

Cryptocephalus decemmaculatus at Wybunbury Moss NNR:
Current status of population and recommendations for
habitat management/future work

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Summary

The leaf-beetle, *Cryptocephalus decemmaculatus* is restricted to one known site in England – Wybunbury Moss. Three surveys were conducted at the site in the early summer of 2015 to estimate the total population size, study the survival of larvae and to inform further recommendations for habitat management.

Two estimates of population size were made with a mark-release-recapture technique. During the peak time for the adults the total population size was estimated to be 3959 ±847 individuals, considerably greater than any estimates that have been made previously. This suggests that habitat management, particularly the creation of sheltered areas planted with cuttings of their primary host plant (*Salix cf. cinerea*), has greatly benefited this beetle.

Work to investigate the mortality of wild larvae will be ongoing from 2015 through to 2016 and possibly beyond.

In terms of habitat management, the following is recommended:

- Ensure areas currently supporting the beetle are open to the maximum amount of sunlight, but without excessive exposure to winds.
- Scallop woodland edges to create sheltered micro-climates.
- Link the numerous subpopulations by planting preferred host plants and remove any potential barriers to dispersal.
- Minimise ground disturbance in the key areas during the spring when the larvae are fully developed.
- Planting of *Salix cf. cinerea* cuttings in newly created and existing habitat.
- Re-plant *S. cinerea* bushes in areas where they have died.

In terms of further work, the following is recommended:

- Continued monitoring to gauge how this beetle reacts to further habitat management.
- Surveys of surrounding and/or historical sites in the vicinity to determine if the species is present. Recently emerged females taken from Wybunbury Moss could be used as captive lures – attracting any males if they are present.
- Further work to investigate if the individuals observed during odd-numbered and even-numbered years represent temporally separated populations.

Background

Nineteen *Cryptocephalus* species are found in Britain, many of which are of conservation concern (Hyman and Parsons, 1992). Adults of the genus are fully winged, thermophilic (Erber, 1988) and can be found perching on their respective host plants. The female beetle encases each egg she lays in faeces. The eggs are dropped onto the ground and once hatched the larvae add to their egg case to form a larval case, which they carry around and retreat into at the first sign of danger. Larvae of all the species feed on leaf litter.

Cryptocephalus decemmaculatus is a particularly enigmatic member of the genus (Figure 1). Adults are found primarily on small *Salix* species, especially willows, although specimens are also found on small *Betula pubescens* trees.



Figure 1. Mating pair of *C. decemmaculatus* and a waiting male on a *Betula pubescens* leaf (Wybunbury Moss, May 20th 2011)

The distribution of the species is unusual (Figure 2) with a small number of disjunct locations. The species is generally found in wet areas. Adults in the one remaining English population (Wybunbury Moss) are found most frequently on willows growing around the edge of the main sphagnum lawn. Only eight confirmed sites and one unconfirmed site (Fenns and Whixhall Moss) are known, with a small cluster in the northwest of England (Stott 1929; Allen, 1960; Allen, 1970; Shirt, 1987; Hyman and Parsons, 1992). Three of the site records are based on single specimens and *C. decemmaculatus* has always been considered to be rare (Stott, 1929; Allen, 1970). Prior to 1981 the only known UK sites for

this species were Chartley Moss in Staffordshire where it had been known since 1879 (Stott, 1929), Burnt Woods in Staffordshire, a single specimen from Abbots Wood in East Sussex (Allen, 1970), Camghouran in Perthshire (Stott, 1929) and a single specimen from Braemar in Aberdeenshire (Allen, 1960). Records also exist for Chat Moss in Lancashire (1983?) and the Muir of Dinnet (Aberdeenshire, 1986 Shell Survey). In 1981 a large population of this species was found at Wybunbury Moss and this colony was the subject of intensive field and laboratory based studies between 1999 and 2002. The author has also returned to the site frequently between 2002 and this present study.



Figure 2. Past and present distribution of *Cryptocephalus decemmaculatus*. [Black symbols = extant populations (positive surveys within last five years); White symbols = extinct/very likely extinct/survey deficient populations].

Methods

Wybunbury Moss was visited on three occasions in June 2015 (4th, 10th and 18th). On each occasion the site was surveyed for the adults. The most efficient survey technique is simple visual searching as the adults are typically found basking on the leaves and twigs of *Salix cf. cinerea* and *Betula pubescens*. The primary goal of these visits was to estimate population size, so only the numbers of individuals observed was recorded.

On the first two visits the beetles were marked with a tiny spot of quick-drying paint in order to estimate population size. To estimate population size, the following formula was used, where:

R = marked recaptures; *C* = total in second sample; *M* = marked initially and *N* = total population size

$$N = [(M+1)(C+1) / (R+1)] - 1$$

To calculate the uncertainty of the population estimate, the standard error is calculated using the following formula:

$$SE = \text{sqrt} \{ [(M+1)(C+1)(M-R)(C-R)] / (R+1)^2(R+2) \}$$

Five females and males were taken from the site in order to obtain eggs and eventually larvae to enable larval mortality in the wild to be studied later in the year. After hatching the larvae will be reared to their 1st or 2nd instar in captivity before they are taken back to Wybunbury Moss and placed in shallow trays containing the elements of the typical larval habitat, e.g. moss and leaf litter. These trays will be left in place for the rest of 2015 and then collected in the early spring of 2016, although this will depend on the developmental stage of the larvae. This will enable the larval mortality to be studied, particularly the impact of parasitoids.

Results

Population size

During the three visits, 124, 290 and 271 adult beetles were recorded (Table 1). Marking of the beetles recorded during the first and second visits allowed two population estimates for the entire site to be calculated: 1254 \pm 190 for visit 2 and 3959 \pm 847 for visit 3 (Table 1).

Table 1. Mark-release-recapture to estimate population size of *Cryptocephalus decemmaculatus* at Wybunbury Moss.

Visit	Date	Adults recorded	Marked	Recaptured	Population estimate
1	4/06/2015	124	124		
2	10/06/2015	290	262	28	1254 \pm 190
3	18/06/2013	270		17	3959 \pm 847

Discussion

Cryptocephalus decemmaculatus adults typically emerge towards the end of May and the population reaches its peak around the middle of June, hence the difference in the two population estimates. The population estimate from the final visit (3959 \pm 847) corresponds with when the number of adult beetles is at its peak. The number of recaptured individuals dictates the degree of error in the population estimate. As the proportion of recaptures was lower in the second recapture (6.5% vs 22.5%) the error is higher for the second population estimate.

The smaller proportion of recaptures in visit 3 points to the active dispersal of the adults throughout the entire central part of the moss after an initial period of feeding and mating on or very near the host-plants that they developed below as larvae. The high proportion of recaptures in visit 2 suggests that many of the adults had not yet entered this dispersal phase as many were encountered on the same bush as where they had been captured on visit 1. Interestingly, there also appears to be a difference in the time of adult emergence between sub-populations.

The numbers of adult beetles recorded during visits 2 and 3 of this study are the highest that have ever been seen at this site. Both the population estimates from this study suggest the population of this beetle has grown considerably over the time the author has been visiting the site.

The large populations observed in 2011, 2013 and 2015, together with the very small numbers of adults observed in 2012 and 2014 suggest that most of the eggs produced in any one year take two years to reach adulthood. It remains to be seen if the small numbers of adults observed in 2012 and 2014 represent individuals that have taken one year to reach

maturity or if they represent a smaller population that is separated temporally from the larger population of the odd-numbered years.

Habitat recommendations

Habitat management to create a mosaic of habitats, sheltered micro-climates and the provision of host-plants in such areas has obviously benefitted the beetle enormously. The observation of so many adult beetles during the visits made this year is unprecedented. Furthermore, the beetle now occurs in good numbers in areas where it was never formerly observed. Scalloping the margins of the woodland to create warm, sheltered micro-climates and the planting of host-plants in these areas has enabled considerable sub-populations to develop.

To enhance the site still further for this species and a number of other arthropods that have similar requirements the following is recommended:

- Ensure areas currently supporting the beetle are open to the maximum amount of sunlight, but without excessive exposure to winds.
- Attempt to link the subpopulations of beetle by the planting of willows and the removal of barriers to dispersal (e.g. very tall, dense scrub). This is key to further enhance the population and to minimise the negative impact of any stochastic events.
- Minimise ground disturbance during the spring in the areas where large concentrations of adults are normally seen as the larvae will be fully developed at this stage and perhaps more prone to trampling if there is very heavy disturbance.
- Further planting of cuttings of the primary host plant and replacement of dead and dying host-plants.
- Enhancing scrub and woodland edges in the right places is crucial to provide the beetles with the stepping stones they need to move around their habitat.

Recommendations for further work

- Continued monitoring of Wybunbury Moss to gauge how this beetle reacts to further habitat management.
- Surveys of surrounding areas and similar, more distant sites to determine if the species is to be found elsewhere.
- Further work to investigate if the individuals observed during odd-numbered and even-numbered years are temporally separated populations.

There are a number of sites surrounding Wybunbury Moss that could potentially support this species – not just mosses, but also open areas within tracts of ancient wet woodland. Alongside simply surveying these sites it may also be possible to lure the beetles if they are present by using a small number of freshly emerged females from Wybunbury Moss. These females must be broadcasting, via pheromones, their willingness to mate as they are often surrounded by several males. Males and females alike may even produce aggregation pheromones as it is not uncommon to find many individuals on a suitable host-plant.

By placing recently emerged females in gauze enclosures on a suitable host-plant any males in the vicinity would be attracted. If this technique was successful it would be an efficient way of searching for a beetle that is easily overlooked when present at very low population densities.

References

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