NOTES ON THE DISTRIBUTION, ECOLOGY AND CAPTIVE REARING OF *CRYPTOCEPHALUS DECEMMACULATUS* (L.) (COL.: CHRYSOMELIDAE)

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Abstract

Cryptocephalus decemmaculatus was one of the subjects of an English Nature funded PhD thesis on the conservation biology of the genus *Cryptocephalus*. This species is a Biodiversity Action Plan species and is currently listed as Vulnerable (*UK Red Data Book* category 2). Objectives of the Action Plan for this species are a better understanding of the beetles' ecology together with detailed distribution data. The UK distribution, rearing and autecological information presented in this paper are crucial in preserving the remaining UK populations of this species.

The beetle and it's past and present distribution

Nineteen *Cryptocephalus* species are found in Britain. Many of these species 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 adds to the egg case to form a larval case, which it carries around and retreats 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 (Plate J). Adults are found primarily on small *Salix* species, especially sallows, although specimens have also been found on small *Betula pubescens* trees.

The distribution of the species is unusual (Figure 1) with a small number of disjunct populations. The species is generally found in wet areas. Adults in the one remaining English population are found most frequently on sallows growing on a schwingmoor site. Only eight confirmed sites and one unconfirmed site (Fenns and Whixhall Moss) are known, with a small cluster in the north-west 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 and the Muir of Dinnet (Aberdeenshire, 1986 Shell Survey). In 1981, a large population of this species was found at the Schwingmoor site and this colony has been the subject of intensive field and laboratory based studies for the last three years.

Plate J. *Cryptocephalus decemmaculatus* (L.) ♀ Photograph © R. W. Piper

Adults and larvae in captivity

1271 eggs were obtained from nine wild caught females during the summer of 2000. Adults were maintained in purpose built cages with a sprig of *Salix alba* that was inserted into a wetted core of florists foam ("Oasis"; Oasis, UK) fastened to the side of the container. Eggs were collected periodically and placed in purpose built boxes. Each of these boxes was part filled with plaster of Paris to buffer the humidity. The eggs were kept dry until hatching occurred. Moisture was then applied to one or two Oasis cores (1cm diameter) placed on glass cover slips in each of the larval boxes. First and second instar larvae spent a lot of time on these Oasis cores drinking the water. Later instars were less dependant on drinking. The larvae were fed fresh pieces of *Salix alba* leaves.

Sealing of the larval cases and subsequent pupation was induced by giving the larvae a simulated winter in progressively cooler incubators and decreasing artificial day length. Of the total number of eggs laid 728 (57.2%) hatched. A further 283 (22.3%) of the larvae died during their first instar. The majority (300) of the remaining larvae were used in experimental releases to investigate larval overwintering. 145 larvae remained in captivity and 23 (1.8 %) of these died before reaching maturity. A further 30 larvae (1.6%) reached maturity but did not pupate after diapause and carried on feeding. Of the 145 *Cryptocephalus decemmaculatus* larvae 78 adults hatched (53.8%) and 66.6% of the adults that hatched were male. Fourteen (9.7%) of the adults that pupated failed to hatch and 41.7% of these were deformed. Most of these deformed adults were male (85.7%). The only deformity observed was manifested in a twisting of one of the elytra. Of the unhatched adults, only two were female and one of these was deformed. 2.6% of the adults that hatched exhibited the same deformity that was seen in the unhatched adults and also displayed a paralysis of the metathoracic limbs and wings. The adults were individually marked on hatching enabling longevity to be recorded. In captivity the mean longevity for females was mean = 27 ± S.D. 3.9 days and mean = 18 ± 3.6 days for males. There was a significant difference in the median longevity of males and females [males (n = 40), 18 ± 4 days, median = 18 days; females (n = 18), 27 ± 4 days, median = 27 days; Mann-Whitney Z = -5.183, P = <0.001]. These captive adults produced more eggs and the larvae of these were fully grown by the autumn of 2001.

Searches for wild larvae

The English site for this species was searched for larvae in the summer of 2000. Moss and litter was sorted over a beating tray and seven larval cases were located. All of these cases were of fully-grown larvae, and all seemed to have been broken into. The Scottish site was visited in June 2000 and, using the same technique, six larvae were found. None of these were fully grown (≤3 mm) and all but one was alive.

During a visit to the English site in June 2001 a single live larva (3- 4 mm long) was found clinging to a *Salix cinerea* leaf at 1.3 m above the ground. Characteristic

feeding damage was evident on the leaf. It is impossible to determine if this larva had scaled the host plant or if an oviposited egg had some how found its way into a recess on the plant.

Table 1. The flight period of *Cryptocephalus decemmaculatus* in three areas within the English site.

Visit	Date	Adults Observed		
		Area A	Area B	Area C
1	08-May-00	0	0	0
2	09-May-00	0	0	0
3	10-May-00	0	0	0
4	22-May-00	28	0	5
5	24-May-00	32	0	8
6	01-Jun-00	36	48	16
7	02-Jun-00	36	52	18
8	03-Jun-00	40	60	19
9	11-Jun-00	54	83	21
10	15-Jun-00	46	99	22
11	16-Jun-00	33	58	31
12	17-Jun-00	33	54	42
13	24-Jun-00	24	43	29
14	04-Jul-00	20	37	27
15	05-Jul-00	18	11	21
16	12-Jul-00	14	4	15

Adult mortality in the wild

Dead beetles were found by visual searching of host plants and the ground at the English site. Spiders' webs were scrutinised in particular. Mortality of adults was apparently low. The only observed cause of mortality was capture in the webs of *Enoplognatha ovata* (Clerck). The spiders were observed feeding on the adults, which were trapped in the webs. Eighteen adults were observed in webs; 12 (66.12%) of these were male. One adult male was also observed being eaten by a crab spider of the genus *Xysticus* (Koch). The very low mortality observed in the adults may be a consequence of their black and yellow warning colouration. Many chrysomelids have been shown to produce chemical deterrents (Pasteels, Rowell-Rahier, Braekman and Daloze, 1984). Of these, many feed on *Salix* species (Tahvanainen, Julkunen-Titto and Kettunen, 1985).

Adult flight period

Three sub-populations exist at the English site and in areas A and C *Cryptocephalus decemmaculatus* adults emerged two weeks earlier (mid-May) than the adults in Area B (early June) (Table 1). The peak number of adults was observed at approximately the same time in all three areas (mid-June). Adults could be found until the beginning of August.

The distribution data in this paper highlights the need for surveys of historic localities, especially in Scotland. The beetle was relatively easy to rear from eggs through to adults. Many larvae could be maintained in a small space on leaf litter facilitating mass rearing for re-introductions. Wild larvae, although very cryptic, can be found by intensive searching beneath the host-plant giving an indication of development time, predation and micro-habitat preferences in the wild. Adult mortality appeared to be low, possibly due to the aposematic colouring of the imagines. Adults numbers are at their peak in the middle of June suggesting that surveys conducted during this time may have a greater chance of producing positive results, particularly in the north west of England.

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