Further surveys for the Rock-rose Pot Beetle (*Cryptocephalus primarius*) in Gloucestershire

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Liam Olds

Saving the small things that run the planet

CONTENTS

Executive Summary

The Rock-rose pot beetle (*Cryptocephalus primarius*) (Harold, 1872) is an Endangered and Nationally Rare species (Hubble, 2014) with a very restricted distribution. In Britain, it is currently known from just a handful of calcareous grassland sites across southern England and is therefore considered of primary conservation concern. Given its rarity and high conservation status within Britain, survey work has been recommended to identify new locations supporting suitable habitat in an attempt to find new populations, alongside monitoring of known populations to clarify its conservation status at these locations (Hubble, 2014). It has also been suggested that historic sites be re-surveyed in the hope of rediscovering 'lost' populations (Piper, 2002).

Gloucestershire (Vice County [VC] 34) has long been considered a national stronghold for Rock-rose pot beetle, however there has been a paucity of records in recent years and it is presumed extinct from at least one site. In an attempt to clarify its conservation status in Gloucestershire, targeted surveys were undertaken at three sites within the Cotswolds Area of Outstanding Natural Beauty (AONB) in 2020. These surveys were a continuation of surveys conducted in the Cotswolds AONB in 2019, during which four Rock-rose pot beetles were found across two sites (Olds, 2020). These two sites supporting modern records (Breakheart Hill and Stinchcombe Hill) were re-surveyed in 2020 alongside surveys at Rodborough Common – a site from which Rock-rose pot beetle was now presumed extinct. Twelve surveys were conducted between the period of 29th May 2020 and 25th June 2020 and focussed on the visual searching for adult beetles in suitable habitat. Rock-rose pot beetle was found at all three survey sites in the Cotswolds AONB in 2020. This included the re-discovery of Rock-rose pot beetle at Rodborough Common – a site from which they have not been seen since 1985 (Piper, 2002). As such, it can now be confirmed that Rock-rose pot beetle is present at three sites in Gloucestershire (VC34).

A total of 92 Rock-rose pot beetle adults were seen across the three study sites in 2020. This included 69 sightings at Breakheart Hill, 14 sightings at Rodborough Common, and 9 sightings at Stinchcombe Hill. Rock-rose pot beetle adults were encountered throughout the entirety of the survey period (29th May 2020 to 25th June 2020) and the majority of sightings occurred on sheltered, short-sward, south facing slopes of calcareous grassland supporting Common rock-rose – in common with other field observations of this species in Britain (Piper, 2002). Eighty-five of the 92 Rock-rose pot beetle sightings occurred between the times of 13:33 and 16:59, adding further weight to the belief that Rock-rose pot beetles are most active during the warmest part of the day. All adult sightings also occurred on warm days with an air temperature between 21°C and 30°C.

To maximise the chances of detecting Rock-rose pot beetles, it is recommended that future surveys in suitable habitat: take place between mid-May and mid-July, with at least one survey occurring during the period of peak emergence in Britain (29th May and 5th June) or as close to this as possible; occur on warm days with an air temperature of 21°C or above; and are conducted between the approximate times of 13:30 and 17:00. Further surveys are recommended at Breakheart Hill, Stinchcombe Hill and Rodborough Common to gauge the size of the population, improve our understanding of its ecology, and to provide appropriate habitat management recommendations. Surveys at additional sites supporting suitable habitat are also recommended in the continued hope of finding new populations of Rock-rose pot beetle within Gloucestershire.

1 INTRODUCTION

1.1 Background

The Rock-rose pot beetle (*Cryptocephalus primarius*) (Harold, 1872) is the largest of the 19 British pot beetle (*Cryptocephalus*) species, measuring up to 8 mm in length. Like other pot beetles, the head is strongly retracted and sunk into the thorax, and the body is somewhat cylindrical. It is distinctive owing to its black thorax, head and legs, and red abdomen typically supporting five small black spots on each elytron or wing case (Figure 1). Confusion with other British pot beetle species is unlikely, the exception perhaps being the Two-spotted pot beetle (*C. bipunctatus*) which usually has either a single black band or two black spots on each elytron.

Classified as Endangered and Nationally Rare (Hubble, 2014), the Rock-rose pot beetle has a very limited British range and is currently known from just a handful of locations across southern England in Dorset, Gloucestershire and Hampshire. Available records suggest that very few British sites have ever been known for this species, with perhaps fewer than 50 individuals having ever been captured; the ecology of this species remains poorly known because of this (Piper, 2002). This species is therefore considered a priority for conservation and is listed under Section 41 of NERC Act 2006 as a 'species of principal importance for the conservation of biodiversity in England'. Elsewhere in Europe, it has a restricted distribution and, where it does occur, it is of high conservation concern (Piper, 2002). Given the rarity of this species both in Britain and overseas, it is appropriate that this species is considered of primary conservation concern.

Figure 1. Adult Rock-rose pot beetle © Liam Olds.

Pot beetles are so-called because of the protective shell-like cocoon or 'pot' that the larvae live in, created using the beetle's own faeces (Hubble, 2017). Living within their protective 'pot', the larvae feed on leaf litter at the base of their food plant. In common with some other species of pot beetle, it is thought that the larvae of this species take two years to reach maturity (Owen, 1996).

In Britain, it is speculated that the larvae of Rock-rose pot beetle feed on leaf litter beneath Common rock-rose (*Helianthemum nummularium*) and that the adults feed on the plant's leaves, hence their common name; though this remains unconfirmed and other food plants may be used (Piper, 2002). Research during captivity has suggested that Common rock-rose appears to be its preferred adult food plant when given a choice between this species and Hazel (*Corylus avellane*), Willow (*Salix* species) and Oak (*Quercus* species) (Piper, 2002), which are plant species with which it is often associated with on the continent (Warchalowski, 1991). Adults have also been observed feeding on the petals, anthers and pollen of Common rock-rose (Hubble, 2014).

As with other species of this genus, adults are found in late spring and early summer. Wiltshire and Owen (2004) have suggested that the peak emergence in Britain is likely to be between 29th May and 5th June, with the earliest and latest recorded dates being 11th May and 30th June respectively. Seemingly unpublished research by Leeds University suggests, however, that its period of activity is longer than previously anticipated with adults recorded until 15th July. This was also confirmed by surveys in the Cotswolds AONB in 2020, which found adults as late as 16th July (Olds, 2020).

Though limited, field observations in Britain have linked the Rock-rose pot beetle to relatively short sward calcareous grasslands with an abundance of Common rock-rose on sheltered, south facing slopes (Piper, 2002). The European distribution of this species and its occurrence in habitats with very warm microclimates lends weight to the theory of a species on the northern edge of its range in Britain (Piper, 2002). Surveys in the Cotswolds AONB in 2019 appeared to support this theory, with all four adult sightings occurring on warm days (with an air temperature between 21°C and 23°C) on south facing slopes of short-sward calcareous grassland (Olds, 2020). These sightings were also made between the times of 13:21 and 14:42, suggesting that Rock-rose pot beetles are most active during the warmest part of the day and require elevated temperatures to become active (Olds, 2020).

An underlying thermal requirement seems to exist given that known sites for Rock-rose pot beetle in Dorset and Hampshire are sparsely-vegetated and south-facing, with plentiful bare earth and exposed chalk (Andy Jukes and Mike Baker, personal communication). It perhaps seems reasonable to presume, therefore, that the Rock-rose pot beetle requires elevated temperatures at the ground surface for larval development, provided by the presence of bare ground and exposed chalk, as is the case in some butterflies e.g. Dingy skipper butterfly (*Erynnis tages*). Unpublished data by Leeds University appears to support this theory with oviposition noted as occurring only at temperatures above 25°C, with adults of both sexes only becoming active at temperatures exceeding approximately 22°C.

Due to the paucity of records of this species, its decline in Britain has not been as marked as in some other species within the genus. A decline is evident, however, and is believed to have been caused by the loss of unimproved chalk grasslands to agricultural improvement (i.e. reseeding and/or fertiliser application) or conversion to arable use (Hubble, 2014). Further habitat loss or degradation has also likely occurred due to natural succession or neglect (Hubble, 2014). Historically this has

occurred at Stinchcombe Hill in Gloucestershire, one of its key sites in Britain, however extensive work has been undertaken in recent years to bring the site into more favourable condition by the rotational cutting of grassland areas (and the subsequent removal of cuttings) and the control of invading scrub; grazing is not currently feasible but options are currently being explored to address this. Given the rarity of Rock-rose pot beetle and its high conservation status within Britain and Europe, it has been suggested that survey work is undertaken to identify new areas supporting suitable habitat (in an attempt to find new populations), alongside the monitoring of existing sites to clarify its conservation status at these locations (Hubble, 2014). It has also been suggested that historic locations that were known to support this species are re-surveyed in the hope of rediscovering 'lost' populations (Piper, 2002).

1.2 Rock-rose pot beetle in Gloucestershire

Gloucestershire has long been considered a national stronghold for the Rock-rose pot beetle. It is known from three locations in the county, these being:

1. **Breakheart Hill –** the first known site for this species in Gloucestershire following its discovery by C. Bartlett on 30th June 1935 (Wiltshire and Owen, 2004). It was not recorded on this site again until 1990 (some 55 years later) when an adult female was found by local resident Chris Wiltshire. Despite a paucity of records in recent years, and growing concerns regarding its potential loss from this site, surveys in 2019 confirmed its continued presence at Breakheart Hill (Olds, 2020).
2. **Rodborough Common –** first recorded at this site by T.B. Fletcher in 1942; he recorded 11 individuals that year (Wiltshire and Owen, 2004). The last specimen caught at Rodborough Common was in 1985 and it is was presumed extinct from this location (Piper, 2002). Surveys in 2019 failed to find any Rock-rose pot beetle adults, adding further weight to the belief that this population is now extinct (Olds, 2020).
3. **Stinchcombe Hill –** the most recently discovered site in Gloucestershire. It was first discovered here by Chris Wiltshire on 15th June 1990. Since then, Stinchcombe Hill has remained one of the key national sites for this species in Britain. Despite a paucity of records in recent years, and growing concerns regarding its potential loss from this site, surveys in 2019 confirmed its continued presence at Stinchcombe Hill (Olds, 2020).

There is some uncertainty as to the status of Rock-rose pot beetle within Gloucestershire (VC 34). It was presumed extinct from Rodborough Common, one of its three known sites in the county, where it was last recorded in 1985. Modern records exist from both Breakheart Hill and Stinchcombe Hill, though sightings are sporadic and concerns regarding its potential local extinction have remained. Due to the uncertainty surrounding the conservation status of this species in Gloucestershire, in what has historically been an area of national importance for this endangered species, survey work was undertaken in 2019 and 2020 as part of the 'Back from the Brink' partnership project, funded by the National Lottery Heritage Fund, to confirm its status in the county. This report details the results of surveys undertaken in 2020, delivered by Buglife – The Invertebrate Conservation Trust in partnership with Butterfly Conservation and Natural England. This survey work was delivered through the 'Limestone's Living Legacies' sub-project of the 'Back from the Brink' project. The results from the 2019 surveys in the Cotswolds AONB can be found in Olds (2020).

2 SURVEY METHODOLOGY

Daytime surveys for Rock-rose pot beetle were conducted at three sites within the Cotswolds AONB in 2020 in an attempt to clarify its conservation status within Gloucestershire (**Table 1**). These three sites include two sites with modern records (Stinchcombe Hill and Breakheart Hill), and one site from which the species had been previously recorded but was now presumed extinct (Rodborough Common). Surveys on sites with modern records (Stinchcombe Hill and Breakheart Hill) should help us to gauge a better understanding of its conservation status at these locations and help inform habitat management. Surveys at historic sites (Rodborough Common) supporting suitable habitat were undertaken in the hope of rediscovering 'lost' populations. Photographs of the three study sites can be seen in **Appendix 1**.

To date, all known specimens of Rock-rose pot beetle in Britain have been found either by sweep netting or visually searching areas of south facing, calcareous grassland. Due to the tendency of pot beetles to display thanatosis (feigning death) when threatened, causing them to drop from the flowers of the host-plant, surveys in 2020 (as per 2019) focussed solely on the visual searching of adults on or near Common rock-rose. It was presumed that this survey method would be more reliable at finding this species than indiscriminately sweep-netting suitable grassland sites.

Table 1. Summary of sites surveyed for Rock-rose pot beetle in 2020.

Site Name	**Grid Reference**	**Notes**	**No. of site visits**
Stinchcombe Hill, Dursley	ST740983	25.72 ha site within the Cotswolds AONB supporting lowland calcareous grassland and designated as a Site of Special Scientific Interest (SSSI).	3
Breakheart Hill, Dursley	ST757965	1.1 ha site within the Cotswolds AONB supporting lowland calcareous grassland. Privately owned.	3
Rodborough Common, Stroud	SO851032	109.64 ha site within the Cotswolds AONB supporting lowland calcareous grassland and designated as a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC).	6

2.1 Survey dates and weather conditions

A total of 12 targeted surveys were delivered across the three study sites in the Cotswolds AONB in 2020. Each site was visited during warm, dry and sunny conditions when adults were most likely to be active. Surveys were conducted between the period of 29th May 2020 and 25th June 2020. Details regarding the survey dates, times and weather conditions for each of the three study sites can be found in **Table 2** below.

Table 2. Summary of survey dates, times and weather conditions in 2020.

Survey site	Dates surveyed	Surveyor name	Survey times	Weather conditions
Stinchcombe Hill, Dursley	29/05/2020	Liam Olds	09:40 to 13:05	Dry, clear and sunny; air temperature of 17°C to 22°C; 9 miles per hour (MPH) easterly wind.
	02/06/2020	Julian and Emma Bendle	14:00 to 16:30	Dry; air temperature of 23°C to 24°C; 4 MPH wind.
	15/06/2020	Julian and Emma Bendle	13:50 to 15:40	Dry, sunny intervals; air temperature of 21°C; 6 MPH south-westerly wind.
Breakheart Hill, Dursley	29/05/2020	Liam Olds	13:50 to 17:17	Dry, clear and sunny; air temperature of 23°C to 24°C; 9 MPH easterly wind.
	01/06/2020	Julian and Emma Bendle	13:45 to 16:00	Dry, sunny intervals; air temperature of 23°C; 8 MPH north-easterly wind.
	14/06/2020	Chris Wiltshire	Not recorded	Dry, sunny intervals; air temperature of 22°C; 6 MPH south to south-easterly wind.
Rodborough Common, Stroud	30/05/2020	Liam Olds	12:30 to 17:10	Dry, clear and sunny; air temperature of 21°C to 25°C; 8-10 MPH easterly wind.
	15/06/2020	Jennifer Gilbert and Josh Baum	14:30 to 16:45	Dry, sunny intervals; air temperature of 22°C to 23°C; 6 MPH south-westerly wind.
	24/06/2020	Julian Bendle	12:15 to 13:30 & 13:55 to 15:40	Dry, clear and sunny; air temperature of 27°C to 29°C.
	24/06/2020	Jo Hackman	13:15 to 15:15	Dry, clear and sunny; air temperature of 28°C to 30°C; 8 MPH westerly wind.
	25/06/2020	Julian Bendle	10:10 to 12:50 & 13:30 to 15:30	Dry, clear and sunny; air temperature of 25°C to 29°C; 8MPH south-easterly wind.
	25/06/2020	Liam Olds	10:30 to 16:30	Dry, clear and sunny; air temperature of 27°C to 30°C; 8-10 MPH south-easterly wind.

3 RESULTS

All three of the sites surveyed in the Cotswolds AONB in 2020 were found to support Rock-rose pot beetle. While its presence at Breakheart Hill and Stinchcombe Hill was unsurprising, given that adult beetles were encountered at both of these sites in 2019 (Olds, 2020), its re-discovery at Rodborough Common is particularly noteworthy since it was presumed extinct from this site, having not been recorded since 1985 (Piper, 2002). Given that no known populations of Rock-rose pot beetle exist within the vicinity of Rodborough Common, it is presumed that it has existed (perhaps in limited numbers) undetected throughout this period. There is the possibility, however, that it has repopulated Rodborough Common from an adjacent site that we are currently unaware of. Targeted surveys of suitable habitat within the vicinity of Rodborough Common would be a worthwhile exercise in attempting to locate additional populations.

A total of 92 Rock-rose pot beetle adult sightings were made across the three sites surveyed in 2020 (**Appendix 2**). This included 69 sightings at Breakheart Hill, 14 sightings at Rodborough Common, and 9 sightings at Stinchcombe Hill. As individual beetles were not captured and retained when encountered, the occasional double-counting of individuals may have occurred. As such, 92 sightings do not directly reflect 92 individual Rock-rose pot beetles. Such double-counting is presumed to have been minimal, however, given the survey methodology (during which the surveyor rarely visited the same location more than once during any given survey) and the tendency of Rock-rose pot beetles to exhibit thanatosis when disturbed, reducing their chances of being re-encountered. Just 2 of the 92 Rock-rose pot beetle sightings were casual observations, with the majority of sightings occurring during the 12 targeted surveys.

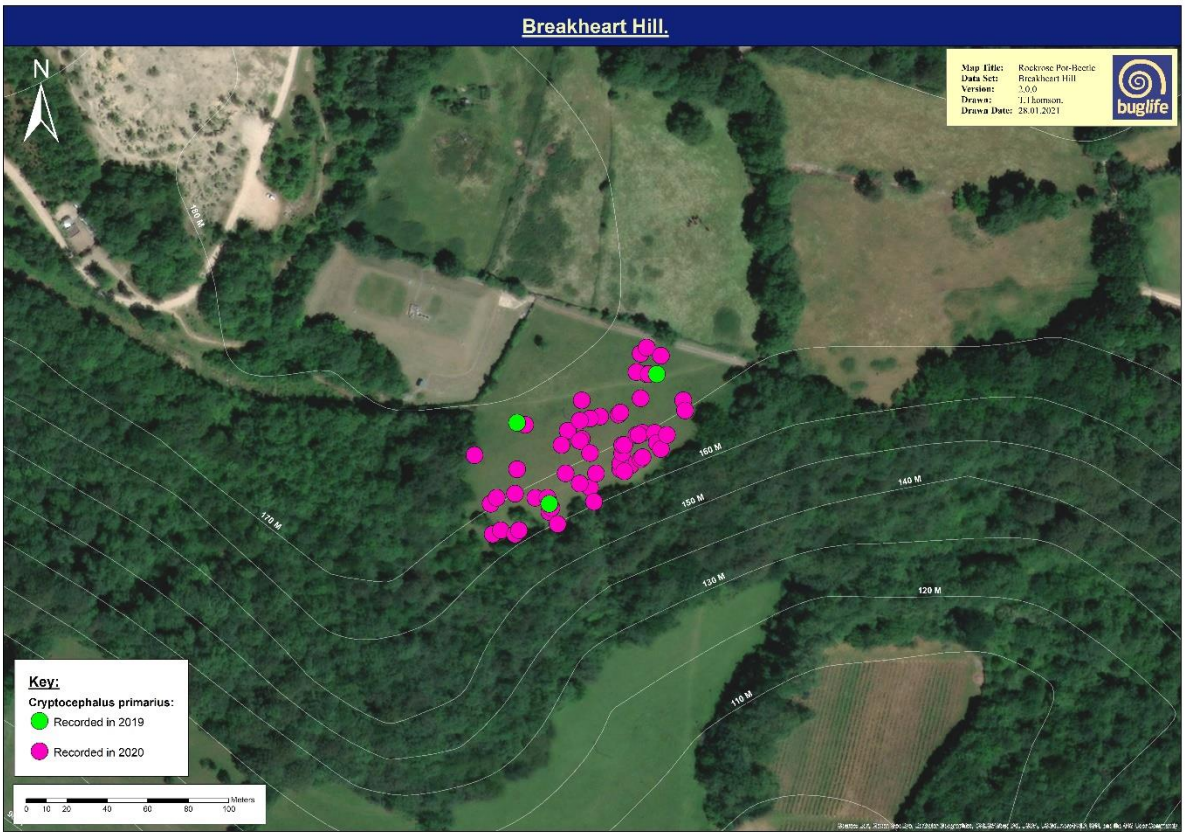
Rock-rose pot beetle adults were encountered throughout the entirety of the survey period, with the first individual encountered on 29th May 2020 at Breakheart Hill and the final individual on 25th June 2020 at Rodborough Common. One further Rock-rose pot beetle individual was encountered prior to the targeted surveys commencing in 2020; this individual was encountered by the landowner of Breakheart Hill during a casual visit on 25th May 2020.

Eighty-five of the 92 Rock-rose pot beetle sightings in 2020 occurred between the times of 13:33 and 16:59, adding further weight to the belief that Rock-rose pot beetles are most active during the warmest part of the day. Given that all 4 Rock-rose pot beetle sightings in 2019 also occurred in the afternoon between the times of 13:21 and 14:42 (Olds, 2020), it appears that Rock-rose pot beetle is best found on warm days between the approximate times of 13:30 and 17:00. As such, it is recommended that future surveys for Rock-rose pot beetle in the Cotswolds AONB (and elsewhere) target suitable habitats during periods of warm weather and between these times where possible. Two Rock-rose pot beetle sightings in 2020 did occur, however, outside of this time period with one individual at Rodborough Common encountered at 10:35 and another at Breakheart Hill encountered approximately 17:45. It is worth noting, however, that the air temperature was already 27°C when the individual at Rodborough Common was encountered at 10:35. These encounters suggest that visits to suitable sites in favourable weather conditions can occasionally prove fruitful earlier or later in the day. Based on the most current available evidence, however, searches for Rock-rose pot beetle are most successful between the times of 13:30 and 17:00.

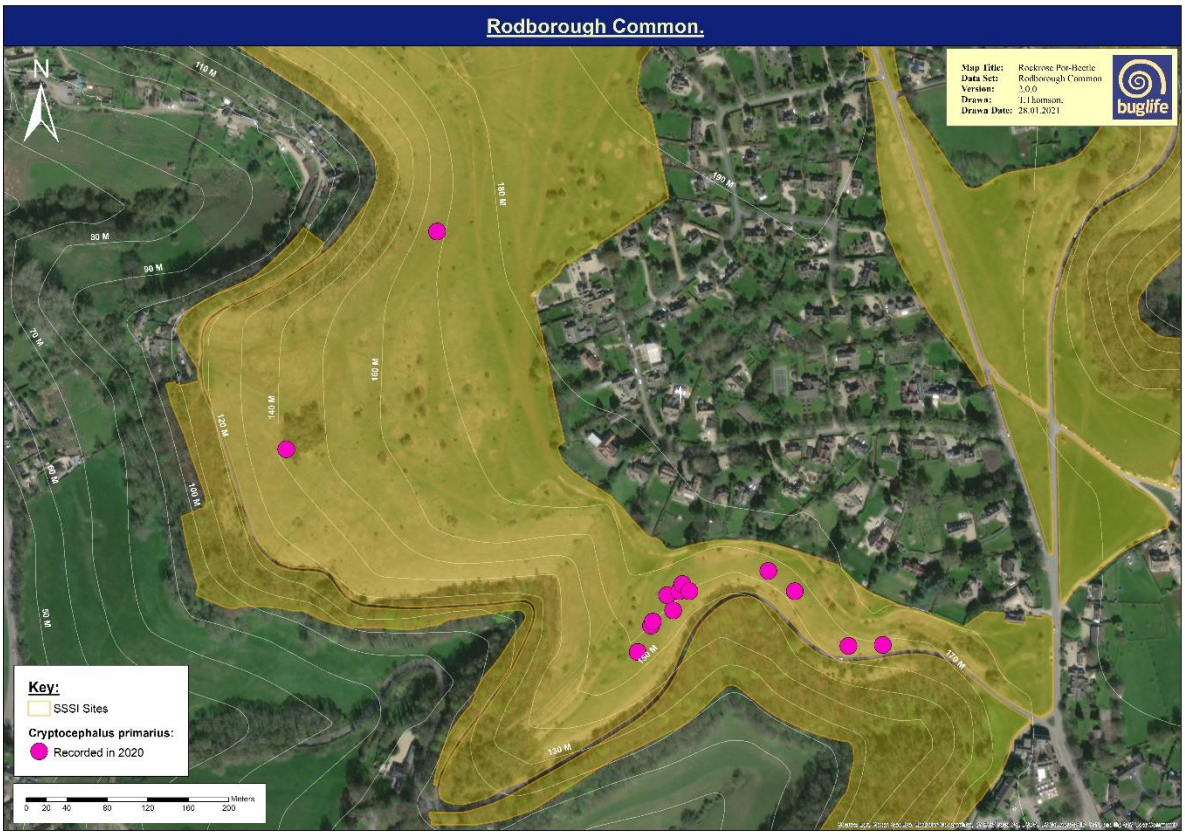
At all three sites surveyed, Rock-rose pot beetle adults were predominately encountered on sheltered, south facing slopes of short-sward calcareous grassland supporting Common rock-rose (**Map 1 to 3**); this is in common with other field observations of the beetle in Britain (Piper, 2002). On several occasions, however, Rock-rose pot beetle adults could not be found during visits to these sites, despite extensive searching of seemingly suitable habitat during favourable weather conditions. It appears that Rock-rose pot beetle is very localised on some sites, especially at Rodborough Common where surveys were unsuccessful in detecting individuals across much of the site. This emphasises the need of repeat visits in many instances to detect the presence of this easily overlooked species.

All adult sightings in 2020 occurred on warm days with an air temperature between 21°C and 30°C, seemingly adding further weight to the theory that this particular species requires elevated temperatures exceeding approximately 22°C to become active. Likewise, all sightings in 2019 occurred on warm days with an air temperature between 21°C and 23°C (Olds, 2019). Selecting warm, sunny days with an air temperature at 21°C or above appears to be the best conditions for encountering Rock-rose pot beetle in the Cotswolds AONB. It is unclear as to how wind speed and wind direction influence the efficacy of locating Rock-rose pot beetle adults, however adults were encountered on days where the wind speeds reached 10 MPH (though no surveys were undertaken on days where the winds speed exceeded this). As such, air temperature is deemed most important when determining the best survey conditions for Rock-rose pot beetle.

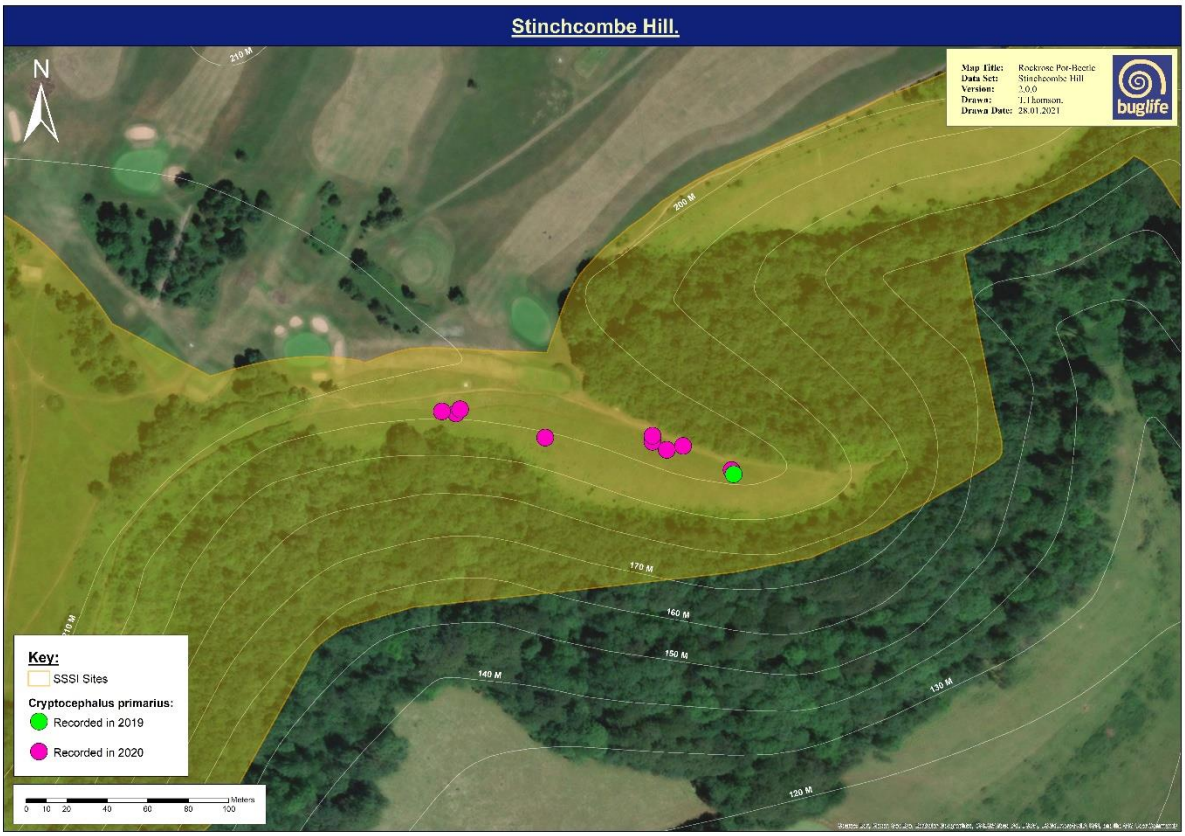
Map 1. Rock-rose pot beetle sightings at Breakheart Hill in 2019 and 2020.



Map 2. Rock-rose pot beetle sightings at Rodborough Common in 2020.



Map 3. Rock-rose pot beetle sightings at Stinchcombe Hill in 2019 and 2020.



Though Rock-rose pot beetle can evidently be encountered in Britain as early as 11th May (Wiltshire and Owen, 2004) and as late as 16th July (Olds, 2020), the results presented in this report support the comment made by Wiltshire and Owen (2004) that the peak emerge of Rock-rose pot beetle in Britain is between the 29th May and 5th June, since 77 of the 92 Rock-rose pot beetle sightings in 2020 (~84%) occurred during this period. It is recommended, therefore, that future surveys for Rock-rose pot beetle include at least one survey during this period (or as close to these dates as possible). Though the period of peak emergence in Britain is likely to be between 29th May and 5th June, there is clear evidence that survey effort beyond this period (until mid-July) is still worthwhile (Olds, 2020), as are surveys in early to mid-May.

4 DISCUSSION

Despite their distinctive colour pattern and body shape, Rock-rose pot beetles are difficult to survey for on the basis of their small size, tendency to display thanatosis when threatened, activity during the warmest parts of the day when surveyors may not be active, and their tendency to be found on steep slopes that can prove difficult surveying terrain. To maximise the chances of detecting Rock-rose pot beetles, it is recommended that future surveys:

- Target sheltered, south facing slopes of short-sward calcareous grassland supporting Common rock-rose;
- Occur between mid-May and mid-July, with at least one survey occurring during the period of peak emergence in Britain (29th May and 5th June) or as close to this as possible;
- Occur on warm days with an air temperature of 21°C or above; and
- Are conducted between the approximate times of 13:30 and 17:00.

Given that available records suggest that perhaps fewer than 50 Rock-rose pot beetle individuals having ever been captured in Britain (Piper, 2002), the sighting of 92 beetles in the Cotswolds AONB in 2020 is significant. It seems reasonable to suggest that the Cotswolds AONB is once again considered a national stronghold for Rock-rose pot beetle, as it has been historically. The 69 sightings at Breakheart Hill is also significant, far exceeding the number of sightings at Rodborough Common, Stinchcombe Hill and (to our knowledge), any other known site for this species in Britain. It seems reasonable to suggest, therefore, that Breakheart Hill is considered among (if not, the) most important British site for Rock-rose pot beetle. The future conservation and management of this site is therefore deemed to be of upmost importance.

Due to the paucity of records and lack of basic biological information on this species, formulating recommendations for habitat management is difficult (Piper, 2002). Field observations have, however, linked it to relatively short sward calcareous grassland (mostly of chalk origin) with an abundance of Common rock-rose on sheltered, south facing slopes. The maintenance of open conditions with an abundance of Common rock-rose is therefore considered important. This is likely best achieved through rotational livestock grazing, using sheep or cattle, though care needs to be taken with stocking densities to avoid overgrazing. Aim to graze for some or all of the period between late autumn and spring. This will remove old growth, leaving an open short sward. Consider removing livestock for the summer months, thus ensuring plants and the ground remain undisturbed during the main growing season.

Cutting will be required should grazing be unfeasible. Leave some areas uncut each year, cutting on a rotation every several years. Cutting should be done as late in the summer as possible, allowing plants to set seed and invertebrates to complete their reproductive cycles. It is important to remove cuttings to prevent the accumulation of nutrients in the soil, which is detrimental to many plant species.

Scrub encroachment is a natural consequence of insufficient, inappropriate or an absence of grazing management and is a major threat to Rock-rose pot beetle populations. Scrub management interventions should be implemented to arrest further scrub encroachment where it is deemed to be of threat. This is best achieved before dense thickets are formed. Scrub should be removed sensitively, with an aim to achieve a balance between open sunny areas and scrub.

Scrub is typically controlled by scrub cutting and selective treatment with herbicides, or stump grinding and removal. This should be undertaken during the winter when scrub is not actively growing and to ensure disturbance to wildlife is kept to a minimum. Grazing can be used following cutting of scrub, where possible, to browse and prevent regrowth.

Further surveys and monitoring of Rock-rose pot beetle is recommended at Breakheart Hill, Rodborough Common and Stinchcombe Hill over the coming years to improve our understanding of the ecology of the Rock-rose pot beetle and to help define habitat management recommendations. These surveys will also help to gauge the population size and which locations the beetle is using at these sites, therefore, helping to define its conservation status at these individual sites. Additional surveys are also recommended at other locations in the Cotswolds AONB supporting suitable habitat in the continued hope of finding additional populations. Though surveys failed to find Rock-rose pot beetle at Breakheart Quarry in 2019, this site would make a good candidate for future surveys given its situation between two known sites for Rock-rose pot beetle (Breakheart Hill and Stincombe Hill). Any sites supporting suitable habitat within the vicinity of Rodborough Common would also be worthwhile surveying, as would surveys of suitable habitat elsewhere in the Cotswolds AONB.

5 ACKNOWLEDGMENTS

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APPENDIX 1. Site photographs.

Figure 1 – View looking east across a steep, south-facing slope of calcareous grassland at Stinchcombe Hill that formed the focal area for surveys at this site in 2020 (NGR ST739981). Image © Liam Olds.

Figure 2 – View looking north-east across short-sward, calcareous grassland on a south-easterly slope at Breakheart Hill (NGR ST757965). Due to its small size, the entire site was surveyed in 2020. Image © Liam Olds.

Figure 3 – View looking north across an area of steep, largely west-facing slope of calcareous grassland at Rodborough Common (NGR SO847032). It was on this slope that one Rock-rose pot beetle individual was encountered in 2020. Image © Liam Olds.

Figure 4 – View looking north-east across a short-sward, largely south to south-east facing slope of calcareous grassland at Rodborough Common (NGR SO849027). It was in this area that most Rock-rose pot beetles were encountered at Rodborough Common in 2020. Image © Liam Olds.

APPENDIX 2. Rock-rose pot beetle records from surveys in the Cotswolds AONB in 2019 and 2020.

Location	Grid Reference	Date	Recorder (s)	Abundance	Comments
Stinchcombe Hill	ST7405698171	01/06/2019	Liam Olds	1	Adult climbing grass stem.
Breakheart Hill	ST7571796568	16/07/2019	Liam Olds	1	Adult flushed from vegetation. Seen at 14:42.
Breakheart Hill	ST7573396528	16/07/2019	Liam Olds	1	Seen climbing grass stem amongst Common Rock-rose just below the footpath. Seen at 13:48.
Breakheart Hill	ST7578696592	16/07/2019	Liam Olds	1	On Common Rock-rose. Seen at 13:21.
Breakheart Hill	ST7570596513	25/05/2020	Private landowner	1	
Breakheart Hill	ST7570496528	29/05/2020	Liam Olds	2	Two adults on grass stems.
Breakheart Hill	ST7570996515	29/05/2020	Liam Olds	1	Adult seen climbing vegetation immediately below footpath.
Breakheart Hill	ST7571796545	29/05/2020	Liam Olds	1	Adult landed on ground.
Breakheart Hill	ST7572696531	29/05/2020	Liam Olds	1	Adult below path on grass stem attempting to fly.
Breakheart Hill	ST7573296531	29/05/2020	Liam Olds	1	Adult landed on grass stem and captured.
Breakheart Hill	ST7573396524	29/05/2020	Liam Olds	2	Two adults on grass stem.
Breakheart Hill	ST7573496526	29/05/2020	Liam Olds	1	Adult attempting to fly.
Breakheart Hill	ST7573796518	29/05/2020	Liam Olds	1	Adult on grass stem.

Location	Grid Reference	Date	Recorder (s)	Abundance	Comments
Breakheart Hill	ST7574196543	29/05/2020	Liam Olds	1	Adult on *Sanguisorba minor* flowerhead.
Breakheart Hill	ST7574996560	29/05/2020	Liam Olds	2	Two adults on grass stems.
Breakheart Hill	ST7575396536	29/05/2020	Liam Olds	3	Three adults in this area.
Breakheart Hill	ST7575596529	29/05/2020	Liam Olds	3	Mating pair on vegetation. Another also seen in same area.
Breakheart Hill	ST7575896571	29/05/2020	Liam Olds	1	Adult on plant stem attempting to fly.
Breakheart Hill	ST7576796572	29/05/2020	Liam Olds	1	Adult captured in flight.
Breakheart Hill	ST7576896545	29/05/2020	Liam Olds	1	Adult climbing grass stem amongst bare earth.
Breakheart Hill	ST7577396547	29/05/2020	Liam Olds	1	Adult amongst clump of grass and Horseshoe Vetch beside animal track.
Breakheart Hill	ST7577896550	29/05/2020	Liam Olds	2	Two adults on grass stems above 30cm apart. Male and female started mating when placed in the same sample pot.
Breakheart Hill	ST7577996563	29/05/2020	Liam Olds	1	Adult landed on grass stem and captured.
Breakheart Hill	ST7578196592	29/05/2020	Liam Olds	1	Adult on grass stem.
Rodborough Common	SO8461302956	29/05/2020	Helen Taylor & Alasdair Hills	1	First sighting at Rodborough Common since 1985.

Location	Grid Reference	Date	Recorder (s)	Abundance	Comments
Rodborough Common	SO8476203171	30/05/2020	Liam Olds	1	Adult amongst flowering Common Rock-rose.
Rodborough Common	SO8496002756	30/05/2020	Liam Olds	1	Adult climbing grass stem.
Rodborough Common	SO8497302782	30/05/2020	Liam Olds	1	Adult perched on grass stem.
Rodborough Common	SO8498902812	30/05/2020	Liam Olds	1	Adult perched on grass stem.
Rodborough Common	SO8500102816	30/05/2020	Liam Olds	1	Adult landed on ground.
Rodborough Common	SO8500402823	30/05/2020	Liam Olds	1	Adult landed on ground.
Rodborough Common	SO8508902836	30/05/2020	Liam Olds	1	Adult took off and landed in same area.
Breakheart Hill	ST7569696552	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7570796531	01/06/2020	Julian Bendle, Emma Bendle	2	
Breakheart Hill	ST7571696513	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7571696533	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7571896515	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7572196567	01/06/2020	Julian Bendle, Emma Bendle	2	Mating
Breakheart Hill	ST7574296564	01/06/2020	Julian Bendle, Emma Bendle	1	

Location	Grid Reference	Date	Recorder (s)	Abundance	Comments
Breakheart Hill	ST7574896538	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7574896559	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7574996579	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7575396553	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7575396570	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7575696543	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7576896548	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7576896573	01/06/2020	Julian Bendle, Emma Bendle	2	Mating
Breakheart Hill	ST7576996553	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7576996557	01/06/2020	Julian Bendle, Emma Bendle	2	
Breakheart Hill	ST7577096544	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7577096557	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7577696562	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7577696593	01/06/2020	Julian Bendle, Emma Bendle	1	

Location	Grid Reference	Date	Recorder (s)	Abundance	Comments
Breakheart Hill	ST7577796562	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7577896580	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7577896602	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7577996551	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7578196605	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7578296592	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7578596563	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7578696558	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7578896555	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7578896601	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7579196562	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7579996579	01/06/2020	Julian Bendle, Emma Bendle	1	
Breakheart Hill	ST7580096574	01/06/2020	Julian Bendle, Emma Bendle	2	Mating
Stinchcombe Hill	ST7403198185	02/06/2020	Julian Bendle, Emma Bendle	1	Area where contractors cut and removed grass + scrub, winter 2019/20

Location	Grid Reference	Date	Recorder (s)	Abundance	Comments
Stinchcombe Hill	ST7405598173	02/06/2020	Julian Bendle, Emma Bendle	1	Area where contractors cut and removed grass + scrub, winter 2019/20
Rodborough Common	SO8497502786	15/06/2020	Jen Gilbert; Josh Baum	1	
Rodborough Common	SO8499502797	15/06/2020	Jen Gilbert; Josh Baum	1	
Rodborough Common	SO8501102816	15/06/2020	Jen Gilbert; Josh Baum	1	
Stinchcombe Hill	ST7391998201	15/06/2020	Julian Bendle, Emma Bendle	1	Area where contractors cut and removed grass + scrub, winter 2019/20
Stinchcombe Hill	ST7392198203	15/06/2020	Julian Bendle, Emma Bendle	1	Area where contractors cut and removed grass + scrub, winter 2019/20
Stinchcombe Hill	ST7396398189	15/06/2020	Julian Bendle, Emma Bendle	1	Area where contractors cut and removed grass + scrub, winter 2019/20
Stinchcombe Hill	ST7401698187	15/06/2020	Julian Bendle, Emma Bendle	1	Area where contractors cut and removed grass + scrub, winter 2019/20
Stinchcombe Hill	ST7401698190	15/06/2020	Julian Bendle, Emma Bendle	1	Area where contractors cut and removed grass + scrub, winter 2019/20
Stinchcombe Hill	ST7402398183	15/06/2020	Julian Bendle, Emma Bendle	1	Area where contractors cut and removed grass + scrub, winter 2019/20
Stinchcombe Hill	ST7391298202	15/06/2020	Julian Bendle, Emma Bendle	1	Area where contractors cut and removed grass + scrub, winter 2019/20
Breakheart Hill	ST7573996557	24/06/2020	Chris Wiltshire	1	Active in warm sunshine c 17.45 hrs
Breakheart Hill	ST7574896569	24/06/2020	Chris Wiltshire	1	Active in warm sunshine c 17.45 hrs

Location	Grid Reference	Date	Recorder (s)	Abundance	Comments
Rodborough Common	SO8511502816	24/06/2020	Jo Hackman	1	One adult seen at 14:55hrs on *Brachypodium pinnatum* grass stem before flying off.
Rodborough Common	SO8516802762	25/06/2020	Liam Olds	1	Adult seen climbing grass stem at 14:30hrs.
Rodborough Common	SO8520202763	25/06/2020	Liam Olds	1	Adult seen flying and landing on vegetation at 10:35hrs.

Contact us: Buglife, The Lindens, 86 Lincoln Road,

Peterborough, PE1 2SN

www.buglife.org.uk

Tel: 01733 201210

Email: info@buglife.org.uk

@buzz_dont_tweet

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