

2023-07-19

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Tasker, SJL

<https://pearl.plymouth.ac.uk/handle/10026.1/21216>

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10.1080/01650424.2023.2233504

Aquatic Insects

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To cite this article: Samuel J. L. Tasker & David T. Bilton (2023): Field evidence of caddisfly larvae (Trichoptera: Limnephilidae, Leptoceridae) using alien *Crassula helmsii* (Kirk) Cockayne fragments (Saxifragales: Crassulaceae) in case construction, *Aquatic Insects*, DOI: 10.1080/01650424.2023.2233504

To link to this article: <https://doi.org/10.1080/01650424.2023.2233504>



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Published online: 19 Jul 2023.



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# Field evidence of caddisfly larvae (Trichoptera: Limnephilidae, Leptoceridae) using alien *Crassula helmsii* (Kirk) Cockayne fragments (Saxifragales: Crassulaceae) in case construction

Samuel J. L. Tasker<sup>a</sup>  and David T. Bilton<sup>a,b</sup> 

<sup>a</sup>School of Biological and Marine Sciences, Marine Biology and Ecology Research Centre, University of Plymouth, Plymouth, United Kingdom; <sup>b</sup>Department of Zoology, University of Johannesburg, Johannesburg, South Africa

## ABSTRACT

We present the first field observations of caddisfly (Trichoptera) larvae using an invasive alien aquatic plant, *Crassula helmsii* (Kirk) Cockayne, in case construction. In samples from invaded ponds across the UK and Belgium, we have recorded the presence of *C. helmsii* fragments in cases from *Limnephilus lunatus* Curtis, 1834, *Limnephilus marmoratus* Curtis, 1834, *Limnephilus flavicornis* (Fabricius, 1787) (Limnephilidae), *Triaenodes bicolor* (Curtis, 1834), and *Oecetis furva* (Rambur, 1842) (Leptoceridae). Fragmentation of *C. helmsii* in case creation and augmentation may produce vegetative propagules, thus facilitating further dispersal of this invasive macrophyte.

## ARTICLE HISTORY

Received 27 March 2023  
Revised 29 June 2023  
Accepted 29 June 2023



## KEYWORDS

New Zealand  
pygmyweed; invasive;  
aquatic macrophyte;  
propagules; dispersal

## Introduction

Invasive alien aquatic plants are proliferating globally, with far-reaching (and potentially detrimental) consequences for the structure and functioning of recipient ecosystems (Gallardo Clavero, Sánchez, and Vilà 2016; Lobato-de Magalhães et al. 2023; Strayer 2010; Tasker, Foggo, and Bilton 2022). The dispersal and establishment of alien macrophyte species is therefore of great interest to researchers and conservation practitioners. Propagule pressure, including from vegetative fragments, is considered a key factor in the spread of such plants (Lobato-de Magalhães et al. 2023; Louback-Franco, Dainez-Filho, Souza, and Thomaz 2020).

Caddisfly larvae (Trichoptera) are widespread and frequently abundant members of the benthic fauna of freshwaters worldwide (de Moor and Ivanov 2007). Many caddisfly species create protective cases from plant fragments, mollusc shells and/or mineral grains,

**CONTACT** Samuel J. L. Tasker  [samuel.tasker@students.plymouth.ac.uk](mailto:samuel.tasker@students.plymouth.ac.uk)  School of Biological and Marine Sciences, Marine Biology and Ecology Research Centre, University of Plymouth, Devon, Plymouth, PL3 4LL, United Kingdom  
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adhered using silk secreted from labial glands. These are made recurrently through each of the five larval instars (Hanna 2009). Crane et al. (2021) hypothesised that the creation and augmentation of caddis cases could facilitate the dispersal of vegetatively propagating alien macrophytes, and demonstrated this potential in the laboratory by assessing the fragmentation of *Elodea canadensis* Michx., *Elodea nuttallii* (Planch.) H. St. John, *Crassula helmsii* (Kirk, 1899) Cockayne and *Lagarosiphon major* (Ridl.) Moss during case-building by *Limnephilus lunatus* Curtis, 1834. Here, we present the first field observations of the invasive alien macrophyte New Zealand pygmyweed (*Crassula helmsii* – see Smith and Buckley 2020) used in case construction by caddisfly larvae.

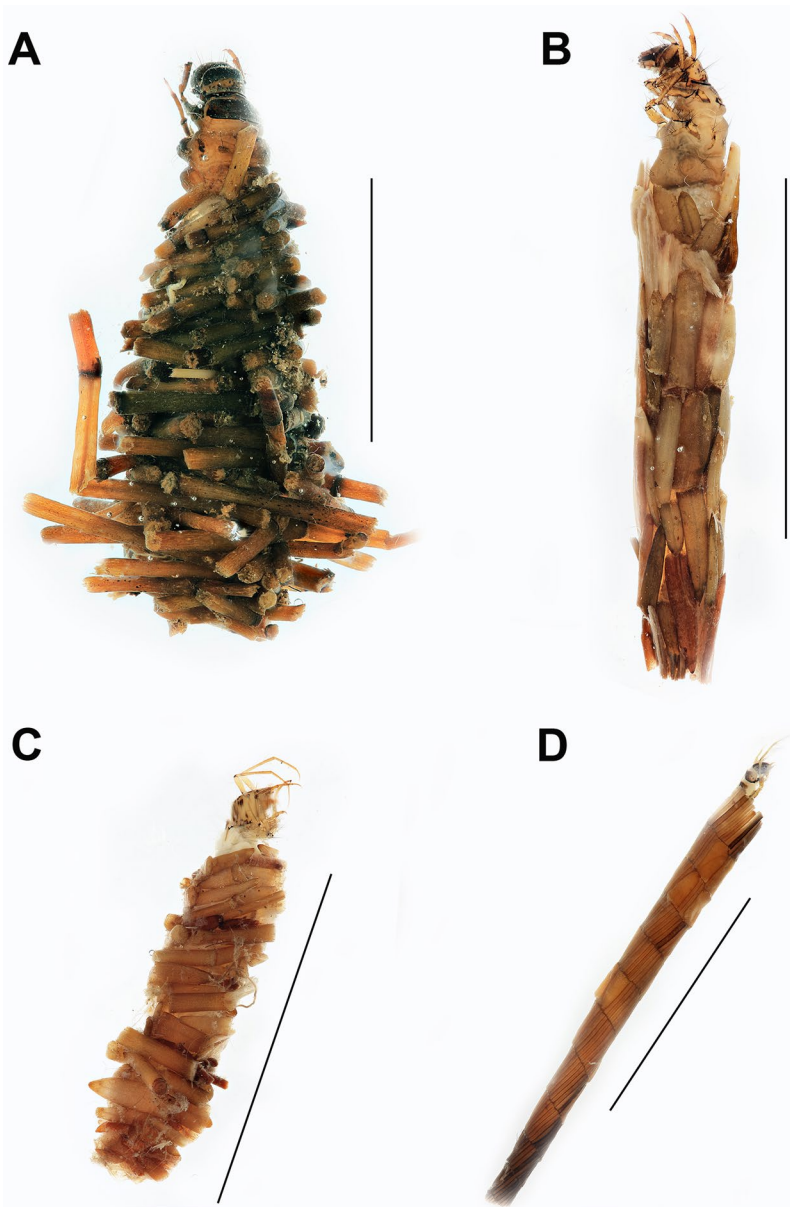
## Material and methods

As part of a field study assessing the impacts of *Crassula helmsii* on benthic macroinvertebrates (unpublished), we collected samples from waterbodies invaded by *C. helmsii* across NW Europe. Samples were taken from dense (>50% cover) *C. helmsii* stands using an FBA net (20×25 cm, 1 mm mesh). Samples were transferred to 11 pots and immediately fixed in either 70% industrial denatured alcohol or 70% propylene glycol.

## Observations

In samples from invaded ponds across the United Kingdom (UK) and Belgium, case-building caddisfly larvae frequently used fragments of *Crassula helmsii* for case-building. From invaded ponds in Cornwall, Norfolk and Sussex, UK, we have recorded the presence of *C. helmsii* fragments in cases from *Limnephilus lunatus*, *Limnephilus marmoratus* Curtis, 1834, *Limnephilus flavicornis* (Fabricius, 1787) (Limnephilidae) and *Triaenodes bicolor* (Curtis, 1834) (Leptoceridae). In Antwerp Province, Belgium, *C. helmsii* fragments were also observed in the case of *Oecetis furva* (Rambur, 1842) (Leptoceridae). *Crassula helmsii* material in the cases we examined varied according to caddisfly species. *Limnephilus marmoratus* and *L. flavicornis* cases consisted of stem fragments, whilst *L. lunatus* and *T. bicolor* tended to use leaves and *O. furva* was observed using a mixture of leaf and stem fragments (Figure 1).

*Crassula helmsii* has been demonstrated to readily reproduce from single-node stem fragments (Hussner 2009), so their production during case-building is likely to represent a source of viable propagules, as suggested by Crane et al.'s (2021) laboratory studies. Even in caddisfly species using leaves, which for *C. helmsii* are not viable propagules (Hussner 2009), case-building is likely to also generate 'waste' fragments which may themselves be viable. Material in cases tended to be green upon collection, suggesting that the caddisfly larvae had generated these fragments through shredding rather than utilising material already broken down by other processes. In sites where we observed the use of *C. helmsii* fragments in case-building, native aquatic macrophytes were often abundant, but caddisfly larvae did not appear to select these preferentially. Indeed, the recalcitrant (degradation-resistant) nature of *C. helmsii* detritus relative to many native macrophytes (Tasker, personal observations) may promote preferential use of *C. helmsii* fragments as a source of material for case-building.



**Figure 1.** Caddisfly larvae (Trichoptera) with cases containing *Crassula helmsii* (Kirk, 1899, Cockayne fragments): (a) *Limnephilus flavicornis* (Fabricius, 1787), with case composed of stem fragments; (b) *Limnephilus lunatus* Curtis, 1834, with case composed of leaves; (c) *Oecetis furva* (Rambur, 1842), with case comprising a mixture of leaves and stem fragments; (d) *Triaenodes bicolor* (Curtis, 1834), with case containing leaves. Scale bars = 2 cm.

## Conclusion

Our observations provide the first field evidence that the creation and augmentation of caddisfly cases may result in the fragmentation of the invasive alien macrophyte

*Crassula helmsii*, as demonstrated in the laboratory by Crane et al. (2021). Given the near-ubiquity of caddisflies in freshwater systems worldwide, this behaviour could significantly increase the production of *C. helmsii* propagules, and facilitate its further dispersal and establishment. The interactions between caddisfly larvae and *C. helmsii* reported here may also apply to other invasive alien aquatic plants.

## Acknowledgements

We thank Kevin Scheers for his assistance with sampling in Belgium.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

This work was supported by the University of Plymouth through a funded PhD studentship.

## ORCID

Samuel J. L. Tasker  <http://orcid.org/0000-0002-7880-1241>

David T. Bilton  <http://orcid.org/0000-0003-1136-0848>

## References

- Crane, K., Cuthbert, R. N., Ricciardi, A., Kregting, L., Coughlan, N. E., MacIsaac, H. J., Reid, N., and Dick, J. T. A. (2021), 'Gimme Shelter: Differential Utilisation and Propagule Creation of Invasive Macrophytes by Native Caddisfly Larvae', *Biological Invasions*, 23, 95–109.
- Curtis, J. (1834), 'Descriptions of Some Nondescript British Species of May-Flies of Anglers', *The London and Edinburgh Philosophical Magazine and Journal of Science*, 4, 120–125.
- de Moor, F.C., and Ivanov, V.D. (2007), 'Global Diversity of Caddisflies (Trichoptera: Insecta) in freshwater', in *Freshwater Animal Diversity Assessment*, eds. E. V. Balian, C. Lévêque, H. Segers and K. Martens, Dordrecht: Springer, pp. 393–407.
- Fabricius, J.C. (1787), *Mantissa insectorum sistens eorum species nuper detectas adiectis characteribus genericis, differentiis specificis, emendationibus, observationibus*, Copenhagen: Proft.
- Gallardo, B., Clavero, M., Sánchez, M. I., and Vilà, M. (2016), 'Global Ecological Impacts of Invasive Species in Aquatic Ecosystems', *Global Change Biology*, 22, 151–163.
- Hanna, H. M. (2009), 'The Growth of Larvae and Their Cases and the Life Cycles of Five Species of Caddis Flies (Trichoptera)', *Proceedings of the Royal Entomological Society of London. Series A, General Entomology, Ser A*, 34, 121–129.
- Hussner, A. (2009), 'Growth and Photosynthesis of Four Invasive Aquatic Plant Species in Europe', *Weed Research*, 49, 506–515.
- Kirk, T. (1899), *The Students' Flora of New Zealand and the Outlying Islands*, Wellington: John Mackay.
- Lobato-de Magalhães, T., Murphy, K., Efremov, A., Davidson, T. A., Molina-Navarro, E., Wood, K. A., Tapia-Grimaldo, J., Hofstra, D., Fu, H., and Ortegón-Aznar, I. (2023), 'How

- on Earth Did That Get There? Natural and Human Vectors of Aquatic Macrophyte Global Distribution', *Hydrobiologia*, 850, 1515–1542.
- Louback-Franco, N., Dainez-Filho, M. S., Souza, D. C., and Thomaz, S. M. (2020), 'A Native Species Does Not Prevent the Colonization Success of an Introduced Submerged Macrophyte, Even at Low Propagule Pressure', *Hydrobiologia*, 847, 1619–1629.
- Rambur, P. (1842), *Histoire naturelle des insectes: Neuroptera*, Paris: Librairie Encyclopédique de Roret.
- Smith, T., and Buckley, P. (2020), 'Biological Flora of the British Isles: *Crassula Helmsii*', *Journal of Ecology*, 108, 797–813.
- Strayer, D. L. (2010), 'Alien Species in Fresh Waters: Ecological Effects, Interactions with Other Stressors, and Prospects for the Future', *Freshwater Biology*, 55, 152–174.
- Tasker, S. J. L., Foggo, A., and Bilton, D. T. (2022), 'Quantifying the Ecological Impacts of Alien Aquatic Macrophytes: A Global Meta-Analysis of Effects on Fish, Macroinvertebrate and Macrophyte Assemblages', *Freshwater Biology*, 67, 1847–1860.