DICRANOCEPHALUS AGILIS (SCOPOLI) (HEMIPTERA, HETEROPTERA) AT SLAPTON SANDS

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Dicranocephalus agilis is a monophagous insect, found on vegetated shingle and sand dunes, in association with sea spurge (*E. paralias*). It is distributed almost exclusively across coastal regions of South-west England and Wales (NBN Atlas 2017a), and was first recorded at Slapton Sands, in Devon, in August 2013. However, the storms of 2013-2014 caused severe damage to this coastline, with much of the vegetation, being scoured from the beach. This short article reports on a 5-year study of the known site of D. *agilis* at Slapton Sands.

INTRODUCTION

Monophagous insects with a strong host-plant relationship constitute a significant proportion of UK insect biodiversity, including many members of speciose families such as the Chrysomelidae (286 spp.), Curculionidae (493 spp.) and Miridae (237 spp.). A lesser-known family of monophagous insects is the Stenocephalidae, the spurge bugs, represented by only two species in the UK. One, *Dicranocephalus medius* (Scopoli), is found in association with wood spurge (*Euphorbia amygdaloides* L.) and leafy spurge (*E. esula* L.) in woodland clearings (British Bugs, 2017a). The other, *D. agilis* (Scopoli) (Figure 1), is found on vegetated shingle and sand dunes in association with sea spurge (*E. paralias*) (Figure 2) and Portland spurge (*E. portlandica* L.) (British Bugs, 2017b).

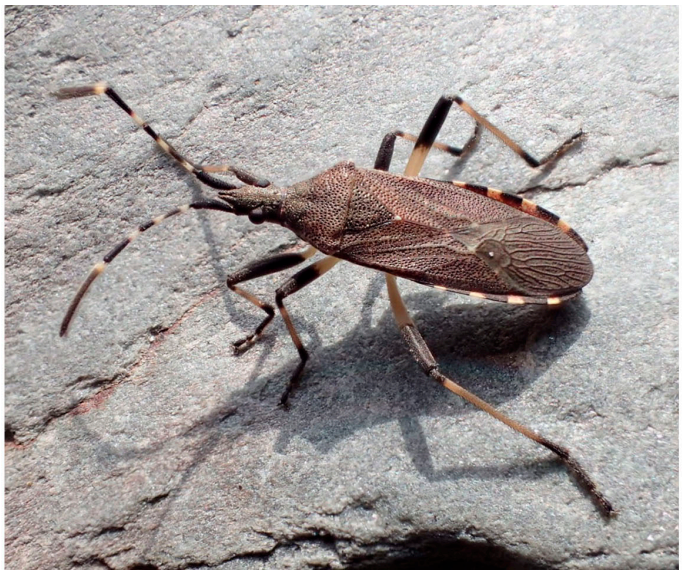

FIGURE 1. *Dicranocephalus agilis*, one of the three adults found on 24th August 2017 on shingle ridge, adjacent to sea spurge *(Euphorbia paralias)* plants on Slapton Sands.

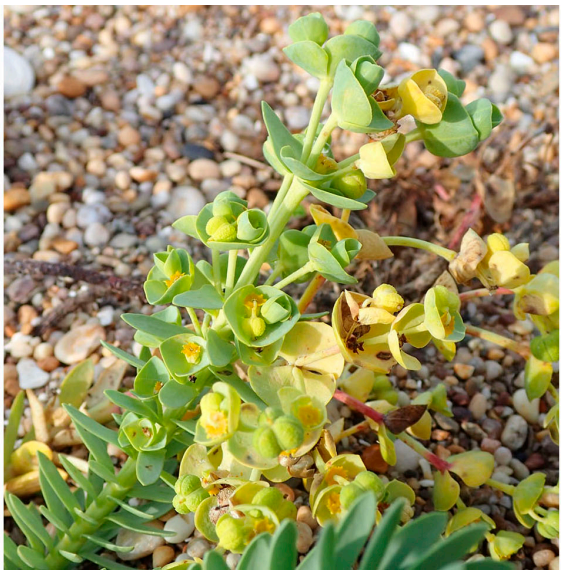

FIGURE 2. Sea spurge (*Euphorbia paralias*) on Slapton Sands, Devon.

The global range of *D. agilis* is large, covering most of the Western Palearctic (Global Biodiversity Information Facility, 2017). In regions with a similar climate to the UK, it is generally scarce and restricted in range; for example, it has not been recorded since 1955 in the Netherlands (Aukema, 2003) and past records are mostly from coastal provinces. In warmer climates, it occurs in a wider array of habitats and in association with more *Euphorbia* species than in the UK, occurring for example on Cypress spurge (*E. cyparissias* L.) at inland localities in Germany (Munch, 2012) and in Mediterranean oak-scrub habitats in Iberia (Boierio *et al.*, 2010; Gesse *et al.*, 2014).

Although from a conservation perspective *D. agilis* is classified as Least Concern in the UK (Bantock, 2016), examination of the NBN Atlas showed that it is scarce with just 29 records of the species in the UK, distributed almost exclusively across coastal regions of South-west England and Wales (NBN Atlas, 2017a). *Dicranocephalus agilis* was first recorded from Slapton Sands in August 2013 when several individuals were found on the vegetated area of the shingle ridge in associated with sea spurge. There were no previous records from this site (NBN Atlas, 2017b).

METHODS AND RESULTS

During the winter 2013-2014 the British coastline was battered by a series of unusually powerful storms (Masselink *et al.*, 2015, 2016). Much of the biodiversity that had colonised the shingle ridge on Slapton Sands successfully was lost as the sea scoured the beach, removing vegetation in places right back to the Dartmouth to Kingsbridge road (A379) (Scott *et al.*, 2016). In the three years after these storms (2014, 2015 and 2016) systematic hand searches for *D. agilis* were carried out over a three-day period each August along the shingle ridge and no individuals were found. This suggests that that *D. agilis* was extirpated from the site. However, during a comparable systematic search on the 24th August 2017 four *D. agilis* individuals (three adults and one nymph) were found (Figure 1). They were all found in the same vicinity just south of the monument car park at SX 828440 (Figure 3, Figure 4). All individuals were found clinging to the underside of flat stones immediately adjacent to sea spurge plants. This was the only place that *D. agilis* was found during the survey.

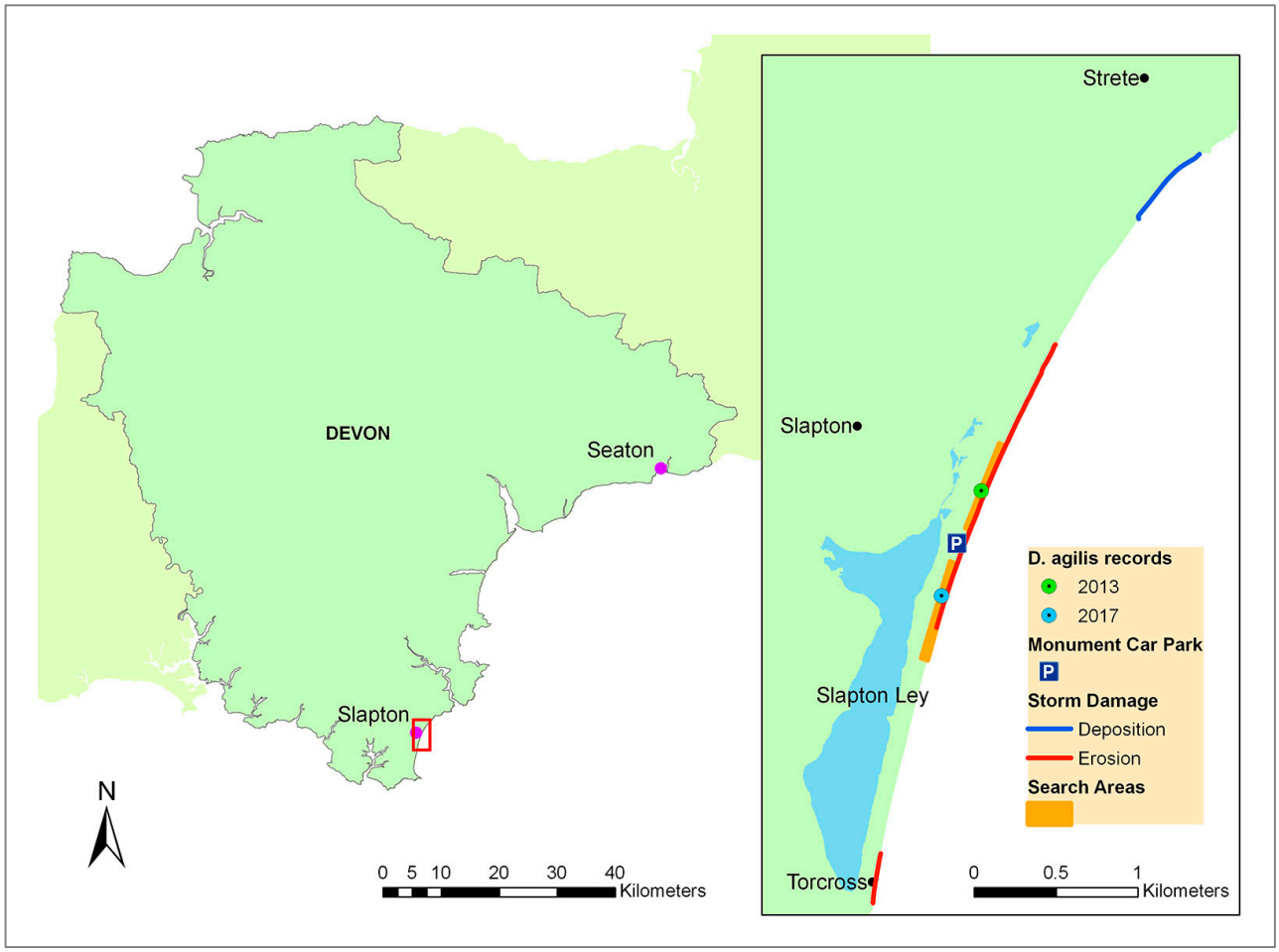

FIGURE 3. Map of the Slapton coastline showing the research area at Slapton Sands, sites where *Dicranocephalus agilis* was recorded and areas damaged by the 2013-2014 winter storms.

DISCUSSION

The results of this five-year study suggest that the *Dicranocephalus agilis* population in the central part of Slapton Beach may have been wiped out or reduced to very low levels by the storm events of 2013/14. Its rediscovery in 2017 suggests that the population may either have survived the storms persisting at very low levels, or was able to recolonise within a relatively short time period (around 3 years).

The first record from Slapton Sands in 2013 was only the third record from Devon and the second from South Devon, the other record being from Seaton. There is no doubt, therefore, that *D. agilis* is a scarce species in Devon. As with many insect species, it is likely to be under-recorded but if the mapped distribution is correct (NBN, 2017a) and it was extirpated from Slapton, the recolonization of *D. agilis* at this site could be in excess of 60 km which is the straight-line distance to the next-nearest record at Seaton (Figure 3). We know *D. agilis* can cross large expanses of water on

occasions as it has been recorded on the Azores in the Atlantic (Leston and Carthy, 1957). It is possible that *D. agilis* can persist wherever sea spurge is found, but sea spurge is also a scarce species in Devon (BSBI, 2017).

Monophagous species like *D. agilis* existing in fragile coastal habitats are very susceptible to climatic conditions. Storms such as those experienced in the winter of 2013/14 can completely destroy communities of plants and animals co-existing on shingle and sand. Inclement conditions could eliminate the insect populations directly or indirectly through the loss of their host plants. For the insect species the end result is the same: local extinction. At present, global climate change may be favouring *D. agilis* which appears to be undergoing range expansion northwards along the Welsh coast (Howe, 2007; NBN Atlas, 2017a). However, predictions are for stormy conditions to become more frequent as a result of climate change (Donat *et* al, 2011; Young *et al,* 2011). If this happens, the persistence of *D. agilis* at Slapton Sands is uncertain.

FIGURE 4. Slapton Sands, the beach just south of the monument car park where *Dicranocephalus agilis* was found in 2017.

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REFERENCES

Aukema, B. (2003). Recent changes in the Dutch Heteroptera fauna (Insecta: Hemiptera). Proc. 13th Int. Coll. EIS, Leiden, September 2001: pp. 39-52.

Bantock, T. (2016). A review of the Hemiptera of Great Britain: The shieldbugs and allied families Coreoidea, Pentatomoidea & Pyrrhocoroidea. Species Status No.26. Natural England Commissioned Report NECR190. Natural England, Peterborough.

Boierio, M., Rego, C. Serrano, A.R.M. & Espadaler, X. (2010). The impact of specialist and generalist pre-dispersal seed predators on the reproductive output of a common and a rare Euphorbia species. *Acta Oecologica* **36**, 227-233.

British Bugs (2017a). https://www.britishbugs.org.uk/heteroptera/Stenocephalidae/dicranocephalus_medius.html Accessed 5/11/2017.

British Bugs (2017b). https://www.britishbugs.org.uk/heteroptera/Stenocephalidae/dicranocephalus_agilis.html Accessed 5/11/2017.

BSBI (2017). http://bsbi.org/maps?taxonid=2cd4p9h.c0c Accessed 6/11/2017.

Donat, M.G., Renggli, D., Wild, S., Alexander, L.V., Leckebusch, G.C. & Ulbrich, U. (2011). Reanalysis suggests long-term upward trends in European storminess since 1871. *Geophys. Res. Lett.* **38**, 1-6.

Gesse, F., Monleon-Getino, T. & Goula, M. (2014). Biodiversity Analysis of True Bug Assemblages (Hemiptera, Heteroptera) in Four Habitats in the Garraf Natural Park (Barcelona, Spain).*J. Insect Sc.* **14**, 283.

Global Biodiversity Information facility (2017) https://www.gbif.org/species/119528618 Accessed 9/11/2017

Howe, M. (2007). The Heteroptera of Wales. *Het News* **9**, 4 – 7.

Leston, D. & Carthy, J.D. (1957). Aspects of the fauna and flora of the Azores. X. Hemiptera – Heteroptera. *Annals and Magazine of Natural History* **10**, 194-198**.**

Masselink, G., Scott, T., Poate, T., Russell, P., Davidson, M. & Conley, D. (2015). The extreme 2013/14 winter storms: hydrodynamic forcing and coastal response along the southwest coast of England. *Earth Surf. Process. Landf.* **41**, 378-391.

Masselink, G., Castelle, B., Scott, T., Dodet, G., Suanez, S., Jackson, F. & Floc'h (2016). Extreme wave activity during 2013/14 winter and morphological impacts along the Atlantic coast of Europe. *Geophys. Res. Lett.* **43**, 2135–2143.

Munch, M. (2012). https://www.insekten-sachsen.de/Pages/TaxonomyBrowser.aspx?id=453621 Accessed 9/11/2017.

NBN Atlas (2017a). https://species.nbnatlas.org/species/NHMSYS0020309155 Accessed 3/11/2017.

NBN Atlas (2017b). https://records.nbnatlas.org/occurrences/16061a9b-0c60-4051-a8f8-89c03ee6feb8 Accessed 3/11/2017.

Scott, T., Masselink, G., O'Hara, T., Saulter, A., Poate, T., Russell, P. & Davidson, M. (2016). The extreme 2013/2014 winter storms: Beach recovery along the southwest coast of England. *Marine Geology* **382**, 224-241.

Young, I.R., Zieger, S. & Babanin, A.V. (2011). Global trends in wind speed and wave height. *Science* **332**, 451-455.