildlife Site was the first to receive seed in 2018, so has had marsh lousewort for two years now. Flowering for the first time is expected soon and the effect of parasitism on the sward should be evident. The other four fens have had seed introduced only recently in 2020 after winter cutting of reed and scrub, so the full effect of marsh lousewort parasitism will not be visible until 2021.

Can a fen have too much marsh lousewort and what if it parasitizes desirable rare sedge or rush species? Careful botanical monitoring of the progress of fen restoration will enable us to answer those important questions in future years.

References

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