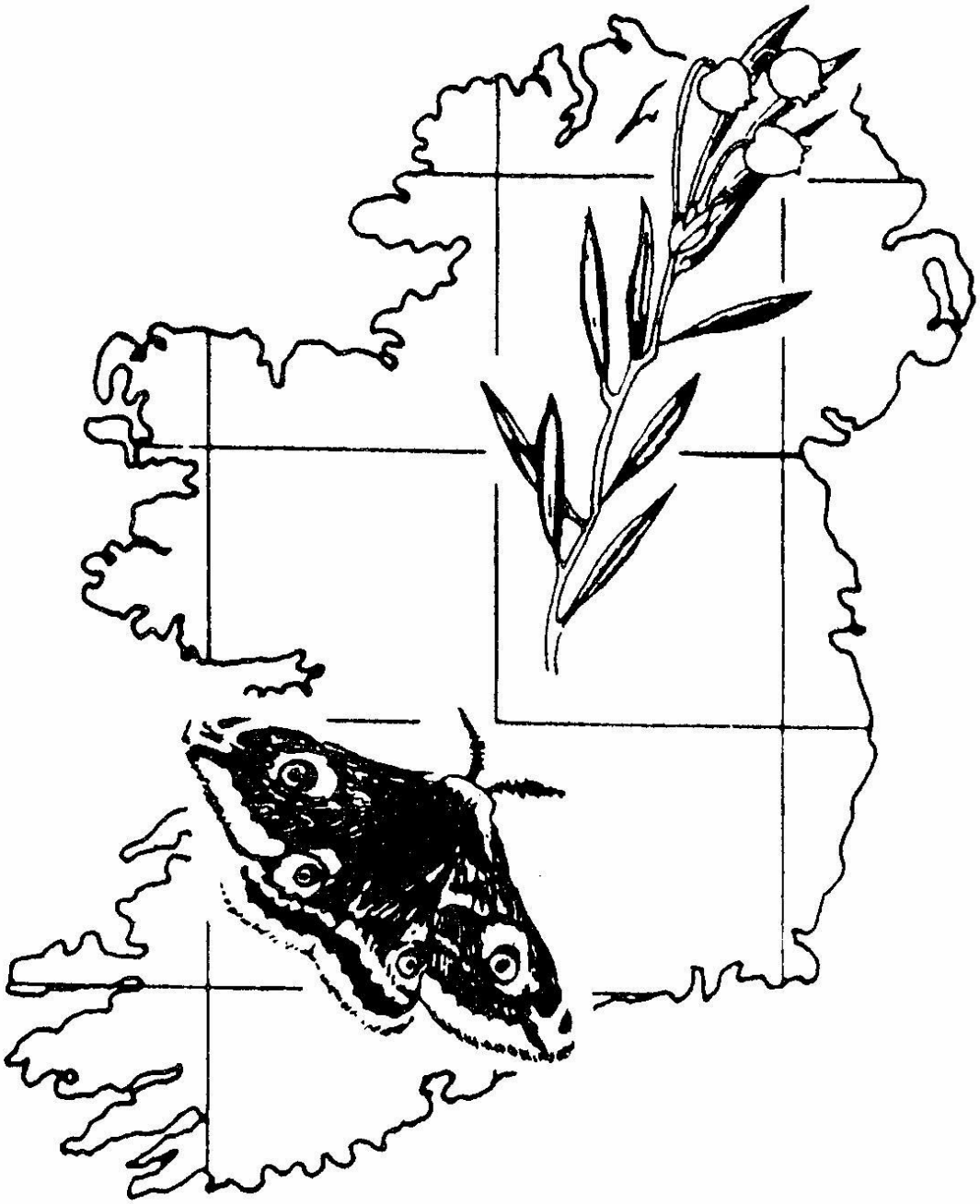
IRISH BIOGEOGRAPHICAL SOCIETY



Bulletin No. 34

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BULLETIN OF THE IRISH BIOGEOGRAPHICAL SOCIETY

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Bulletin of the Irish Biogeographical Society **No. 34** (2010)

EDITORIAL

As I am retiring from the National Museum of Ireland in December 2010, the Committee had considered completing the *Bulletin* series with this issue. However the Director of the Museum, Dr Pat Wallace, has encouraged me to continue on as Editor after retirement. He has very kindly offered the continued co-operation of the Museum with the Society and the future use of its facilities. Since the long association between the two bodies has been so productive for the study of Irish biogeography, I am delighted to accept Dr Wallace's kind offer and to continue on as Editor after this *Bulletin*. Therefore, submissions for *Bulletin* **No. 35** should be sent as usual to me c/o the National Museum of Ireland. The full instructions for authors are given on page 2 and the closing date for submissions is 15 October 2011.

Bulletin **No. 34** contains a wide range of exciting articles which include genera and species new to Ireland and we are very grateful to our contributors for their papers. On behalf of the Committee, I also wish to thank Dr Pat Wallace, Director of the National Museum of Ireland, Mr Raghnall Ó Floinn, Head of Collections and Mr Nigel Monaghan, Keeper of Natural History, for their great support of the work of the Society. We are indebted to our sponsors for their financial contributions and to our referees for the thoroughness of their reports.

J. P. O'Connor
Editor
21 October 2010

INSTRUCTIONS TO AUTHORS

1. Manuscripts should follow the format of articles in this *Bulletin*. The titles of journals should be given in full in the references.

2. Manuscripts may be sent as typed copy on A4 paper, using double-spacing and 2.5cm (one inch) margins with the text and any figures also on an accompanying compact disc to the Editor, Dr J. P. O'Connor, emeritus entomologist, National Museum of Ireland, Kildare Street, Dublin 2, Ireland or submitted electronically to <ampersandwalsh@gmail.com>.

3. Word is preferred and Times New Roman 13pt should be used.

4. Figures and tables should be submitted in a size suitable for reduction to A5 without loss of detail. It is important that the text should remain legible after reduction.

5. Records: please ensure that, when possible, the following information is incorporated in each record included in a manuscript:-
(a) latin name of organism.
(b) statement of reference work used as the source of nomenclature employed in the text. The describer's name should be also given when a zoological species is first mentioned in the text.
(c) locality details including at least a four figure Irish grid reference (e.g. N3946), county or vice-county and some ecological data about the collection site, plus date of capture.
(d) Collector's name and determiner's name (where different from collector's name), and
(e) altitude data should be included where relevant.

Bulletin of the Irish Biogeographical Society **No. 34** (2010)

DISTRIBUTIONAL RECORDS OF IRISH PLATYGASTRIDAE WITH CORRECTIONS AND ADDITIONS TO THE IRISH LIST

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The Irish platygastrids were reviewed by O'Connor *et al.* (2004). Since then further records were published by Buhl (2009a), Buhl and Notton (2009), Buhl and O'Connor (2008, 2009a, b, 2010) and O'Connor (2008). The Irish list was updated by O'Connor *et al*. (2009) but Buhl and Notton (2009) published a revised catalogue of the Platygastridae of the British Isles while the former was in press. Buhl (2009b) also made a relevant nomenclatural change. Recently Buhl and O'Connor (2010) added a further eleven species. As a result, some changes, corrections and additions are required for the Irish list and these are given below.

In addition, numerous new county records are presented here and these greatly expand the known distributions of many species. The Irish counties are shown (Fig. 1). The specimens were determined by P. N. Buhl and the material has been presented to the National Museum of Ireland. The following abbreviations are used: MAOC – M. A. O'Connor; MB – M. Boston and JPOC – J. P. O'Connor.

Corrections to the Irish list

The following changes in nomenclature are from Buhl and Notton (2009).

***Amblyaspis roboris* (Haliday in Walker, 1835)**

The authority is given as Haliday in O'Connor *et al*. (2009).

***Amblyaspis scelionoides* (Haliday in Walker, 1835)**

The authority is given as Haliday in O'Connor *et al*. (2009).

***Ceratacis cochleata* (Walker, 1835)**

Synonym *Platygaster filicornis* Walker, 1835.

Platygaster cochleata in O'Connor *et al*. (2009).

***Ceratacis laricis* (Haliday, 1835)**

Platygaster laricis in O'Connor *et al*. (2009).

***Leptacis laodice* (Walker, 1835)**

Synonym *Leptacis buchi* Buhl, 1997.

***Metaclisis areolatus* (Haliday in Walker, 1835)**

The authority is given as Haliday in O'Connor *et al*. (2009).

***Piestopleura catillus* (Walker, 1835)**

Piestopleura catilla in O'Connor *et al.* (2009)

***Platygaster intermediana* Buhl, 2009**

Synonym: *Platygaster intermedia* Buhl, 2006 preoccupied.

***Platygaster longestriolata* Thomson, 1859**

Platygaster longestriolatus in O'Connor *et al.* (2009).

***Platygaster malpighii* Kieffer, 1916**

Synonymy *Platygaster hanseni* Buhl, 2006. See Buhl (2009).

***Synopeas breve* Buhl, 1998**

Synopeas brevis in O'Connor *et al.* (2009).

***Synopeas ciliatum* Thomson, 1859**

Synopeas ciliatus in O'Connor *et al.* (2009).

***Synopeas gibberosum* Buhl, 1997**

Synopeas gibberosus in O'Connor *et al.* (2009).

***Synopeas lugubre* Thomson, 1859**

Synopeas lugubris in O'Connor *et al.* (2009).

***Synopeas opacum* Thomson, 1859**

Synopeas opacus in O'Connor *et al.* (2009).

***Synopeas sosis* (Walker, 1835)**

Synopeas muticus (Nees, 1834) misidentification in Buhl and O'Connor (2008). The determined taxon is actually the female of *S. sosis*. The real Nees species belongs to *Platygaster*.

Additions

The following species have been added by Buhl and Notton (2009) and by Buhl and O'Connor (2010).

***Amblyaspis prorsa* (Walker, 1835)**

Recorded from Stoneyford near Broadway, Co. Wexford (Buhl and O'Connor, 2010).

***Leptacis coryphe* Buhl, 1998**

Recorded from south of Donegal Town, Co. Donegal (Buhl and Notton, 2009).

***Leptacis halia* (Walker, 1835)**

Recorded from Woodstown, Co. Waterford (Buhl and O'Connor, 2010).

***Leptacis vlugi* Buhl, 1997**

Recorded from Stoneyford near Broadway and Craywell, New Ross, both Co. Wexford (Buhl and O'Connor, 2010).

***Metaclisis montagnei* Maneval, 1936**

Recorded from Bunduff, Co. Sligo (Buhl and Notton, 2009).

***Platygaster athamas* Walker, 1835**

Recorded from Craywell, New Ross, Co. Wexford (Buhl and O'Connor, 2010).

***Platygaster betularia* Kieffer, 1916**

Recorded from Lough Muckno Forest Park, Castleblayney, Co. Monaghan (Buhl and O'Connor, 2010).

***Platygaster demades* Walker, 1835**

Recorded from Lough Muckno Forest Park, Castleblayney, Co. Monaghan and Woodstown, Co. Waterford (Buhl and O'Connor, 2010).

***Platygaster floricola* Kieffer, 1916**

Recorded from Clondalkin, Co. Dublin (Buhl and Notton, 2009).

***Platygaster lineaticeps* Buhl, 1994**

Recorded from Co. Leitrim (no locality) and Trawalua, Co. Sligo (Buhl and Notton, 2009).

***Platygaster munita* Walker, 1835**

Recorded from Batterjohn Big, Co. Meath (Buhl and O'Connor, 2010).

***Platygaster philinna* Walker, 1835;**

Recorded from Clara, Co. Wicklow (Buhl and O'Connor, 2010).

***Platygaster quadriceps* Buhl, 2006**

Recorded from Castleknock, Co. Dublin (Buhl and O'Connor, 2010).

***Synopeas convexum* Thomson, 1859**

Recorded from Woodstown, Co. Waterford and Curracloe, Co. Wexford (Buhl and O'Connor, 2010).

***Synopeas inerme* Thomson, 1859**

Recorded from Ballyteige, Co. Wexford (Buhl and O'Connor, 2010).

***Trichacis didas* (Walker, 1835)**

Recorded from Castleknock, Co. Dublin (Buhl and O'Connor, 2010).

Distributional records

***Acerotella boter* (Walker, 1838)**

DOWN: Cultra J4180, ♀ 15 June 1983, MB.

The only other Irish record is also from Co. Down. The species was collected at Holywood by A. H. Haliday in the eighteen-thirties (O'Connor *et al*., 2004).

***Amblyaspis roboris* (Haliday in Walker, 1835)**

DUBLIN: Castleknock O0837, ♀ 26 April – 26 May 1985, Malaise trap in a suburban garden, JPOC; **KILKENNY**: Woodstock House, Inistioge S6336, ♂♂ 2 August 2008, swept from mixed woodland, JPOC; **TYRONE**: Moy H8356, ♀ 29 March 1983 and ♀ 14 May 1983, MB;

WATERFORD: Belle Lake S6605, ♀ 11 June 1991, swept from lake-side vegetation, JPOC; Woodstown S6904, ♂ 14 August 2009, swept from vegetation in a large marsh, JPOC; **WEXFORD**: Craywell, New Ross S7228, ♂ 5 August 2009, swept from an overgrown area in a small public park on a steep hill, JPOC; Ferrycarrig T0023, ♀ 30 March 1989, JPOC; J. F. Kennedy Park S7319, ♂♂ 14 July 1987, JPOC; Oaklands Wood S7125, ♂♂ 29 July 2008, swept in mixed woodland, JPOC; Stoneyford near Broadway T1009, ♂ 10 August 2009, swept from vegetation beside a stream, JPOC; **WICKLOW**: Glen of the Downs O2611, ♂♂ 27 August 1981 and ♂ 22 August 1988, swept from mixed woodland, JPOC.

Previously recorded from Cos Kildare, Tyrone and Westmeath (O'Connor *et al*., 2004).

***Amblyaspis scelionoides* (Haliday in Walker, 1835)**

KERRY: Killarney V9786, beside the Cloghereen stream, ♂ 10 September 1981, JPOC; **WEXFORD**: Craywell, New Ross S7228, ♂ 3 August 2008, swept from an overgrown area in a small public park on a steep hill, JPOC; Stoneyford near Broadway T1009, ♂♂♀♀ 12-21 August 1993, Malaise trap, ♂ 31 July 2008, swept from vegetation beside a stream, JPOC; **WICKLOW**: Coolattin Wood T0-6-, ♂ 14 September 1984, JPOC.

Previously recorded from Cos Carlow, Cavan, Cork and Kilkenny (O'Connor *et al*., 2004).

***Amblyaspis tritici* (Walker, 1835)**

WICKLOW: Coolattin Wood T0-6-, ♂♂ 14 September 1984, JPOC.

Previously recorded from Cos Cavan, Dublin and Waterford (O'Connor *et al*., 2004).

***Ceratacis cochleata* (Walker, 1835)**

WATERFORD: Ballin Lough S4403, ♀ 19 June 1991, swept from lake-side vegetation, JPOC.

Previously recorded as *Platygaster cochleata* from Cos Down, Kilkenny and Wexford (O'Connor *et al.*, 2004; Buhl and O'Connor, 2008).

***Euxestonotus error* (Fitch, 1861)**

CORK: Glengarriff V9157, ♀ 4 July 1985, swept in the oak *Quercus* woodland, JPOC and MAOC; **WEXFORD**: Oaklands Wood S7125, ♀ 30 July 2007, swept in mixed woodland, JPOC.

Previously recorded from Co. Kilkenny (Buhl and O'Connor, 2008).

***Euxestonotus hasselbachi* Buhl, 1995**

WICKLOW: Powerscourt O2012, ♀ 15 June 1988, swept from vegetation beside the waterfall, JPOC.

Previously recorded from Co. Cork (Buhl and O'Connor, 2008).

***Inostemma boscii* (Jurine, 1807)**

DUBLIN: Castleknock O0837, ♀♀ 8 August – 8 September 1984, Malaise trap in suburban garden, JPOC.

Previously recorded from Co. Clare (Buhl and O'Connor, 2009a).

***Inostemma walkeri* Kieffer, 1914**

WEXFORD: Oaklands Wood S7125, ♀29 July 2008, swept in mixed woodland, JPOC.

Previously only known from Ireland with no further distributional data (O'Connor *et al*., 2004).

***Iphitrachelus lar* Haliday, 1835**

WEXFORD: Oaklands Wood S7125, ♂ 29 July 2008, swept in mixed woodland, JPOC.

Previously only known from Co. Down (Buhl and Notton, 2009a).

***Leptacis laodice* (Walker, 1835)**

WEXFORD: Ferrycarrig T0023, ♀ 15 June 1991, JPOC; Killoughrim Forest S8941, ♀ 27 May 1987, swept in mixed woodland, JPOC; Oaklands Wood S7125, ♂♂ 31 July 2007, swept in mixed woodland, JPOC; Stoneyford near Broadway T1009, ♂ 12-21 August 1993, Malaise trap, JPOC.

Previously recorded from Cos Carlow, Cork, Waterford and Wicklow (O'Connor *et al*., 2004; Buhl and O'Connor, 2008).

***Leptacis ozines* (Walker, 1835)**

DUBLIN: Castleknock O0837, ♀♀ 16 June – 6 July 1996, Malaise trap in suburban garden, JPOC; **WEXFORD:** Stoneyford near Broadway T1009, ♀♀ 12-21 August 1993, Malaise trap, ♂ 10 August 2009, swept from vegetation beside a stream, JPOC.

The species was previously taken at Ferrycarrig, Co. Wexford, in 1986 (O'Connor *et al*., 2004).

***Leptacis tipulae* (Kirby, 1798)**

DUBLIN: Castleknock O0837, ♀ 8 August – 8 September 1984, Malaise trap in suburban garden, JPOC; **WATERFORD**: Ballin Lough S4403, ♀ 4 July 1989, swept from lake-side vegetation, JPOC and MAOC; Dunhill Castle S5000, ♀ 11 July 1989, JPOC and MAOC.

Previously recorded from Cos Down and Wexford (O'Connor *et al*., 2004).

***Platygaster aebeloeensis* Buhl, 2001**

WICKLOW: Russellstown Park N9610, ♀ 16 May 1992, swept from vegetation in a marshy area, JPOC and MAOC.

Previously recorded from Co. Waterford (Buhl and O'Connor, 2009a).

***Platygaster aegeus* Walker, 1835**

WEXFORD: Craywell New Ross S7228, ♀ 5 August 2009, swept from an overgrown area in a small public park on a steep hill, JPOC; Oaklands Wood S7125, ♀ 4 August 2008, swept in mixed woodland, JPOC; **WICKLOW**: Coolattin Wood T0-6-, ♀ 14 September 1984, JPOC.

Previously recorded from Co. Sligo (Buhl and O'Connor, 2009a).

***Platygaster chloropus* Thomson, 1859**

DUBLIN: Castleknock O0837, ♀ 26 April – 26 May 1985, Malaise trap in a suburban garden, JPOC.

Previously recorded from Cos Clare and Wexford (Buhl and O'Connor, 2009a).

***Platygaster cyrsilus* Walker, 1835**

CAVAN: Virginia Woods N5987, ♀ 15 May 1989, swept in mixed woodland, JPOC; **WICKLOW**: Glendalough T1195, ♀ 11 September 1990, JPOC.

Previously recorded from Co. Waterford by Buhl and O'Connor (2008).

***Platygaster danica* Buhl, 1999**

DUBLIN: Clondalkin O0631, ♀ 30 May - 6 June 1982, Malaise trap in a suburban garden, JPOC and MAOC.

Previously recorded from Co. Wicklow by Buhl and O'Connor (2008).

***Platygaster dryope* Walker, 1835**

WEXFORD: Slieve Coiltia S7221, ♀ 4 August 2009, swept from grass tussocks near the 270m

summit, JPOC.

Previously only known from Ireland with no further distributional data (O'Connor *et al*., 2004).

***Platygaster elongata* Haliday, 1833**

WICKLOW: Russellstown Park N9610, ♀ 16 May 1992, swept from vegetation in a marshy area, JPOC and MAOC.

Previously only known from Ireland with no further distributional data (O'Connor *et al*., 2004).

***Platygaster eriphyle* Walker, 1835**

CARLOW: Saint Mullins S7238, ♀ 24 April 1992, swept from vegetation on the banks of the River Barrow, JPOC; **WATERFORD**: Ballin Lough S4403, ♀ 19 June 1991, swept from lake-side vegetation, JPOC.

Previously recorded from Co. Wexford (Buhl and O'Connor, 2008).

***Platygaster gracilipes* Huggert, 1975**

DOWN: Cultra J4180, ♀ 15 June 1983, MB; **TYRONE**: Moy H8356, ♀♀ 19 June 1983, MB.

Previously recorded from Cos Dublin, Sligo and Wexford (Buhl and O'Connor 2008; Buhl and Notton, 2009).

***Platygaster inermis* Walker, 1835**

WICKLOW: Russellstown Park N9610, ♀ 16 May 1992, swept from vegetation in a marshy area, JPOC and MAOC.

Previously recorded from Co. Clare (Buhl and O'Connor, 2008).

***Platygaster longestriolata* Thomson, 1859**

WICKLOW: Avondale T1985, ♀ 27 May 1988, JPOC.

Previously recorded from Co. Wexford (Buhl and O'Connor, 2008).

***Platygaster lysicles* Walker, 1835**

CORK: Sheep's Head V7334, ♀ 3 July 1985, swept from sea-shore vegetation, JPOC; **DUBLIN**: Slade of Saggart O0324, ♀ 18 July 1982, swept from vegetation on the river bank, JPOC and MAOC; **WATERFORD**: Mahon Falls S3009, ♀ 3 July 1989, swept on mountain

moorland, JPOC and MAOC.

Previously recorded from Cos Down, Tipperary and Wicklow (O'Connor *et al*., 2004; Buhl and Notton, 2009)

***Platygaster marginata* Thomson, 1859**

WESTMEATH: Ballynafid Lough N4060, ♀ 5 May 1987, swept from lake-side vegetation, JPOC.

Previously recorded from Co. Wexford (Buhl and O'Connor, 2008).

***Platygaster malpighii* Kieffer, 1916**

CLARE: Kilshanny R1292, ♀ 31 June 1992, swept from hedgerows, JPOC.

Previously recorded from Cos Dublin and Wexford as *Platygaster hanseni* Buhl, 2006 (Buhl and O'Connor, 2008; Buhl and Notton, 2009).

***Platygaster nisus* Walker, 1835**

DUBLIN: Castleknock O0837, ♂♂ 16 June – 6 July 1996, Malaise trap in a suburban garden, JPOC.

Previously recorded from Cos Sligo and Wicklow (O'Connor *et al*., 2004; Buhl and Notton, 2009).

***Platygaster oebalus* Walker, 1835**

WEXFORD: Curracloe T1127, ♀ 7August 2009, swept from the vegetation on the sand-dunes, JPOC; **WICKLOW**: Russellstown Park N9610, ♀ 16 May 1992, swept from vegetation in a marshy area, JPOC and MAOC.

Previously recorded from Cos Clare and Down (Buhl and O'Connor, 2009a).

***Platygaster orcus* Walker, 1835**

KILDARE: Newbridge Fen N7616, ♀ 30 April 1987, JPOC.

Previously recorded from Co. Wicklow (Buhl and O'Connor, 2009a).

***Platygaster oscus* Walker, 1835**

WICKLOW: Glendalough T1195, ♀ 11 September 1990, JPOC.

Previously only known from Ireland with no further distributional data (O'Connor *et al*., 2004).

***Platygaster otanes* Walker, 1835**

CAVAN: Virginia N5888, swpt in alder *Alnus* fen, ♂ 30 May 1982, JPOC; **DUBLIN**: North Bull Island O2337, ♀ 5 May 1991, swept from vegetation on the sand-dunes, JPOC and MAOC.

Previously recorded from Co. Kildare (Buhl and Notton, 2009).

***Platygaster pelias* Walker, 1835**

CARLOW: River Barrow, Saint Mullins S7238, ♀♀ 15 August 1994, JPOC; **DUBLIN**: Castleknock O0837, ♀♀ 26 April – 26 May 1985, Malaise trap in a suburban garden, JPOC.

Previously only known from Ireland with no further distributional data (O'Connor *et al*., 2004).

***Platygaster sagana* Walker, 1835**

GALWAY: Dunguaire, Kinvara M3810, ♂♀♀ 4 June 1992, JPOC.

Previously recorded from Cos Cork, Waterford and Wexford (O'Connor *et al*., 2004; Buhl and O'Connor, 2008).

***Platygaster splendidula* Ruthe, 1859**

DOWN: Cultra J4180, ♀ 15 June 1983, MB; **DUBLIN**: Castleknock O0837, ♀ 16 June – 6 July 1996, Malaise trap in suburban garden, JPOC; **WEXFORD**: Ballyteige, ♀♀ 13 August 2009, swept from the sand-dunes, JPOC.

Previously recorded from Co. Kildare (Buhl and O'Connor, 2008).

***Platygaster tisias* Walker, 1835**

CARLOW: Bahana Woods S7239, ♀ 18 June 1991, swept in mixed woodland, JPOC; **CLARE**: Fanore M1308, ♀ 26 May 1992, swept from vegetation on the sand-dunes, JPOC;

Lisdoonvarna Spa R1397, ♀ 25 May 1992, swept from vegetation beside the river, JPOC and MAOC; **DOWN**: Cultra J4180, ♀♀ 15 June 1983, MB.

Previously recorded from Cos Cavan, Waterford and Wexford (O'Connor *et al*., 2004; Buhl and O'Connor, 2008).

***Synopeas breve* Buhl, 1998**

DUBLIN: Castleknock O0837, ♀ 26 April – 26 May 1985, Malaise trap in a suburban garden, JPOC.

Previously recorded from Co. Tyrone by O'Connor *et al*. (2004).

***Synopeas ciliatum* Thomson, 1859**

WEXFORD: Baginbun Head S8002, ♂ 5 August 2008, JPOC; Craywell, New Ross S7228, ♂ 4 August 2008, ♀ 2 August 2009, swept from an overgrown area in a small public park on a steep hill, JPOC; Curracloe T1127, ♀ 7 August 2009, swept from the sand-dunes, JPOC; Stoneyford near Broadway T1009, ♀ 10 August 2009, swept from vegetation beside a stream, JPOC; **WICKLOW**: Coolattin Wood T0-6-, ♀ 14 September 1984, JPOC.

Previously recorded from Cos Cork and Kildare (Buhl and O'Connor, 2008).

***Synopeas euryale* (Walker, 1835)**

DUBLIN: Castleknock O0837, ♂16 June – 6 July 1996, Malaise trap in a suburban garden, JPOC; **WEXFORD**: Curracloe T1127, ♀ 7 August 2009, swept from vegetation on the sand-dunes, JPOC; Duncannon S7308, ♀♀ 12 August 2009, swept from vegetation on the sand-dunes, JPOC.

The only other Irish record is from Co. Down. The species was taken once at Holywood by A. H. Haliday in the eighteen-thirties (O'Connor *et al*., 2004).

***Synopeas larides* (Walker, 1835)**

WATERFORD: Portlaw woods S4415, ♂♂ 1 April 1991, JPOC; **WICKLOW**: Coolattin Wood T0-6-, ♀ 14 September 1984, JPOC.

Previously recorded from Co. Tyrone by O'Connor *et al*. (2004).

***Synopeas muticus* (Nees, 1834)**

CAVAN: Virginia Woods N5987, ♀ 21 May 1989, swept in mixed woodland, JPOC and MAOC; **MONAGHAN**: Nuremore H8502, ♀♀ 11 April 2007, mixed woodland beside lake, JPOC; **WEXFORD**: Killoughrim Forest S8941, ♀ 4 June 1987, mixed woodland, JPOC.

Previously recorded from Cos Tyrone and Waterford (Buhl and O'Connor, 2008).

***Synopeas noyesi* Buhl, 2009**

KERRY: Hotel Europa V9291, Killarney, ♂ 23 May 1996, swept in mixed woodland beside the Lower Lake, JPOC.

Previously recorded from Cos Galway and Wexford (Buhl, 2009a; Buhl and O'Connor, 2010)

***Synopeas osaces* (Walker, 1835)**

DUBLIN: Castleknock O0837, ♀♀ 8 August – 8 September 1984, Malaise trap in a suburban garden, JPOC.

Previously recorded from Co. Down. The species was taken at Holywood by A. H. Haliday in the eighteen-thirties (O'Connor *et al*., 2004).

***Synopeas rhanis* (Walker, 1835)**

CORK: Glengarriff Forest V9157, ♀ 4 July 1985, JPOC and MAOC; **WATERFORD**: Dunmore East X6999, ♀ 7 August 2008, swept from the coastal cliffs at Black Knob, JPOC; Woodstown S6904, ♀♀ 14 August 2009, swept from vegetation in a large marsh, JPOC; **WEXFORD**: Ballyteige S9504, ♂ 1 August 2008, swept from the sand-dunes, JPOC; Craywell, New Ross S7228, ♂♂♀♀ 3 August 2008, ♀ 5 August 2009, swept from an overgrown area in a small public park on a steep hill, JPOC; Curracloe T1127, ♀ 30 July 2008, swept from vegetation on the sand-dunes, JPOC.

Previously only known from Ireland with no further distributional data (O'Connor *et al*., 2004).

***Synopeas sosis* (Walker, 1835)**

CARLOW: Altamont Gardens S8665, ♀ 19 April 1992, JPOC; Saint Mullins S7238, ♂ 24

April 1992, swept from vegetation on the banks of the River Barrow, JPOC; **DUBLIN**: Castleknock O0837, ♀ 26 April – 26 May 1985, Malaise trap in a suburban garden, JPOC; **MONAGHAN**: Lough Muckno Forest Park, Castleblayney H8320, ♀ 16 April 2009, swept from lake-side vegetation, JPOC; **WATERFORD**: Portlaw woods S4415, ♀♀ 1 April 1991, JPOC.

Previously recorded from Cos Down, Meath and Wexford (O'Connor *et al*., 2004; Buhl and O'Connor, 2008) and from Cos Tyrone and Waterford as *S. muticus* (Buhl and O'Connor, 2008).

***Synopeas trebius* (Walker, 1835)**

WEXFORD: Craywell, New Ross S7228, ♀ 3 August 2008, swept from an overgrown area in a small public park on a steep hill, JPOC; Stoneyford near Broadway T1009, ♂ 10 August 2009, swept from vegetation beside a stream, JPOC.

Previously recorded from Cos Tyrone and Wicklow (Buhl and O'Connor, 2009a).

***Trichacis pisis* (Walker, 1835)**

CLARE: Corker Pass M3010, Burren, ♂ 27 May 1992, swept from vegetation beside the green road, JPOC.

Previously only known from Ireland with no further distributional data (O'Connor *et al*., 2004).

Acknowledgements

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FIGURE 1. The counties of Ireland.

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A REVIEW OF THE IRISH CENTIPEDES (CHILOPODA)

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Abstract

This article considers the status and distribution of the 30 species of centipede currently recorded from Ireland, and compares the Irish chilopod fauna with that of Great Britain. Included are a bibliography of the fauna and a summary of the history of the study of this group in Ireland. Distribution maps are presented for each species, offshore island occurrences summarised and an up to-date vice-county list provided. *Henia vesuviana* (Newport) is added to the Irish fauna.

Introduction

The centipedes constitute a small order of myriapodous invertebrates, comprising approximately 2800 described species. They differ from the other large myriapod order, the millipedes (Diplopoda) in having one as opposed to two pairs of legs per segment. Unlike the millipedes, they are carnivorous and soft bodied. Three Orders occur in Ireland, the generally elongated geophilomorphs which have in excess of 35 pairs of legs, the relatively short, stout lithobiomorphs, with 15 pairs of legs, and the 21 legged scolopendromorphs, of which three species occur in Ireland. The fauna includes a number of littoral species. Many centipedes, especially among the geophilomorphs and scolopendromorphs, exhibit strong thermophilic and synanthrophic tendencies. Consequently southern urban areas have the most diverse centipede faunas. However a few species are more frequently encountered in the north.

John Templeton (1766-1825) was the first to record this group in Ireland, collecting specimens in the vicinity of Belfast. His findings on centipedes and millipedes were published after his death by his son Robert Templeton (1836). Until recently, and as with many other

invertebrate groups, most of what we know had been gathered in the last decade of the 19th and first decades of the 20th centuries, when W. F. Johnson, G. H. Carpenter, C. M. Selbie and N. H. Foster were active. During this period centipedes were added to the Irish list by Pocock (1893), Carpenter (1895), Brolemann (1896), Johnson (1912, 1913) and Selbie (1912). Johnson (1912) summarised all Irish centipede records as part of his contribution to the Clare Island Survey. As with many invertebrate groups, the First World War ushered in a period of almost total neglect of Irish centipedes. The appearance of a comprehensive key (Eason, 1964) led to a marked increase in interest in Great Britain but this was not reflected in Ireland. Barber (1984) summarised what was known about the Irish centipedes, placed the fauna in a British Isles context, provided a bibliography and a table summarising vice-county records. That publication marked the beginning of a modest upsurge in recording, much of which was carried out under the auspices of the British Myriapod and Isopod Group. Visits by Rundle (1986) and Jones (1992) resulted in additions to the Irish list. Records to 1984 were summarised in a provisional distribution atlas (Barber and Keay, 1988), however the total of plottable Irish records was just 631. The Irish centipede fauna was briefly alluded to in a British Isles context by Barber (1992). Keay (1989, 1993) published tables showing the distribution of Irish centipedes at the vice-county level. Information collated in tabular form by Cawley (1998) showed a doubling of 10km square records to 1290, and subsequently (Cawley, 2001a) to just over 1600 10km square records. In October 2001 the British Myriapod and Isopod Group visited Ireland, recording primarily in the south west (Gregory, 2002).

The author's centipede fieldwork was often carried out as an adjunct to other natural history activities, although with specific searches for some of the more interesting species. Fieldwork has been somewhat concentrated in Co. Cork but I have collected centipedes on regular visits to other parts of the country. As a general rule, specimens were determined using Eason (1964), supplemented to a small extent by Demange (1981), as well as a series of identification papers in the *Bulletin of the British Myriapod Group*. In 2010 a large number of specimens, including

vouchers for all uncommon records, were redetermined using Barber (2009). The present state of recording at the 10km square level is shown in Table 1. Species are also ranked on this table, taking into account the number of 10km square records, geographical spread and proportion of older records.

The centipede collection in The National Museum of Ireland

In May 2010 the author had the opportunity to examine the Irish centipede collection in the National Museum of Ireland. A typed catalogue, compiled by Dora Murphy, greatly facilitated this task. The collection comprises just over 200 tubes of specimens, representing 17 species, namely *Stigmatogaster subterranea* (Shaw, 1789), *Schendyla nemorensis* (C. L. Koch, 1837), *Strigamia crassipes* (C. L. Koch, 1835), *S. maritima* (Leach, 1817), *Geophilus easoni* Arthur, Foddai, Lewis, Luczynski and Minelli, 2001, *G. flavus* (De Geer, 1778), *G. insculptus* Attems, 1895, *G. osquidatum* Brolemann, 1909, *G. truncorum* (Bergsö and Meinert, 1886), *Cryptops hortensis* Donovan, 1810, *Lithobius borealis* Meinert, 1868, *L. crassipes* L. Koch, 1862, *L. forficatus* (Linné, 1758), *L. melanops* Newport, 1845, *L. microps* Meinert, 1868, *L. variegatus* Leach, 1813 and *Lamyctes emarginatus* (Newport, 1844). The bulk of the collection dates back to the early years of the 20th century. Some tubes appear to have dried out in the past rendering the specimens unidentifiable. The tubes contain interesting specimens of *G. easoni* and *G. osquidatum*, as indicated in the species accounts below.

Centipede records from offshore islands

Centipedes have been recorded from 16 Irish offshore islands. These are Tearaght Island and Great Blasket (South Kerry), Bear Island, Sherkin and Cape Clear (West Cork), Inishmore (vice-county Clare), Inishbofin (West Galway), Inishturk, Clare Island, and Bills Rock (all in West Mayo), Inishmurray (Co. Sligo), Rutland (= Inishmacadura) and Tory (West Donegal) and Dalkey Island, Ireland's Eye and Lambay (all Co. Dublin). These are listed separately below under each species account. More details concerning the island species, together with sources

for pre-2000 records are given in Cawley (2000a). Since then some additional material has been collected on Clare Island, Inishmore, Sherkin and Tory.

Irish vice-county records for centipedes

Barber (1984) and Keay (1989, 1993) have provided tables summarising vice-county records for Irish centipedes. However there are a number of inconsistencies in the respective tables. Barber listed 226 vice-county records, some of which were omitted from Keay's tables. In order to provide an accurate basis for future recording, I have drawn up a fresh census, based on literature records, information submitted to the Chilopod recording scheme, museum specimens and records generated by recent fieldwork. All doubtful records have been excluded and the various inconsistencies in previous attempts resolved. The grand total of Irish vice-county records for centipedes now stands at 548, giving an average of about 14 species recorded per vice-county. The actual totals vary from 8 for Cavan to 22 for Mid Cork.

Species accounts

ORDER GEOPHILOMORPHA

FAMILY HIMANTARIIDAE

***Stigmatogaster subterranea* (Shaw, 1789)**

First recorded by Templeton (1836). *Stigmatogaster subterranea* occurs widely in Ireland and with *Geophilus flavus*, it is the only commonly encountered large geophilomorph. The species turns up in a great variety of lowland habitats, excepting blanket bogs. It is often frequent in gardens and deciduous woodland, especially on deep, lime rich soils. Many sites show signs of disturbance, and one would suspect that many colonies arise through human agency. *S. subterranea* tends to be relatively commoner than *G. flavus* in the milder western part of the country than in the east.

Offshore island records: Inishmore, Clare Island and Lambay.

Vice-county checklist: H01-H17, H19-H35, H37-H39 **(Fig. 1)**.

Irish bibliography: 8, 13, 16, 18, 21, 24, 26, 27, 28, 30, 32, 35, 37, 40, 41, 44, 47, 48, 49, 54, 58, 61, 62, 65.

FAMILY SCHENDYLIDAE

Hydroschendyla submarina (Grube, 1869)

Hydroschendyla submarina is a medium sized intertidal geophilomorph. It was first recorded in Ireland during the Clare Island Survey (Johnson, 1912), this record being repeated by Southern (1915). The only other record is from West Cork (Cawley, 1998). Keay (1989, 1993) lists this species as occurring in North-east Galway but there is no basis for this record which should be deleted. While the scarcer intertidal geophilomorphs are likely to be under recorded, it is notable that a fair amount of collecting along the south coast has failed to turn up any further records. *H. submarina* can be confused with *Strigamia maritima* and could be overlooked among that species. However on the present evidence, it appears to be genuinely rare. A more likely explanation is that it occurs further down the shore than other geophilomorphs.

Offshore island record: Clare Island.

Vice-county checklist: H03, H26 **(Fig. 2)**.

Irish bibliography: 13, 14, 16, 26, 28, 30, 35, 44, 48, 49 64.

Schendyla dentata (Brolemann and Ribaut, 1911)

This centipede was added to the Irish list when a single specimen was sieved from leaf litter on waste ground in Cork City (Cawley, 2001b). In January 2009, I collected a specimen in a small graveyard on the outskirts of Dunboyne, Co. Meath (O0241). In both instances female specimens were involved, males being unknown. It is likely to be a naturalized alien here. Although *Schendyla dentata* is a remarkably small and inconspicuous geophilomorph, the species is distinctive when examined under the microscope. It could easily be overlooked as an immature of one of the larger species, and the Dunboyne record suggests that it could yet prove widespread, at least in the south and east of the country.

Vice-county checklist: H04, H22 **(Fig. 3)**.

Irish bibliography: 30, 31.

***Schendyla nemorensis* (C. L. Koch, 1837)**

First recorded by Selbie (1912). *Schendyla nemorensis* is a widespread centipede in Ireland, but it is usually only present in small numbers and is likely to be under-recorded. The species is distinctly less in evidence than the other small geophilomorph *Geophilus truncorum*. *S. nemorensis* is noticeably commoner in coastal areas, where it can be frequent in habitats such as exposed grassland and sand dunes. *S. nemorensis* is not normally found between the tide lines, where it is replaced along the south coast by *S. peyerimhoffi*.

Offshore island records: Cape Clear, Clare Island, Tory, Lambay and Ireland's Eye.

Vice-county checklist: H01-H16, H18, H20-H24, H27-H28, H33-H35, H37-H40 **(Fig. 4)**.

Irish bibliography: 12, 13, 14, 16, 26, 28, 30, 35, 40, 41, 43, 44, 45, 47, 48, 49, 58, 60, 61, 63.

***Schendyla peyerimhoffi* Brolemann and Ribaut, 1911**

First recorded by Cawley (2001b). *Schendyla peyerimhoffi* is very similar to *S. nemorensis*, from which it is most easily distinguished by comparing the ultimate and penultimate legs. It is an exclusively littoral animal, usually found in the upper shore inter-tidal rock crevices, or under stones near the high water mark in estuaries. The species occurs widely along the south Irish coast. At all Irish sites, it has been found in association with the common littoral centipede *S. maritima*. Elsewhere, *S. peyerimhoffi* has been reported from Atlantic coasts between Morocco and Britain (Barber, 1987).

Vice-county checklist: H03-H06, H12 **(Fig. 5)**.

Irish bibliography: 30, 31, 32.

FAMILY DIGNATHODONTIDAE

***Henia brevis* (Silvestri, 1896)**

First recorded by Jones (1992), with most subsequent records coming from southern synanthrophic sites. *Henia brevis* is likely to be a naturalized alien in Ireland, and as in Great

Britain, it is generally confined to more southern parts. The species is likely to be rather more frequent than the few records would suggest, however certainly not common, and generally not located, even when searched for in southern urban areas. Specimens need to be deliberately searched for, especially in gardens, graveyards and similar synanthrophic sites.

Vice-county checklist: H02, H04-H06, H11 and H21 **(Fig. 6)**.

Irish bibliography: 26, 30, 31, 32, 47, 49.

***Henia vesuviana* (Newport, 1844)** **New to Ireland**

DUBLIN: Archbishop's House, Drumcondra (O161364), 30 September 2008. Single female collected from under a stone. Site comprises a disturbed shrubby area, dominated by mature *Acer* spp. and with an ivy (*Hedera helix* L.) understorey. A second visit in May 2010 failed to reveal any additional specimens.

Henia vesuviana is very distinctive under the microscope, but the above specimen was assumed to be *Stigmatogaster subterranea* in the field. The species is confined to the south in Britain where it is usually recorded from synanthrophic sites. Also reported from France, Central Europe and North Africa (Barber, 2009).

Vice-county checklist: H21 **(Fig. 7)**.

FAMILY LINTOTAENIIDAE

***Strigamia crassipes* (C. L. Koch, 1835)**

First recorded by Pocock (1893). *Strigamia crassipes* is a rare centipede in Ireland, recorded from 12 vice-counties, and with just 20 plottable 10km square records. It has however been reported from all parts of the country, with the exception of the midlands. Many of the records are from coastal areas, and there are minor concentrations in south Munster and in the south east. *S. crassipes* is also quite a scarce animal in Great Britain. There are no records from offshore islands.

Vice-county checklist: H01, H03-H06, H11-H13, H19, H28, H35, H37 **(Fig. 8)**.

Irish bibliography: 13, 16, 21, 26, 30, 35, 40, 41, 44, 45, 48, 49, 54, 58, 61.

***Strigamia maritima* (Leach, 1817)**

First recorded by Templeton (1836). This robust geophilomorph is the only commonly encountered littoral centipede in Ireland, where it occurs all around the coast, at the mid to upper shore level. It is often frequent in shingle, under stones on estuarine gravel/mud, in intertidal rock fissures and in coastal erosion banks. As might be expected, the species is widespread on the offshore islands.

Offshore island records: Cape Clear, Sherkin, Tearaght, Inishmore, Clare Island, Tory, Lambay and Ireland's Eye.

Vice-county checklist: H01-H06, H08-H09, H12, H15-H17, H21-H22, H27-H29, H31, H34-H35, H38-H39 **(Fig. 9)**. As yet unrecorded from Cos Wicklow and Derry.

Irish bibliography: 2, 12, 13, 16, 17, 21, 22, 23, 24, 25, 26, 28, 30, 32, 35, 40, 41, 44, 47, 48, 49, 54, 58, 61, 64, 65.

FAMILY GEOPHILIDAE

***Geophilus carpophagus* agg.**

First recorded by Pocock (1893). The *Geophilus carpophagus* aggregate comprises two very similar robust centipedes *viz. Geophilus carpophagus* Leach and the recently described *Geophilus easoni* Arthur *et al*. The aggregate has a generally northern distribution in Ireland with a disproportional number of records dating back to the early 20th centuary. Fortunately the aggregate is well represented in the National Museum of Ireland collection, and this has allowed many of these older records to be assigned to *G. easoni*.

Offshore island records: Cape Clear, Tearaght, Clare Island, Rutland and Ireland's Eye.

Vice-county checklist: H01, H03, H05, H06, H08, H12, H13, H16, H17, H19, H20-H21, H25, H27-H29, H33, H34 H35, H37-H40.

Irish bibliography: 5, 12, 13, 16, 18, 21, 24, 26, 28, 30, 35, 40, 41, 44, 45, 47, 48, 49, 54, 61, 63.

***Geophilus carpophagus* Leach, 1814** *sensu stricto*

Geophilus carpophagus is much scarcer than *G. easoni* in Ireland, and on present evidence

its distribution is largely southern and coastal. The species is also much scarcer than *G. easoni* in Great Britain. The few Irish records for this centipede strongly reflect its tendency to occur on sea cliffs and under bark, as reported by Arthur *et al*. (2002).

Vice-county checklist: H01, H03, H05-H06 **(Fig. 10)**.

Irish bibliography: 41.

***Geophilus easoni* Arthur, Foddai, Lewis, Luczynski and Minelli, 2001**

First recorded by Gregory (2002). The species is much more widespread than *G. carpophagus* in Ireland but distinctly local overall. It is likely to be under recorded in the northern part of the country. Virtually all the Irish records are from wild habitats. However in Great Britain, where the species is much commoner, it often occurs in synanthrophic habitats. All the *G. carpophagus* aggregate specimens in the National Museum of Ireland belong to this species, as do most of my specimens. It has not been possible to check vouchers for some records, mostly early 20th century ones. These refer to occurrences in the following 10km squares: V19, V65, V91, S71, O21, J03, J37 and J43. For mapping purposes, I have decided to treat all of these as belonging to *G. easoni* although it is possible that some southern coastal records refer to *G. carpophagus*.

Offshore island records: Clare Island, Rutland and Ireland's Eye.

Vice-county checklist: H01, H03, H08, H12-H13, H16-H17, H19-H21, H25, H27-H28, H34-H35, H38-H40 **(Fig. 11)**.

Irish bibliography: 41.

***Geophilus electricus* (Linnaeus, 1758)**

First recorded by Templeton (1836). This species is another large geophilomorph which has been recorded from a fair number of widely scattered sites in the southern half of Ireland with records from the northern half of the country being virtually unknown. *G. electricus* is relatively frequent in counties along the south coast, and especially in Kerry and Cork, where it occasionally turns up in wild habitats including woodlands and quarries. However even in these counties, it is a local centipede. Away from the south coast, it becomes increasingly rare and

increasingly restricted to synanthrophic sites especially gardens. It is probable that all populations in the northern half of the country arise through human introductions. A remarkable recent record is that from a disturbed field adjacent to a graveyard in Dungiven, Co. Derry. Records for West Mayo and Leitrim contained in Johnson (1912) and Foster (1919) respectively are represented by specimens in the National Museum of Ireland and belong to *G. insculptus* Attems.

Offshore island record: Ireland's Eye.

Vice-county checklist: H01-H07, H09-H12, H14, H18-H19, H21, H23, H39, H40 **(Fig. 12)**.

Irish bibliography: 13, 16, 26, 28, 29, 30, 35, 40, 41, 44, 46, 47, 48, 49, 53, 58, 65.

***Geophilus flavus* (De Geer, 1778)**

First recorded by Templeton (1836). This medium sized centipede is a generally distributed and common species in Ireland where it is the most widely recorded geophilomorph. The species occurs in a great variety of habitats especially grasslands and coastal sites, as well as gardens and waste ground. As in Great Britain, *G. flavus* is distinctly commoner in the eastern part of the country than in the west, where it shows a tendency to be replaced by *S. subterranea*. It is for example much less in evidence in Co. Sligo than *S. subterranea*.

Offshore island records: Cape Clear, Sherkin, Tearaght, Clare Island, Tory, Lambay and Ireland's Eye.

Vice-county checklist: Recorded from every Irish vice-county except Tyrone (H36) **(Fig. 13)**.

Irish bibliography: 3, 13, 16, 19, 21, 23, 26, 28, 29, 30, 32, 34, 35, 39, 40, 41, 44, 45, 47, 48, 49, 53, 54, 58, 61, 65.

***Geophilus gracilis* Meinert, 1870**

First reported in Ireland by Brolemann (1896). *Geophilus gracilis* is a littoral geophilomorph, usually found under stones at about the mid-tide level, under estuarine conditions, and with some records also from shingle and from rock fissures. This is a predictable centipede in southern estuaries although much less frequent than *S. maritima*. It is also present in the Shannon estuary. *G. gracilis* might yet be expected from the east coast,

however so far specific searches for it along the north-west coast have been unsuccessful. Probably greatly under-recorded along the south-west coast and in Galway Bay.

Offshore island record: Inishmore.

Vice-county checklist: H01, H03-H04, H06, H08-H09, H12, H15-H16 **(Fig. 14)**.

Irish bibliography: 13, 15, 16, 17, 21, 26, 30, 31, 32, 35, 44, 48, 49, 52.

***Geophilus insculptus* Attems, 1895**

First recorded by Brolemann (1896). This is a medium sized centipede which is widespread and generally common in Ireland, turning up in gardens, woodlands and coastal habitats. *Geophilus insculptus* has a somewhat confused taxonomy, as discussed by Eason (1990) and Barber (1999). Many older records are under the name *G. proximus* C. L. Koch, however the true *G. proximus* has a northern distribution, with only a single authentic British Isles record, from the Shetland Isles. More recent records are often under the name *G. oligopus* (Attems). This centipede is less in evidence in southern counties, and information from Great Britain also suggests a relative scarcity along the south coast. Occasionally, specimens are found which show varying degrees of phosphorescence on the posterior half of the body.

Offshore island record: Inishmore and Clare Island.

Vice-county checklist: Recorded from every Irish vice-county except Carlow (H13) **(Fig. 15)**.

Irish bibliography: 3, 5, 13, 16, 18, 19, 21, 26, 30, 31, 34, 35, 39, 40, 41, 44, 47, 48, 49, 58, 61.

***Geophilus osquidatum* Brolemann, 1909**

Added to the Irish list by Rundle (1986), and now known in Ireland from a few synanthrophic sites, mostly in southern counties. The National Museum of Ireland contains a specimen collected at Lough Guitane, North Kerry in 1893 and identified as *Geophilus flavus*. In all likelihood *G. osquidatum* is a naturalized alien in Ireland, and it is probably confined to synanthrophic habitats, especially along the south coast. However the discovery of a specimen in the grounds of University College Galway hints to a possible wider distribution along the west coast. The species is a fairly nondescript geophilomorph, easily mistaken for the

widespread *G. flavus*. It is likely to be rather more frequent here than the handful of known records would suggest, and would be worth searching for, especially in gardens, graveyards and public parks. Some of the Irish specimens have exhibited marked phosphorescence on the posterior half of the body, as is typical for this centipede.

Vice-county checklist: H02-H04, H11, H16, H20-H21 **(Fig. 16)**.

Irish bibliography: 16, 26, 30, 31, 32, 41, 48, 49, 58.

***Geophilus pusillifrater* Verhoeff, 1898**

The only Irish record for this littoral geophilomorph is from under a rock on shingle at Stradbally Cove and, from fissures on a sea cliff at Templeyvrick, Bunmahon, both in Co. Waterford (Cawley, 2002). Surprisingly there have been no subsequent records, despite more collecting along the south coast. This is however a small and inconspicuous animal, and inevitably under-recorded.

Vice-county checklist: H06 **(Fig. 17)**.

Irish bibliography: 30, 32.

***Geophilus truncorum* (Bergsö and Meinert, 1886)**

First recorded by Selbie (1912). This is the most frequently encountered small geophilomorph in Ireland, although *Schendyla nemorensis* may occasionally be as common, especially near the coast. The species is a characteristic centipede of peat bogs, often being present in and under well-rotted sods of turf. It is also frequent in woodland, usually turning up under dead bark, in rotting wood, or in leaf litter. The presence of just two coxal pores, coupled with well developed sternal gutters allow for easy determination. I have collected one abnormal animal in Co. Sligo in which the coxal pores were united to form slit like structures.

Offshore island records: *Geophilus truncorum* is surprisingly scarce on the offshore islands, being recorded so far only from Tearaght, Clare Island and Tory.

Vice-county checklist: Recorded from every Irish vice county, H01-H40 **(Fig. 18)**.

Irish bibliography: 5, 8, 12, 13, 16, 18, 26, 28, 29, 30, 32, 34, 35, 39, 40, 41, 42, 43, 44, 46, 47, 48, 49, 57, 58, 60.

ORDER SCOLOPENDROMORPHA

FAMILY CRYPTOPIDAE

***Cryptops anomalans* Newport, 1844**

First recorded by Cawley (2001b). The only Irish record for this species is based on a singleton collected in the grounds of Kilmainham Gaol, in Dublin City. It is surprising that there have been no subsequent records, however the Greater Dublin area has received relatively little attention.

Vice-county checklist: H21 **(Fig. 19)**.

Irish bibliography: 30, 31.

***Cryptops hortensis* (Donovan, 1810)**

First recorded by Templeton (1836), this centipede is widespread but generally quite local in Ireland. As in Great Britain, the species is distinctly more frequent in the south where it regularly turns up in natural habitats especially woodlands and coastal sites. However many records, even in the south, are from sites modified by humans. As one moves northwards, it becomes progressively rarer and almost exclusively synanthrophic. In contrast to this general trend, *Cryptops hortensis* has proved to be surprisingly widespread in the north-east, and conversely notably scarce in the extreme south-east. *C. hortensis* is also surprisingly widespread on offshore islands given its local status on the mainland, and it appears to be a predictable centipede on southern islands.

Offshore island records: Cape Clear, Great Blasket, Tearaght, Inishmore, Clare Island and Ireland's Eye.

Vice-county checklist: H01-H12, H15-H17, H20-H21, H25-H28, H34, H38-H40 **(Fig. 20)**.

Irish bibliography: 13, 16, 21, 26, 27, 28, 30, 35, 40, 41, 44, 47, 48, 49, 54, 58, 61, 65.

***Cryptops parisi* Brolemann, 1920**

First recorded by Rundle (1986), *Cryptops parisi* is a relatively large animal, rather more robust than the only native Irish scolopendromorph (*C. hortensis*). The species is well established in Cork City, and there are scattered records from a number of towns in Mid and

East Cork. The only other Irish records are from Kilmallock, Co. Limerick and Lismore and Waterford City, both in Co. Waterford. Virtually all the records are from heavily man-modified habitats, however a few records refer to woodland edges. *C. parisi* might be expected in time to turn up in other urban areas along the south and east coasts.

Vice-county checklist: H04-H06, H08 **(Fig. 21)**.

Irish bibliography: 15, 16, 26, 27, 30, 31, 41, 48, 49, 58.

ORDER LITHOBIOMORPHA

FAMILY LITHOBIIDAE

Lithobius borealis Meinert, 1868

First recorded by Johnson (1913). Some published records are under the name *Lithobius lapidicola* Meinert. A widespread centipede in Ireland, but distinctly less in evidence than *L. variegatus*, *L. forficatus* or *L. microps*. The species is very much an animal of wild habitats, often associated with acid soils. It is characteristic of blanket bogs and mountain summits. *Lithobius borealis* is generally less common in the lowlands, turning up in woodlands and grasslands, again often on acid soils. Many records have come from under loose bark on trees in conifer plantations, and from moss on old walls and trees. *L. borealis* is regularly found in coastal habitats, especially in the west, but also along the south coast. It is unknown in synanthrophic habitats.

The extent of the development of the posterior angles of tergite 9 varies in this centipede, with the angles being well developed in northern specimens, but absent in southern specimens. However examination of a large number of Irish specimens has showed very little variation, with these projections being entirely or nearly entirely absent in specimens from all parts of the country.

Offshore island records: Clare Island, Inishmore, Tory and Ireland's Eye.

Vice-county checklist: H01-H13, H15, H18, H20-H21, H23-H30, H33-H40 **(Fig. 22)**.

Irish bibliography: 5, 7, 10, 12, 13, 16, 18, 19, 26, 28, 29, 30, 32, 33, 35, 40, 41, 45, 47, 48, 49, 57.

***Lithobius crassipes* L. Koch, 1862**

First recorded by Johnson (1913). There are remarkably few Irish records for this small lithobiomorph, and these are restricted to the northern half of the country. This contrasts strongly with its status in Great Britain, where *Lithobius crassipes* is one of the commonest species, although relatively scarce in the south. Irish records are all from wild habitats, including coastal grasslands, mountain cliffs and woodlands. It is probably under recorded in Ulster, and possibly in the midlands, however it seems to be genuinely absent or very rare in Munster and south Leinster. A fair amount of collecting along the Cork-Waterford coast has failed to turn up any specimens.

Offshore island records: Clare Island and Tory.

Vice-county checklist: H23, H27, H28, H31-H33, H35-H40 **(Fig. 23)**.

Irish bibliography: 8, 13, 16, 26, 28, 30, 32, 35, 38, 39, 40, 45, 48, 49, 61, 63.

***Lithobius forficatus* (Linné, 1758)**

Recorded from Ireland by Leach (1815) with Templeton (1836) providing the first locality. *Lithobius forficatus* is the most frequently encountered centipede in Ireland, as is also the case in Great Britain. The species has been recorded from 463 Irish 10km squares, 73% of those from which centipedes have been reported. This is a remarkably successful invertebrate, found in all terrestrial habitats, from city centre waste ground to blanket bogs and mountain summits. It is often common in coastal habitats such as shingle and erosion banks, and has been recorded from a total of 11 offshore islands, making this the most frequently recorded myriapod on Irish offshore islands. This is the centipede that is most likely to make its way indoors, and is a good climber, occasionally turning up on walls.

Offshore island records: Cape Clear, Sherkin, Bear Island, Tearaght, Inishmore, Clare Island, Bills Rock, Inishmurray, Tory, Lambay and Ireland's Eye.

Vice-county checklist: Recorded from every Irish vice-county, H01-H40 **(Fig. 24)**.

Irish bibliography: 5, 8, 13, 16, 18, 21, 23, 24, 26, 28, 29, 30, 31, 32, 35, 39, 40, 41, 43, 44, 45, 47, 48, 49, 51, 54, 55, 58, 61, 63, 65.

***Lithobius macilentus* L. Koch, 1862**

This distinctive small lithobiomorph has only been recorded from one site in Ireland, deciduous woodland along the shore of Lough Derravaragh, Co. Westmeath (Cawley, 2002). The specimen collected was a female, as is usual with this centipede, males being unknown and reproduction occurring by parthenogenesis. *Lithobius macilentus* has been recorded widely in Britain, but very locally with many populations known only from the collection of single individuals. It would seem likely that *L. macilentus* is present in other Irish woodlands, However, given the tendency for this animal to occur in very small numbers, finding new sites may take some time.

Vice-county checklist: H23 **(Fig. 25)**.

Irish bibliography: 30, 32

***Lithobius melanops* Newport, 1845**

First recorded by Carpenter (1895). This medium sized lithobiomorph is widespread in Ireland. The species occurs in a wide variety of natural and man-made habitats, but is distinctly commoner near the coast, especially on sand dunes. I have one record of an animal crawling on the ceiling of a fourth floor apartment in Cork City.

Offshore island records: Cape Clear, Inishmore, Clare Island, Rutland, Tory, Lambay and Ireland's Eye.

Vice-county checklist: H01-H10, H12-H24, H26-H31, H33-H40 **(Fig. 26)**.

Irish bibliography: 12, 13, 16, 21, 22, 23, 24, 26, 27, 28, 30, 35, 39, 40, 41, 44, 45, 47, 48, 49, 54, 58, 61, 63.

***Lithobius microps* Meinert, 1868**

First recorded by Pocock (1893). This small centipede is widespread in Ireland, where it is the only commonly encountered small lithobiomorph. It characteristically turns into a semi-

circle when disturbed in the field, and is easily identified by the presence of just three ocelli. *Lithobius microps* is often frequent in deciduous leaf litter and turns up in a wide variety of habitats, including urban waste areas. However, it avoids exposed acid soils. The species appears to be relatively scarce in central Ulster, in contrast to *L. crassipes*.

Brade-Birks and Brade-Birks (1919) described var. *fosteri* of this species, based on a specimen collected by Nevin Foster in Co. Antrim. The variety differs from the nominate form in having a single rather than a double terminal claw on the last pair of legs.

Offshore island records: Cape Clear, Sherkin, Inishmore and Ireland's Eye, but a surprising absentee from Clare Island, and also not present on Tory.

Vice-county checklist: Recorded from every Irish vice-county except Cavan (H30) **(Fig. 27)**.

Irish bibliography: 7, 11, 13, 16, 18, 19, 20, 21, 26, 27, 28, 29, 30, 31, 35, 40, 41, 44, 47, 48, 49, 53, 54, 58.

***Lithobius pilicornis* Newport, 1844**

This large lithobiomorph is so far recorded in Ireland only from urban waste ground sites in Cork City (Cawley, 1999). It is clearly a naturalized alien here, and might eventually be expected from other urban areas along the south and east coasts. The species may be a relatively recent arrival as searches of southern urban areas have so far proved fruitless, and it is distinctly scarce in Cork City.

Vice-county checklist: H04, H05 **(Fig. 28)**.

Irish bibliography: 27, 30, 31.

***Lithobius variegatus* Leach, 1813**

First recorded by Templeton (1836). This distinctive animal is widespread in Ireland, where it is the second most frequently encountered centipede. The species is a common centipede of woodlands, mountains and blanket bogs, and is frequent also in hedgerows, grasslands and coastal habitats. However unlike most centipedes, *Lithobius variegatus* tends to be entirely absent from urban areas except where there are large parks. In Great Britain, there is a noted area of absence along the east coast. In Ireland, there is also an area of relative scarcity, roughly

corresponding with counties Meath and Louth.

Offshore island records: Cape Clear, Sherkin, Great Blasket, Inishmore, Inishbofin, Clare Island, Inishmurray, Rutland, Ireland's Eye and Dalkey Island. Absent from Tory Island.

Vice-county checklist: Recorded from every Irish vice-county, H01-H40 **(Fig. 29)**.

Irish bibliography: 3, 4, 5, 13, 16, 18, 21, 22, 24, 26, 28, 29, 30, 32, 33, 35, 36, 40, 41, 44, 45, 46, 47, 48, 49, 50, 54, 57, 58, 59, 61, 63, 65.

FAMILY HENICOPIDAE

Lamyctes emarginatus (Newport, 1844)

First recorded by Johnson (1912). A distinctive lithobiomorph, easy identified by the presence of just one ocellus. The species can appear as quite a dark animal in the field. *Lamyctes emarginatus* occurs only as females, reproduction being by parthenogenesis. It has a tendency to occur on damp ground, for example in riverbank shingle, however it can turn up in a variety of open habitats, including urban waste ground. Unlike most centipedes, *L. emarginatus* exhibits a distinct seasonality, usually being collected in the autumn. This is reflected in datable Irish records which break down as follows: May (1 record), June (3 records), July (6), August (7), September (20) and October (9). *L. emarginatus* has been found quite widely in Ireland, and while it is inevitably under recorded because of its restricted season, small size and tendency to occur in small numbers, it appears to be a scarce animal.

Offshore island records: Cape Clear, Inishturk, Clare Island and Tory.

Vice-county checklist: H01-H06, H11-H13, H17-H18, H21-H23, H27-H28, H32, H35-H37, H39-H40 **(Fig. 30)**.

Irish bibliography: 6, 11, 13, 16, 21, 26, 28, 30, 35, 40, 41, 44, 46, 48, 49, 58.

Species not confirmed as Irish

Strigamia acuminata (Leach, 1814)

Strigamia acuminata is listed for West Cork by Keay (1993). Initial enquiries suggested that

this record was based on a misplaced entry. However, more recently, it has emerged that the record is based on a specimen collected by Barnaby Halpin at Unionhall in December 1991, and determined by his father Dick Jones. The specimen is not currently available for examination. Extensive collecting in West Cork, including the Unionhall area, has failed to produce any additional records for this centipede, which is widespread in the south of Britain, and a likely candidate to be found in Ireland.

***Lithobius muticus* C. L. Koch, 1847**

In April 1994, the author, then new to centipede recording, collected a specimen at Ballinacarrow Bridge (G641248), Co. Sligo which he identified as *Lithobius muticus*. This identification was confirmed by Andy Keay. Unfortunately, the specimen was subsequently mislaid. A return visit to the site in February 1998 failed to turn up any additional material, and the site was found to have been largely destroyed by the dumping of rocks and slabs in an apparent attempt to stabilise the banks of the Ballinacarrow River, and from trampling by cattle. A further attempt in April 2010, at nearby and apparently suitable habitat also drew a blank, as has extensive collecting in various parts of Ireland. *L. muticus* is a scarce southern centipede in Great Britain, usually associated with woodlands. In the absence of voucher specimens, I have decided to treat both *L. muticus* and *S. acuminata* as species yet to be confirmed as Irish.

***Lithobius agilis* C. L. Koch, 1847**

Johnson (1913) reported *Lithobius agilis* from Coolmore (East Donegal) and Acton Wood (Co. Armagh). The records are repeated by Foster (1919). There have been no subsequent published records of this widespread European species from Ireland or from Britain, and no recent finds despite considerable recording. There are no vouchers for these records in the National Museum of Ireland. Barber (2009) suggests that the records could possibly refer to *Lithobius tricuspis* Meinert, a species otherwise unknown in Ireland. However given that Johnson had relatively little involvement with centipedes, it is possible that one of the more widespread species was involved. In either case, these is no good evidence that *L. agilis* is or has ever been a part of the Irish fauna.

Discussion

Irish centipedes have been the subject of a considerable amount of recording effort since the group was reviewed by Barber (1984). Since then the Irish list has increased from 19 to 30 species. The number of Irish 10km square records for centipedes has increased from the 631 that were available at the time of the provisional atlas (Barber and Keay, 1988) to 2911. Of these, 1250 10km square refer to geophilomorphs, 1547 to lithobiomorphs and 114 to scolopendromorphs. Centipedes have now been recorded from a total of 634 Irish 10km squares. As might be expected, coverage is patchy and the group remains under-recorded over much of the country. In particular, most of Ulster, Connaught and much of the midlands have received little attention. The Irish centipede fauna is compared with that of some other European countries in Table 2.

The Irish centipede fauna of 30 species compares with 47 species recorded from Great Britain. The Irish centipede fauna thus represents 64% of the British fauna, excluding hothouse aliens. The comparable figures for some other relatively well known terrestrial invertebrate groups are as follows: millipedes 76%, spiders 64%, harvestmen 70%, woodlice 82%, falsescorpions 68%. McCarthy (1986) compared the Irish and British faunas for a number of well recorded invertebrate groups and found that the Irish ones typically represent 65% of those in Britain.

Consideration of the Irish centipede fauna may be facilitated by dividing the group into four sections *viz*. naturalized aliens, rare natives, uncommon natives and common natives. Of the 11 additions to the fauna since Barber's (1984) review, 7 are naturalized aliens. Two of these are restricted to urban areas along the south coast, namely *C. parisi* and *L. pilicornis*. The presence of the additional species, *S. dentata*, *H. vesuviana*, *H. brevis*, *G. osquidatum* and *C. anomalans* in the greater Dublin areas, raises the likelihood that the other aliens will eventually turn up in this area, which represents the largest conurbation in the country. With the mildness of the Irish climate, one might expect that these animals might penetrate a little further north than they do in

Great Britain. It is quite possible that other centipedes which are treated here as natives are in fact thoroughly and long established aliens, or that their native ranges here have been greatly extended by man. In particular, this applies to *G. electricus* and *C. hortensis*. The fact that no alien centipedes were recorded in Ireland prior to the mid 1980's is as might be expected given that early workers concentrated their recording effort almost entirely in the northern half of the country, especially Ulster. The seven alien centipedes now confirmed from Ireland represent 23.3% of the known fauna. The comparable figure for the other relatively well known myriapod group, the millipedes (Diplopoda), is a remarkably similar 23.8% (Lee, 2006). However as with the centipedes, some millipedes which are generally considered to be native, could well be long established introductions.

Five species may be classified as rare natives. It is significant that three of these (*H. submarina*, *S. peyerimhoffi* and *G. pusillifrater*) are littoral species, more or less confined to the south coast. *H. submarina* and *G. pusillifrater* are each known from just two sites, although undoubtedly under-recorded. The status of the true *G. carpophagus* is as yet unclear in Ireland, however it seems likely to be a rare generally southern coastal species here. The remaining rare native species, *L. macilentus*, is only known from a single woodland site.

Seven species (*S. crassipes*, *G. easoni*, *G. electricus*, *G. gracilis*, *C. hortensis*, *L. crassipes* and *L. emarginatus*) occur widely but uncommonly in Ireland, and of these *G. electricus* and *G. gracilis* are more or less confined to the south and *L. crassipes* restricted to the north. Probably, an intensive survey of centipedes anywhere in Ireland would reveal the presence of most of these species, with the natural ranges of *G. electricus* and *C. hortensis* being greatly extended by the activity of man.

The remaining ten species (*S. nemorensis*, *G. truncorum*, *G. insculptus*, *S. subterranea*, *G. flavus*, *L. forficatus*, *L. variegatus*, *L. melanops*, *L. borealis* and *L. microps*) occur more or less commonly throughout Ireland, with *S. maritima* common in many littoral habitats Of these, *L. forficatus* is a truly ubiquitous invertebrate, present even on remote offshore islands, and often the first species encountered wherever centipedes are collected.

With increased urbanisation as well as climatic amelioration, one can expect the Irish centipede fauna to continue to be augmented with species accidently introduced by man. High on the list of likely introductions are species which are well established in Britain, for example *Strigamia acuminata* (Leach) and *Lithobius calcaratus* C. L. Koch.

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TABLE 1. Summary of Irish 10km square records for centipedes.

Species	Number of Irish 10km square records	Rank in Ireland
Stigmatogaster subterranea (Shaw)	208	5
Hydroschendyla submarina (Grube)	2	24
Schendyla dentata (Brolemann and Ribaut)	2	25
Schendyla nemorensis (C. L. Koch)	125	10
Schendyla peyerimhoffi Brolemann &Ribaut	7	22
Henia brevis (Silvestri)	9	21
Henia vesuviana (Newport)	1	28
Strigamia crassipes (C. L. Koch)	20	17
Strigamia maritima (Leach)	104	11
Geophilus carpophagus Leach *sensu stricto*	5	23
Geophilus easoni Arthur *et al.*	42	15
Geophilus electricus (Linné)	48	14
Geophilus flavus (De Geer)	235	4
Geophilus gracilis Meinert	19	18
Geophilus insculptus Attems	203	7
Geophilus osquidatum Brolemann	12	20
Geophilus pusillifrater Verhoeff	2	26
Geophilus truncorum (Bergsö and Meinert)	206	6
Cryptops anomalans Newport	1	29
Cryptops hortensis (Donovan)	97	12
Cryptops parisi Brolemann	16	19
Lithobius borealis Meinert	127	9
Lithobius crassipes L. Koch	21	16
Lithobius forficatus (Linnaeus)	463	1

TABLE 1 (Continued).

Lithobius macilentus L. Koch,	1	30
Lithobius melanops Newport	172	8
Lithobius microps Meinert	287	3
Lithobius pilicornis Newport	1	27
Lithobius variegatus Leach	421	2
Lamyctes emarginatus (Newport)	54	13
Article I. Total 10km square records	2911	

TABLE 2. Ireland's centipede fauna compared with some other European countries.

Country	**Number of species**	**Source**
Ireland	30	this study
Great Britain	47	Barber (2009)
Albania	53	Stoev (2000)
Bulgaria	98	Stoev (1997)
France	110	Geoffroy (2000)
Greece	101	Zapparoli (2002)
Italy	155	Foddai *et al*. (1995)
Macedonia	36	Stoev (2001)
Poland	57	Wytwer (1997)
The Netherlands	40	Berg *et al.* (2008)

FIGURE 1. Distribution map for *Stigmatogaster subterranea* (Shaw).

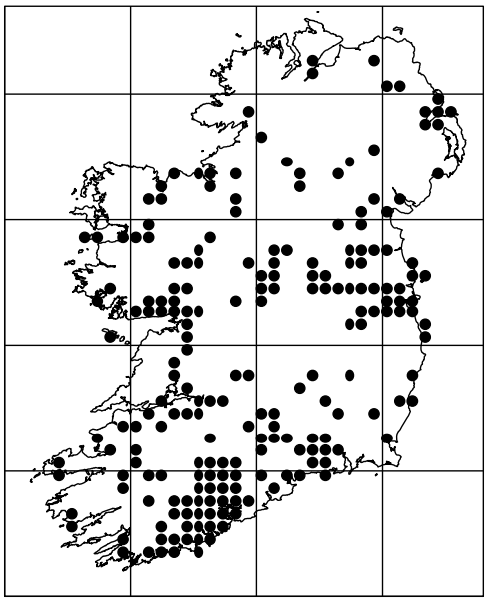


FIGURE 2. Distribution map for *Hydroschendyla submarina* (Grube).

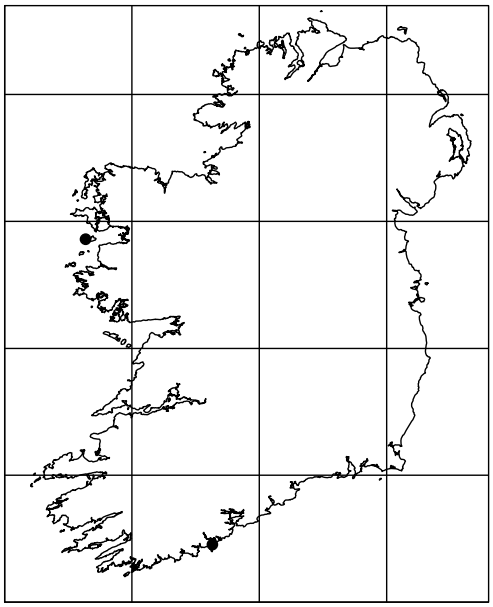


FIGURE 3. Distribution map for *Schendyla dentata* (Brolemann and Ribaut).

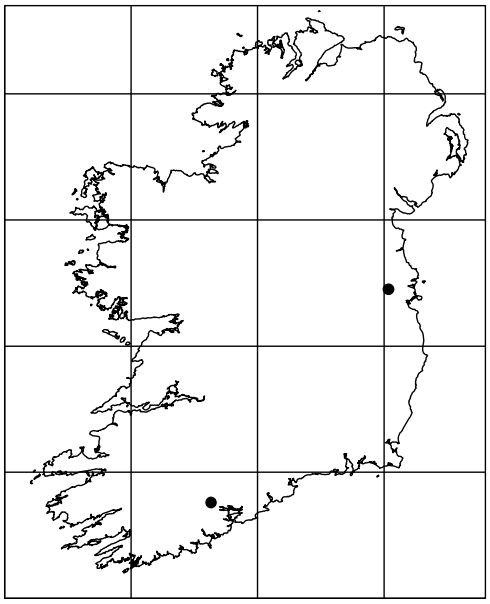


FIGURE 4. Distribution map for *Schendyla nemorensis* (C. L. Koch).

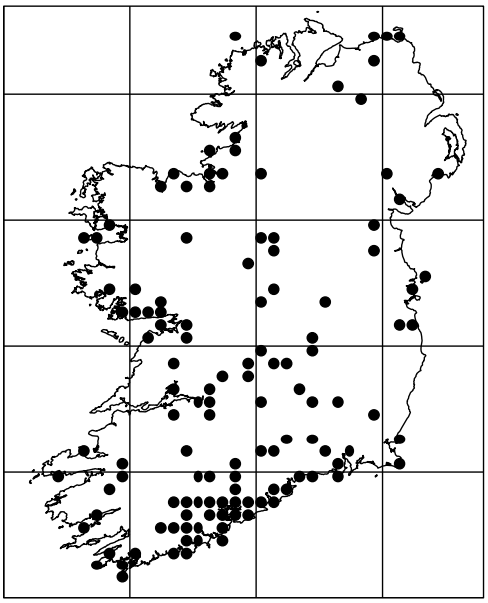


FIGURE 5. Distribution map for *Schendyla peyerimhoffi* Brolemann and Ribaut.

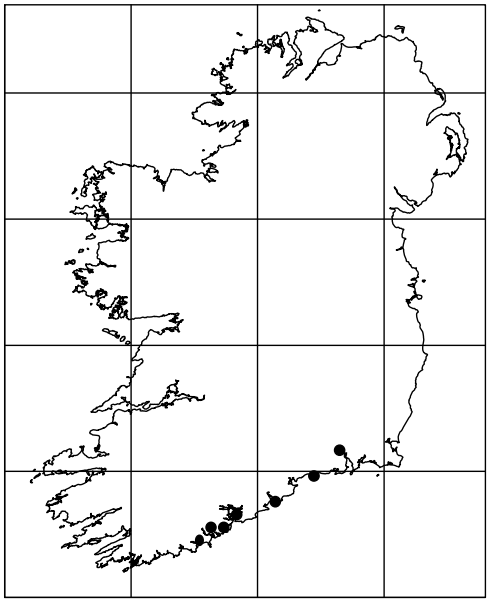


FIGURE 6. Distribution map for *Henia brevis* (Silvestri).

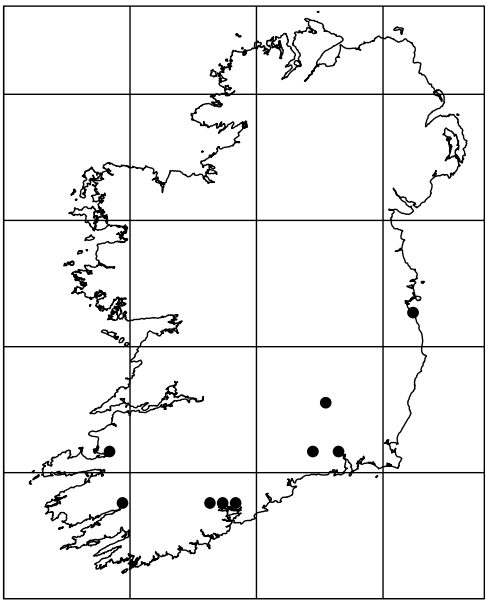


FIGURE 7. Distribution map for *Henia vesuviana* (Newport).

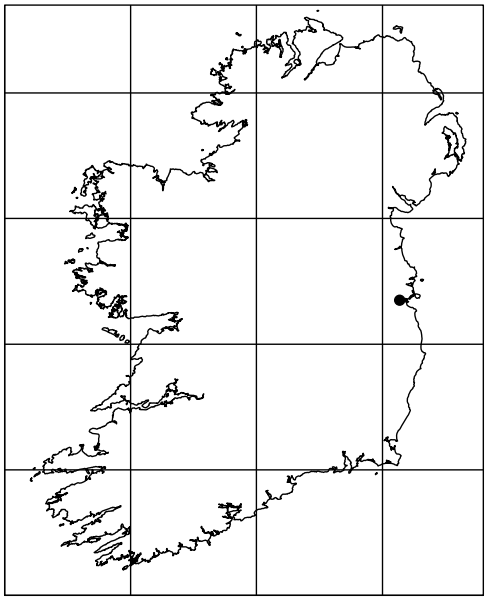


FIGURE 8. Distribution map for *Strigamia crassipes* (C. L. Koch).

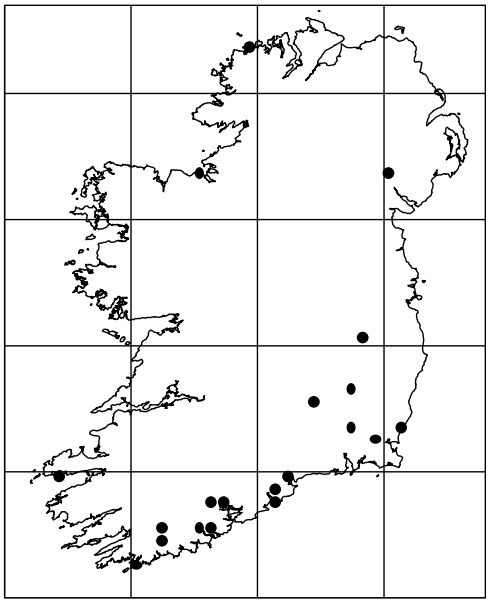


FIGURE 9. Distribution map for *Strigamia maritima* (Leach).

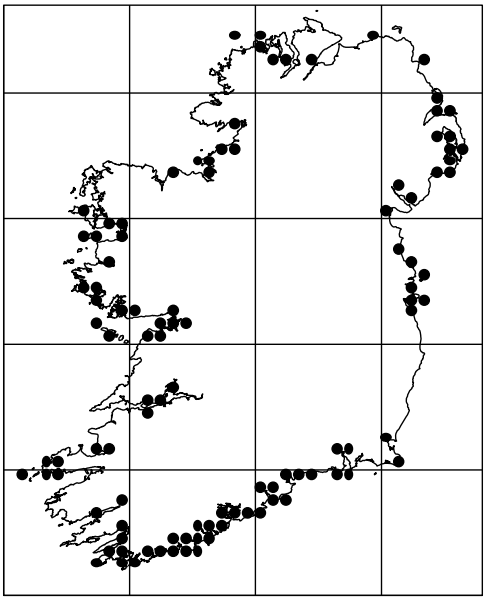


FIGURE 10. Distribution map for *Geophilus carpophagus* Leach *sensu stricto*.

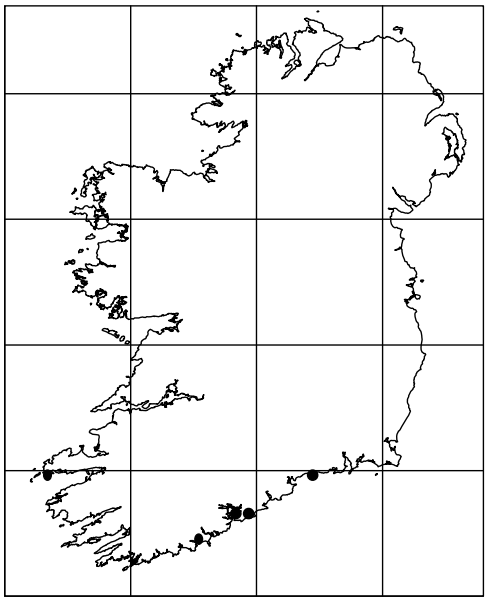


FIGURE 11. Distribution map for *Geophilus easoni* Arthur *et al.*

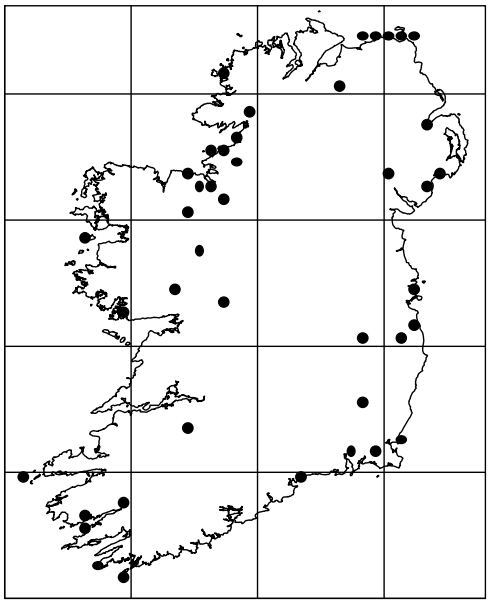


FIGURE 12. Distribution map for *Geophilus electricus* (L.).

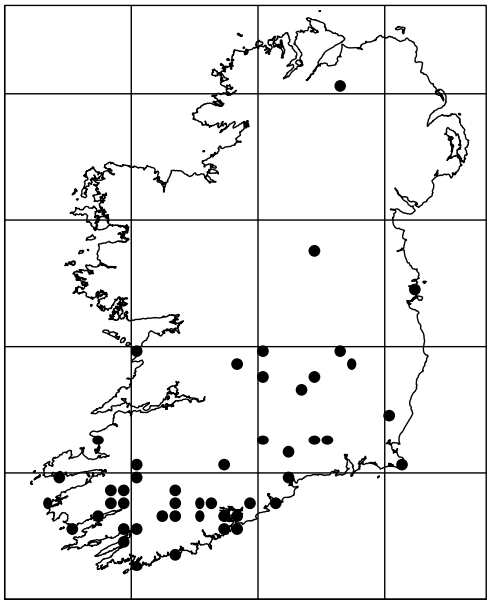


FIGURE 13. Distribution map for *Geophilus flavus* (De Geer).

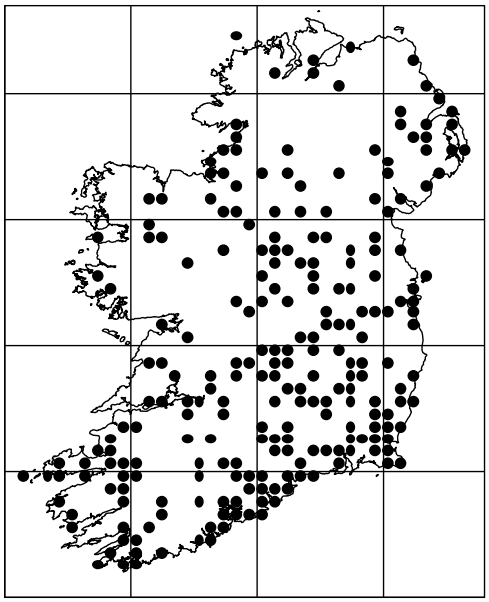


FIGURE 14. Distribution map for *Geophilus gracilis* Meinert.

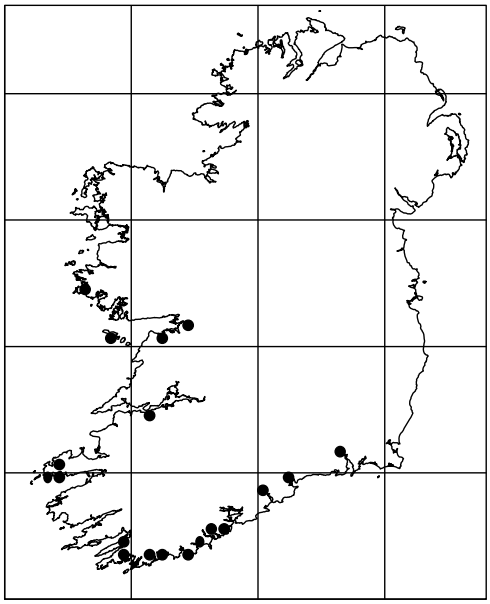


FIGURE 15. Distribution map for *Geophilus insculptus* Attems.

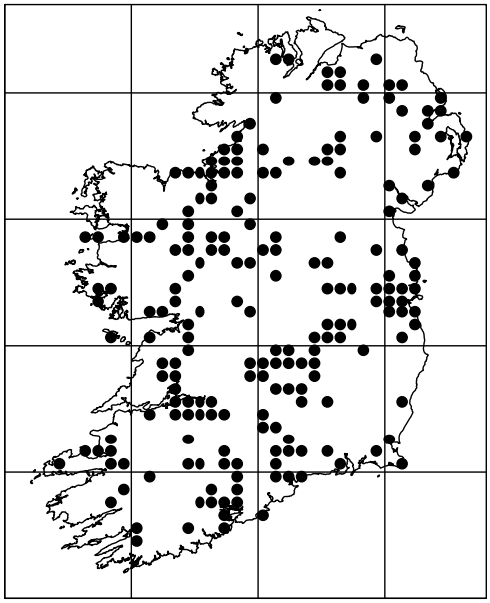


FIGURE 16. Distribution map for *Geophilus osquidatum* Brolemann

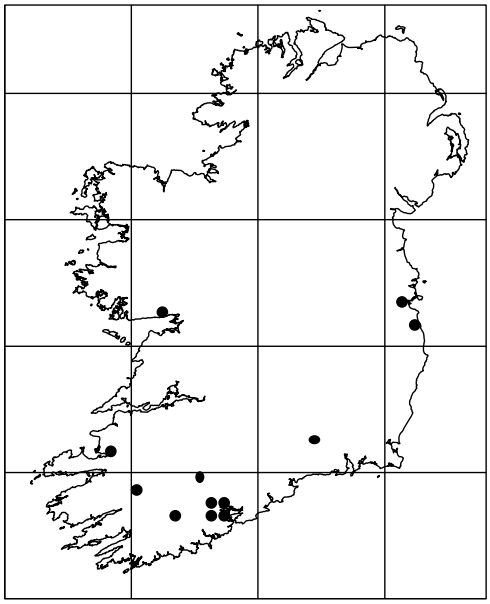


FIGURE 17. Distribution map for *Geophilus pusillifrater* Verhoeff.

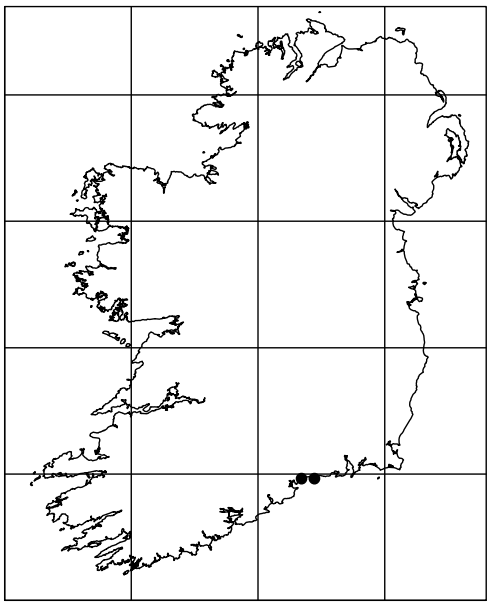


FIGURE 18. Distribution map for *Geophilus truncorum* (Bergsö and Meinert).

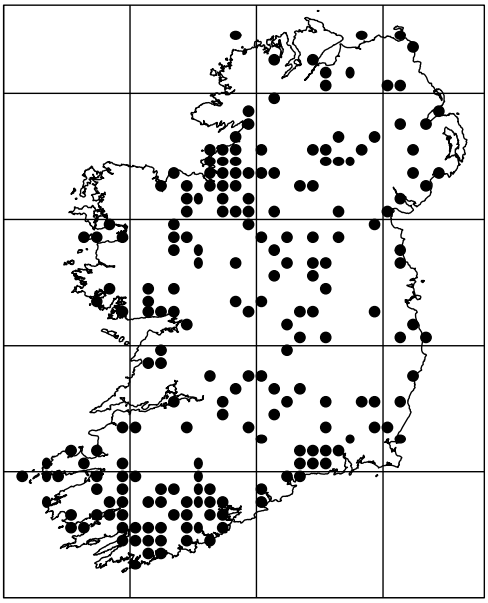


FIGURE 19. Distribution map for *Cryptops anomalans* Newport.

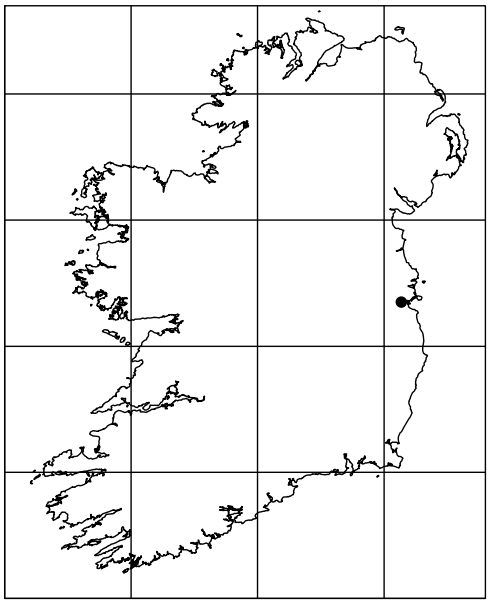


FIGURE 20. Distribution map for *Cryptops hortensis* (Donovan).

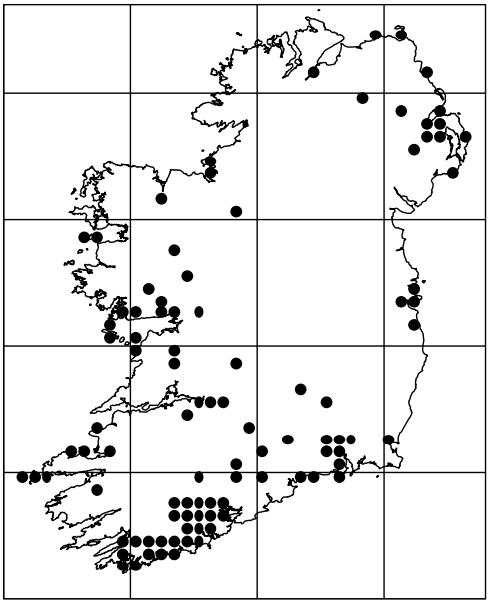


FIGURE 21. Distribution map for *Cryptops parisi* Brolemann.

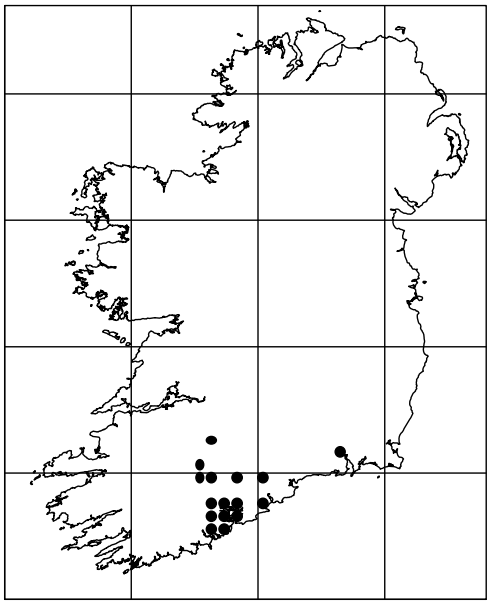


FIGURE 22. Distribution map for *Lithobius borealis* Meinert.

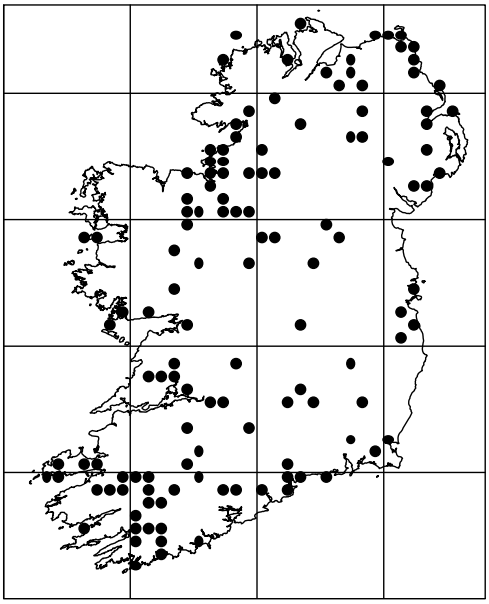


FIGURE 23. Distribution map for *Lithobius crassipes* L. Koch**.**

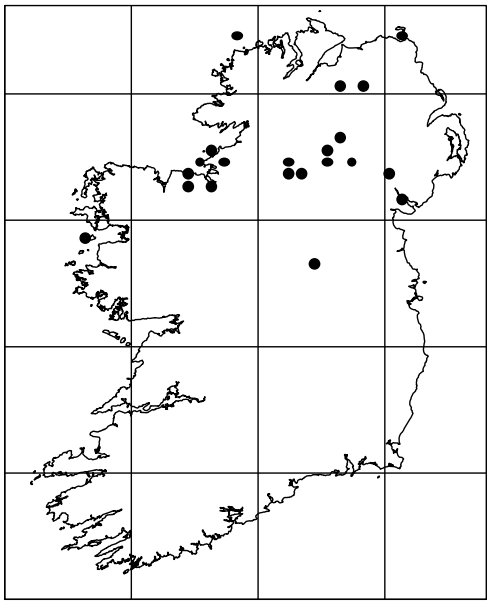


FIGURE 24. Distribution map for *Lithobius forficatus* (L.).

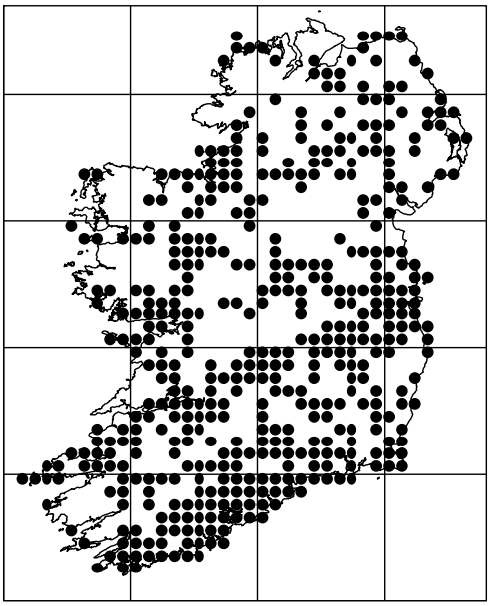


FIGURE 25. Distribution map for *Lithobius macilentus* L. Koch.

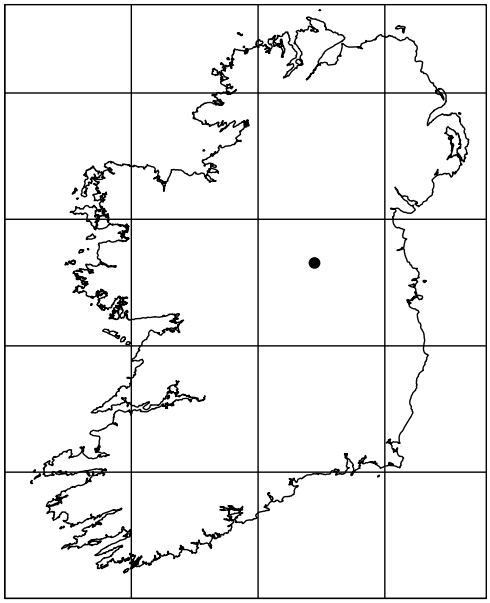


FIGURE 26. Distribution map for *Lithobius melanops* Newport.

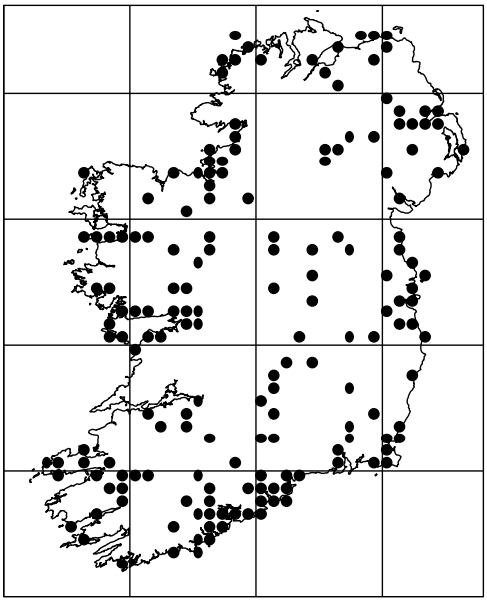


FIGURE 27. Distribution map for *Lithobius microps* Meinert.

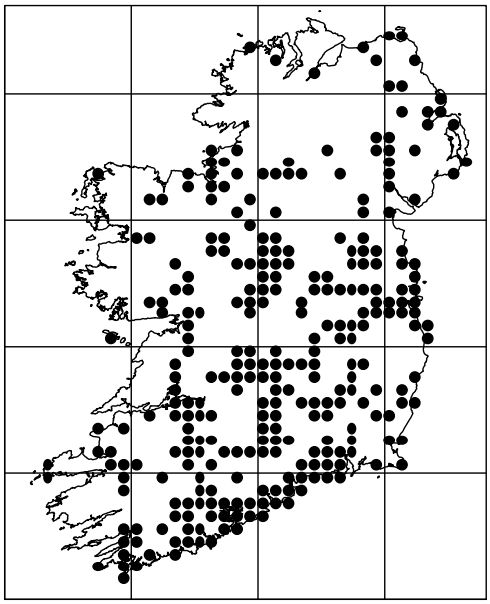


FIGURE 28. Distribution map for *Lithobius pilicornis* Newport.

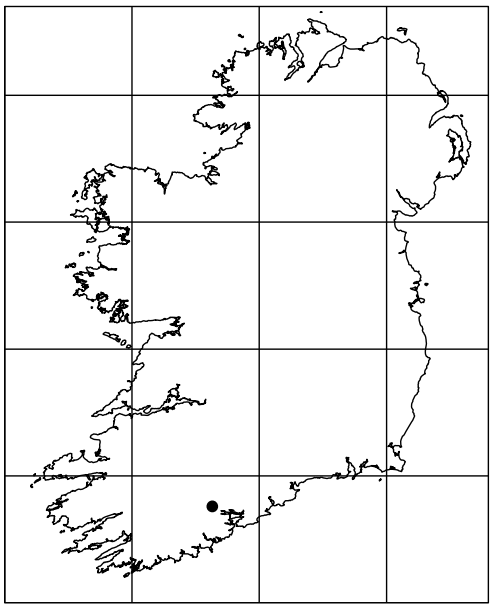


FIGURE 29. Distribution map for *Lithobius variegatus* Leach**.**

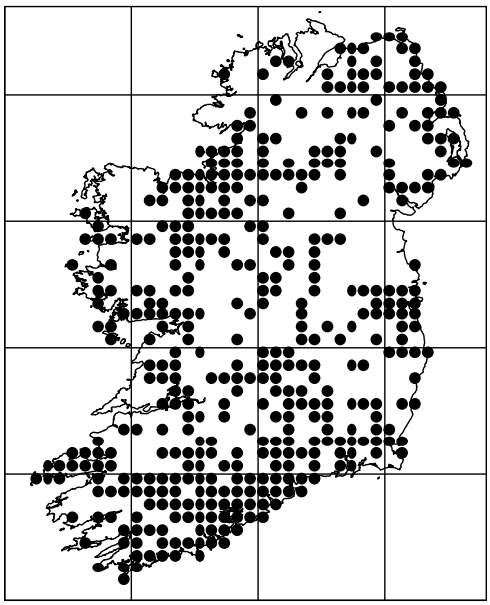
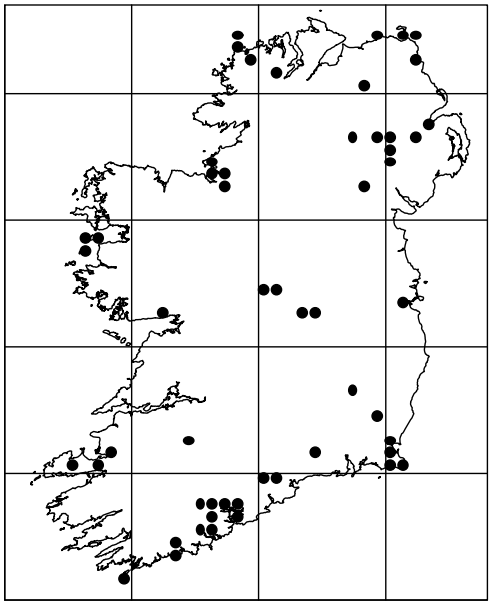


FIGURE 30. Distribution map for *Lamyctes emarginatus* (Newport)**.**



Bulletin of the Irish Biogeographical Society **No. 34** (2010)

ROVE-BEETLES (COLEOPTERA: STAPHYLINIDAE) FROM NORTH-WEST GALICIA COMPARED WITH THE IRISH FAUNA: LUSITANIAN GLACIAL REFUGE HYPOTHESIS NOT SUPPORTED

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[1]*Glinny, Riverstick, Co. Cork, Ireland.*

[2]*Courtmacsherry, Co. Cork, Ireland.*

Abstract

There are over 650 staphylinid beetle species recorded from Ireland, but none of these species are in the Hiberno-Cantabrian subset of 'Lusitanian' species (i.e. occurring in northern Iberia and Ireland, but not in Great Britain). A sample of 81 species of Staphylinidae, recorded from recently created grasslands and young tree plantations in north-west Galicia, included two distinct components which are unknown outside of Iberia, the Pyrenees and Morocco: a set of flightless paederine species, and a set of montane species. If flightless Hiberno-Cantabrian invertebrates such the Kerry Slug (*Geomalacus maculosus* Allman) (Mollusca) were able to colonise south-west Ireland naturally, then why not one or more flightless Galician paederines? Similarly, if montane species such as the saxifrages St Patrick's Cabbage *Saxifraga spathularis* and Kidney-leaved Saxifrage *S. hirsuta* (Saxifragaceae) were also able to survive in an offshore glacial refuge, then why did not one of more Iberian montane staphylinids? Instead, the Hiberno-Cantabrian fauna is dominated by 'flower-pot-loving' groups easily dispersed by human activity: slugs, snails, woodlice and an earthworm. The absence of expected Hiberno-Cantabrian staphylinid species does not support the Lusitanian glacial refuge hypothesis.

Introduction

A small set of the Irish terrestrial flora and fauna, absent from Great Britain but occurring in northern or north-west parts of the Iberian peninsula, are typical examples of the 'Lusitanian element' of the Irish biota, named after the ancient Roman province which now forms most of Portugal and part of mid-western Spain. Species with this 'Lusitanian' distribution include the saxifrages *Saxifraga spathularis* and *S. hirsuta* (see Fig. 1, Waldren and Scally, 1993) and the Kerry Slug *Geomalacus maculosus* Allman (see Fig. 7, Platts and Speight, 1988). The Large-flowered Butterwort (*Pinguicula grandiflora*) has a similar distribution but it also occurs in the montane areas of south-east France (Webb, 1983). A different but related distribution pattern is provided by the Pyrenean Glass Snail (*Semilimax pyrenaicus* Férussac), which only occurs in the Pyrenees and Ireland (Anderson, 1991). Further examples are listed in Praeger (1932), Beirne (1952) and Kingston and Waldren (2005).

There are four hypotheses explaining the occurrence of these species of Lusitanian origin in Ireland: **(1)** Survival in a 'glacial refuge' off the south-west of Ireland during all or the latter part of the last glacial period and subsequent natural colonisation (e.g. Forbes, 1846; Scharff, 1899; Southern, 1909; Praeger, 1932; Beirne, 1952; Webb, 1983; Moore, 1987; Rowe *et al*., 2006; Teacher *et al*., 2009; see Appendix 1); **(2)** Natural colonisation from Iberia via a post-glacial 'land-bridge' linking France to Ireland (e.g. Carpenter, 1895; Mitchell, 1976; Seyd, 1992; Kingston and Waldren, 2006; see Appendix 1); **(3)** Dispersal by natural dispersal agents such as wind, birds or water (see Webb, 1983; Moore, 1987; Seyd, 1992; Kingston and Waldren, 2005); **(4)** Accidental or deliberate human introduction (e.g. Hennessey, 1867; Corbet, 1961; McCarthy, 1984; Foss and Doyle, 1988; Mascheretti *et al*., 2003; Kingston and Waldren, 2005; Martinkova *et al*., 2007; see Appendix 1).

In a study of the 'Lusitanian' Ericaceae, Kingston and Waldren (2005, 2006) pointed out that each species needs to be considered separately for the applicability of the above hypotheses. Nevertheless, the question remains as to the validity of the glacial refuge hypothesis

for any of the species of Lusi tanian origin. Proposing such a hypothesis in order to explain the occurrence of just a few odd species of the Irish biota has been criticised by Speight (1986), and Corbet (1961) wondered why Lusitanian vertebrates such as rodents and lizards did not survive also.

In nearly all discussions of the Irish biota of Lusitanian origin, at least in the publications cited here, little mention has been made of the existing fauna of north-west Spain, northern Portugal, the Cordillera Cantabrica and the Pyrenees, in terms of the potential species pool from which the Irish-Lusitanian fauna could have recolonized. A set of 81 species of rove-beetle (Staphylinidae) from the catchment of the River Eume in the euatlantic part of north-west Galicia is reported here, and compared to the known Hiberno-Cantabrian fauna of this group in Ireland.

Methods

Definition of 'Hiberno-Cantabrian' species

The subset of 'Lusitanian' species referred to here is termed Hiberno-Cantabrian (Kingston and Waldren, 2005). They include species occurring in Ireland and northern Iberia, but exclude: (a) marine species, where the sea obviously was not a barrier (e.g. Vork and Thomsen, 1996); (b) Mediterranean species not recorded from north-west Iberia or the Pyrenees (e.g. the woodlouse *Acaeroplastes melanurus* (Budde-Lund) (Oliver and Meecham, 1993)); (c) species which also occur in Great Britain (e.g. the snail *Testacella maugei* Férussac, the woodlouse *Porcellionides cingendus* (Kinahan) and the ground-beetle *Nebria complanata* (L.) (Praeger, 1932; Kerney *et al*., 1979; Oliver and Meecham, 1993; Luff, 1998)). This contrasts with the much broader concept of 'Lusitanian' by Beirne (1952): "the term *Lusitanian* is applied to western European species that have their centres of distribution in the Iberian region (Atlanto-Mediterranean species) and that reach the northern limits of their ranges in the British Isles." However, the Hiberno-Cantabrian sub-set is preferred because it focuses the question on the group of species considered to be of particular biogeographic interest, because of their absence from Great Britain.

Site

Adult rove-beetles (Staphylindae) were collected from a rehabilitated open-cast mined landscape west of As Pontes de Garcia Rodriguez (UTM 29T 590481), in the valley of the River Eume in the La Coruña region of north-west Galicia, using suction sampling, pitfall trapping and leaf litter sieving. For ease of reading, As Pontes de Garcia Rodriguez is hereafter abbreviated to 'As Pontes' (which is Galician for 'the bridges'). Sampling was carried out in grasslands and young tree plantations (Downy Birch *Betula pubescens*, Common Alder *Alnus glutinosa*, Spanish Chestnut *Castanea sativa*, Monterey Pine *Pinus radiata* and Maritime Pine *P. pinaster*), on a large area (>200ha.) of rehabilitated phyllite mine spoil (see Gil Bueno *et al*., 1990). All staphylinid species would have either recolonized naturally or have been brought into the area in locally sourced topsoil. Sampling was undertaken in June 1993 and May 1995; detailed results are to be published elsewhere.

Identification

Staphylinidae were identified to species using keys and descriptions in the following, in addition to standard Central and Northern European works: Coiffait (1974, 1978, 1982, 1984), Outerelo and Gamarra (1985) and Zerche (1990). Species which could not be reliably determined, using the available keys which did not cover the Spanish fauna, are excluded from the results; these were usually single individuals. Aedeagi and (where relevant) spermathecae of representatives of most species were dissected to confirm their identity. Voucher specimens have been retained in the senior author's collection and deposited in the collections of the Universidad Complutense de Madrid. Nomenclature of Staphylinidae follows Lott (2008) for Irish and British species, and Smetana (2004) and Assing (2006) for Iberian species.

Results

As Pontes

In total, 81 species of Staphylinidae were identified from near As Pontes, of which 67 (83%) are also recorded from Ireland (Table 1). Of the 81 species, seven (8.5 %) are known only from

the Iberian peninsula and the Pyrenees, and (2 species) also from Morocco. Of these seven, four are flightless paederines (*Astenus truncatus*, *Medon cauchoisi*, *Nazeris atlanticus* and *Parameropaederus lusitanicus*), and two are montane species (*Boreaphilus guadarramus* and *Gabrius laticollis*).

A single male of *Astenus truncatus* was recorded in a 12-year-old *Castanea sativa* plantation (18 May 1995). It is known from Portugal and Galicia (Coiffait, 1984; Assing, 2003; Gamarra and Outerelo, 2007).

Three individuals of *Boreaphilus guadarramus* were also recorded from the *Castanea* plantation (18 May 1995). *B. guadarramus* is restricted to montane areas of Iberia, with records from central Spain, Leon and central Portugal (Zerche, 1990).

Four specimens of *Gabrius laticollis* were recorded, two from a young plantation of *Pinus radiata*, *P. pinaster* and *Alnus glutinosa* (18 May 1995), one from a young *A. glutinosa* plantation with grasses (21 June 1993), and one from a six-year-old *Festuca*-dominated grassland (18 May 1995). This species is known only from subalpine and alpine areas of the eastern Pyrenees and the Sierra Cantabrica, although it has been recorded from as far west as the Pontevedra region of Galicia (Coiffait, 1974).

A single male *Medon cauchoisi* Jarrige (=*lusitanicus* Coiffait) was recorded from the 10-year-old birch (*Betula pubescens*) plantation (24 June 1993). *M. cauchoisi* (*sensu lato*) is widespread in Iberia, and also recorded from the Pyrenees and Morocco (Coiffait, 1984; Gamarra and Outerelo, 2007).

Nine individuals of the paederine *Nazeris atlanticus* were sieved from birch leaf-litter in a 10-year-old *Betula pubescens* plantation (21 June 1993, 16 May 1995), and a single specimen was obtained in each of four young restored grassland sites (June 1993, May 1995). The species is only known from north-west Spain and northern Portugal (Coiffait, 1984; Gamarra and Outerelo, 2007). The large sickle-like mandibles suggest that the species preys on Collembola.

Another distinctive paederine, *Parameropaederus lusitanicus*, was represented by a single male from a four-year-old restored grassland (20 May 1995). It is known only from north-west

Spain and Portugal (Coiffait, 1982; Gamarra and Outerelo, 2007).

Quedius pineti occurred in numbers in the *Castanea sativa* (n=5), *Pinus radiata* (n=8) and *Betula pubescens* (n=4) plantations, and as a single individual in grassland (all May 1995). The species is known from Portugal and Spain (Coiffait, 1978) and also Morocco (Smetana, 2004).

The relative abundance of old grassland species at As Pontes also shows strong similarity with Irish grasslands. For instance, *Stenus impressus* was the most abundant species (up to 207 individuals in one sample); it was the dominant species in samples from the Burren limestone grasslands in Co. Clare (Good, 2004). *Stenus ossium* was also dominant (up to 105 in one sample); in equivalent samples from south-west Cork it was the first or second most abundant species (Good and Giller, 1992). *Sepedophilus nigripennis* was also abundant in grassland samples (up to 49 in one sample); it is a dominant species in grasslands on the south Irish coast (Good, 1999). Also, species such as *Metopsia retusa* (up to 4 in one sample) and *Micropeplus staphylinoides* (up to 43 in one sample) occur regularly in Irish limestone grasslands (Good, 2004), and *Astenus lyonessius* (up to 30 in one sample) has been recorded in numbers from esker and sea-cliff grasslands (Good, 1999; J. A. Good, unpublished). Taken together, this indicates that the habitat conditions in As Pontes were similar to those in the south-west and west of Ireland.

Comparative faunistic data

Lott (2001) lists 34 Atlantic/Mediterranean species of Staphylinidae occurring in Great Britain and Ireland, but not recorded from Germany. Only eleven (36%) of these have been recorded in Ireland (Anderson *et al*., 1997; Regan and Anderson, 2004) and all occur also in Great Britain: *Brachygluta waterhousei* (Rye), *Cafius fucicola* Curtis, *Gabius velox* Sharp, *Heterota plumbea* (Waterhouse), *Myrmecopora brevipes* Butler, *Ocypus fortunatarum* Wollaston, *Parameotica difficilis* (Brisout), *Phyllodrepa devillei* Bernhauer, *Phytosus nigriventris* (Chevrolet), *Quedius schatzmayri* Gridelli and *Stenus aceris* Stephens.

Of the five species of Staphylinidae recorded from Ireland but not from Great Britain (*Acrotona convergens*, *Micropeplus caelatus*, *Philonthus furcifer*, *Stenus glabellus*, *Stenus*

palposus) (Lott, 2001, 2009), none have an Atlantic/Mediterranean type of distribution, and all five occur in Central Europe. Thus, despite the large number of Irish species in this family (>650), none are Hiberno-Cantabrian species as defined above.

Beirne (1952) lists two staphylinid species as Lusitanian: *Cafius cicatricosus* (Erichson) and *Myrmecopora uvida* (Erichson). The former, *C. cicatricosus*, has not been recorded from Ireland (Anderson *et al*., 1997; Hammond 2000). The latter, *M. uvida*, has been recorded from the east coast of Ireland and the coast of southern Britain (Hammond, 2000) as well as in France, Germany and the Netherlands (Smetana, 2004). They are thus 'Lusitanian' in the very wide sense.

Finally, the distribution of *Sepedophilus lusitanicus* Hammond also corresponds to the much broader Atlantic concept of 'Lusitanian' than used here, extending from southern Spain (Malaga, Gibraltar) and the Canary Islands to Belgium and England (Hammond, 1971), but notably not Ireland (although it may have been overlooked given the recent description of this species). The species was recorded from young plantations of *Pinus/Alnus* (2) and *Castanea* (1), as well as from 5-year old grassland colonized by *Sarothamnus* sp. (1). In Great Britain, it has been recorded particularly under pine (Hammond, 1971).

Discussion

Refugia should accommodate a wide subset of the regional biota, not just a few taxa (Lynch, 1988). Therefore, the Hiberno-Cantabrian biota should include a set of Iberian species of equivalent survival or dispersal ability, across a range of taxonomic groups. The sample of the staphylinid fauna recolonising new habitat in north-west Galicia (Table 1) does include a set of species which are potentially Hiberno-Cantabrian, yet all of these are absent from Ireland. Furthermore, none of the five staphylinid species recorded in Ireland but not in Great Britain are Hiberno-Cantabrian, despite there being 34 species of Atlantic/Mediterranean species recorded in Great Britain (Lott, 2001).

The proportion of potential Hiberno-Cantabrian staphylinid species from the fauna of north-west Galicia recorded in the sample reported here (8.5%) is almost certainly an underestimate. Evidence for this is provided by Baselga and Novoa (2006), who listed a similar number (83) of leaf beetles (Chrysomelidae) from the Parque Natural del Eume, also in the catchment of the River Eume valley west of As Pontes. They recorded approximately twice the amount of Iberian/Pyrenean/Moroccan species of leaf-beetle (15 (18%) cf. 7 (8.5%)).

The fauna involved in the primary recolonisation of a newly created landscape, such as at As Pontes, is more likely to contain species with better recolonisation ability than that from natural or semi-natural habitats. As a result it could be predicted that a much higher proportion of species would be represented which are also Irish (i.e. with more efficient geographical colonisation ability). This is also borne out by comparison with the chrysomelid data in Baselga and Novoa (2006): Irish species of Staphylinidae from As Pontes rehabilitated mine 67 (83%); Irish species of Chrysomelidae from Parque Natural del Eume 36 (43.5%).

Both As Pontes mine and Parque Natural del Eume are within 25km of the Atlantic coast, and within the recorded range, for example, of the Iberian populations of the Kerry Slug (*Geomalacus maculosus*) (Platts and Speight, 1988) and the Lusitanian earthworm *Lumbricus friendi* Cognetti (Rodríguez *et al*., 1997). Parts of this area would be expected to provide the type of conditions suitable for a source pool of Atlantic Lusitanian fauna which could have colonized a refuge off south-west Ireland; this conclusion is supported by the similarity in relative abundance of staphylinid species from both areas.

If montane Lusitanian species like Irish Heath *Daboecia cantabrica*, Large-flowered Butterwort *Pinguicula grandiflora*, St Patrick's Cabbage *Saxifraga hirsuta* and Kidney-leaved Saxifrage *S. spathularis* could survive in an offshore refuge during at least part of the Pleistocene, then why could not an associated montane Lusitanian insect fauna with species like *Boreaphilus guadarramus* or *Gabrius laticollis*? If flightless molluscs, earthworms and woodlice such as *Geomalacus maculosus*, *Semilimax pyrenaicus*, *Lumbricus friendi* and *Oritoniscus flavus* (Budde-Lund, 1906) could naturally colonise and survive in a Younger

Dryas period refuge (*circa* 11,000 years ago (see Rowe *et al*. (2006)), then why did not one or more flightless paederines like *Astenus truncatus*, *Medon cauchoisi*, *Nazeris atlanticus* or *Parameropaederus lusitanicus*?

It could be argued that some of the paederine staphylinids in this area of north-west Galicia require higher temperatures or seasonally drier soil conditions than are available in western Ireland, because some of them are not restricted to north-west or Atlantic Iberia. However, several of the classic Hiberno-Cantabrian species also have a wider distribution in Iberia than just the north-west and the Pyrenean-Cantabrian mountains. Like *Parameropaederus lusitanicus*, *Daboecia cantabrica* occurs at sites in Atlantic Portugal and central Spain, despite it requiring a humid 'Atlantic' climate (Kingston and Waldren, 2005). Similarly, like *Medon cauchoisi* which occurs in southern Portugal and other parts of Spain, so Mediterranean Heath *Erica erigena* is also known from southern Portugal, and at localities in south and east Spain (Kingston and Waldren, 2005). Of other classic Hiberno-Cantabrian species, the Strawberry Tree *Arbutus unedo* is widespread in Iberia (Mitchell, 1993), and the earthworm *Lumbricus friendi* also occurs in high altitude wet areas in Iberia outside of the north-west (Rodriguez *et al*., 1997). The distribution of potential Hiberno-Cantabrian staphylinid species in localities in central or southern Iberia does not, therefore, mean that they are all too thermophilous or xerophilous to survive in Ireland.

As shown by both the relatively small faunistic sample of staphylinid beetles (Table 1), and also the inventory of chrysomelid beetles (Baselga and Novoa, 2006) (both from the Eume catchment in north-west Galicia), there is a significant pool of Lusitanian species occurring in north-west Spain which could have potentially colonized Ireland. But the classic Hiberno-Cantabrian biota is characterised by a set of species, dominated by heathers, other useful plants, and invertebrates of 'flower-pot-loving' groups easily dispersed by human activity (slugs, snails, woodlice and an earthworm). This biased subset of a much wider potential species-pool does not support the Lusitanian glacial refuge hypothesis. The human introduction hypothesis may have been too hastily dismissed by some proponents of glacial refuges. For instance, Southern (1909) rejected the human introduction hypothesis for the Pyrenean earthworm

Lumbricus friendi with little argument. However, the species has since been accidentally introduced by human transport into North America (Csuzdi and Szlawecz, 2003).

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TABLE 1. Staphylinidae (rove-beetles) recorded from grassland and young tree plantations on rehabilitated mine spoil near As Pontes de Garcia Rodriguez (Galicia), classed according to their geographical occurrence in Anderson *et al*., 1997, Lott, 2008 and Smetana, 2004. Nomenclature follows Lott (2008) (except *Atheta sensu lato*), Smetana (2004) and Assing (2006).

Species also recorded in Ireland [n=67]

Acrotona muscorum (Brisout), *Aloconota gregaria* (Erichson), *Amischa analis* (Gravenhorst), *Amischa decipiens* (Sharp), *Anthobium atrocephalum* (Gyllenhal), *Astenus lyonessius* (Joy), *Atheta amplicollis* (Mulsant and Rey), *Atheta fungi* (Gravenhorst), *Atheta orbata* (Erichson), *Drusilla canaliculata* (Fabricius), *Gyrohypnus angustatus* Stephens. *Habrocerus capillaricornis* (Gravenhorst), *Ischnosoma longicorne* (Mäklin), *Ischnosoma splendidum* (Gravenhorst), *Liogluta longiuscula* (Gravenhorst), *Lordithon thoracicus* (Fabricius), *Metopsia clypeata* (Müller), *Micropeplus staphylinoides* (Marsham), *Mycetoporus lepidus* (Gravenhorst), *Mycetoporus longulus* Mannerheim, *Oligota inflata* (Mannerheim), *Omalium rugatum* Mulsant and Rey, *Othius angustus* Stephens, *Othius punctulatus* (Goeze), *Othius subuliformis* Stephens, *Oxypoda haemorrhoa* (Mannerheim), *Oxypoda lurida* Wollaston, *Paederus caligatus* Erichson, *Philonthus carbonarius* (Gravenhorst), *Philonthus cognatus* Stephens, *Quedius boops* (Gravenhorst), *Quedius curtipennis* Bernhauer, *Quedius fumatus* (Stephens), *Quedius molochinus* (Gravenhorst), *Quedius nigriceps* Kraatz, *Quedius nitipennis* (Stephens), *Quedius schatzmayri* Gridelli, *Quedius semiobscurus* (Marsham), *Quedius simplicifrons* Fairmaire, *Rugilus erichsoni* (Fauvel), *Rugilus geniculatus* (Erichson), *Rugilus orbiculatus* (Paykull), *Sepedophilus immaculatus* (Stephens), *Sepedophilus nigripennis* (Stephens), *Stenus brunnipes* Stephens, *Stenus cicindeloides* (Schaller), *Stenus flavipes* Stephens, *Stenus fulvicornis* Stephens, *Stenus impressus* Germar, *Stenus juno* (Paykull), *Stenus melanarius* Stephens, *Stenus nitidiusculus* Stephens, *Stenus ossium* Stephens, *Stenus picipes* Stephens, *Stenus providus* Erichson, *Stenus similis* (Herbst), *Sunius propinquus* (Brisout), *Tachinus laticollis* Gravenhorst, *Tachinus rufipes* (Linnaeus), *Tachyporus chrysomelinus* (Linnaeus), *Tachyporus dispar* (Paykull), *Tachyporus hypnorum* (Fabricius), *Tachyporus nitidulus* (Fabricius), *Tachyporus*

pusillus Gravenhorst, *Tachyporus solutus* Erichson, *Tachyporus tersus* Erichson, *Xantholinus longiventris* Heer.

Also recorded in Britain (but not in Ireland) [n=6]

Heterothops dissimilis (Gravenhorst), *Oxypoda praecox* Erichson, *Sepedophilus lusitanicus* Hammond, *Stenus assequens* Rey, *Stenus ludyi* Fauvel, *Stenus subaeneus* Erichson.

Also recorded in Central & Southern Europe (but not in Britain or Ireland) [n=1]

Quedius suturalis Kiesenwetter.

Restricted to Iberia / Pyrenees [n=5]

Astenus truncatus Coiffait, *Boreaphilus guadarramus* Sharp, *Gabrius laticollis* Fauvel, *Nazeris atlanticus* Coiffait, *Parameropaederus lusitanicus* Aubé.

Restricted to Iberia / Pyrenees + Morocco [n=2]

Medon cauchoisi Jarrige (= *lusitanicus* Coiffait), *Quedius pineti* Brisout de Barneville.

APPENDIX 1. Citations from selected publications referring to the glacial refuge hypothesis.

Praeger (1932): "On the knowledge at present available I am inclined to think that ... certain plants and animals, ... including ... probably the Lusitanian element, ... survived the main glaciations; these oldest elements having migrated northward in Pre-glacial times along the western European coastline".

Beirne (1952): "The Celtic Land. This name may be applied to the ice-free region that existed west and south-west of the British Ice sheets. ... In its southern region, that between what are now southern Ireland and northern France, the climate must have been relatively temperate because of its low altitude, southerly position, and relatively great distance from the ice fronts, as well as its proximity to the ocean. As will be shown later, this is confirmed by the distribution of the fauna; a much larger number of temperate-phase arrivals survived glacial phases in this than in any other area."

Webb (1983): On *Pinguicula grandiflora*: "...as I can see no likely staging posts for its advance northwards, either from the Jura or the Pyrenees, in post-glacial time, I consider that it too dates from interglacial times as an Irish plant."

"It is concluded that for most of them [Atlantic flora absent from Great Britain] the supposition that they survived the last glaciation in Ireland or on land now submerged off its west coast is less unlikely than any alternative explanation."

Mitchell (1976): "A second path led up the west coast of Europe, and at least one plant - the Strawberry Tree (*Arbutus unedo*) - travelled its full length from the Mediterranean to the islands of Lough Gill in Sligo. ...there was a coastal strip along which movement into Ireland was possible, as is convincingly demonstrated by the modern distribution of the shore-living bug *Aepophilus bonnairei*. The modern headquarters of this insect, which lives in rock-crevices near low-tide mark and can neither swim nor fly, are on the Atlantic coast from Morocco to Portugal. It could not have survived the cold of the Nahanagan Stadial in the British Isles, and when warmth returned at the beginning of the Littletonian Warm Stage it marched north up the French coast, skirted the embayments that then occupied the English Channel and the south of

the Irish Sea, and made its way on to the Atlantic coast of Ireland."

Corbet (1961): "Recent authors have been forced to postulate glacial survival on land now submerged off south-west Ireland, or very early post-glacial colonization by land. We may ask first why a land link should have allowed passage of such a non-athletic creature as the slug *Geomalacus maculosus*, which typifies the Lusitanian element, and not of such vertebrates as rodents and reptiles which abound in Iberia? Alternatively, it is inconceivable that the vertebrates but not the invertebrates should have perished in a glacial re-advance. The present distribution of the Lusitanian species, confined to the warmest corner of Ireland, scarcely suggests great tolerance of peri-glacial conditions. On the other hand, trade between Iberia and Ireland has taken place since Mesolithic times, and the size and habits of the Lusitanian species predispose them to such a form of transport."

Mascheretti *et al*. (2003): "Currently there is no evidence of a temporary land-bridge between Ireland and continental Europe at the end of the last glaciations that could explain the Lusitanian element. Therefore, Corbet's (1961) suggestion that the Lusitanian element is attributable to human cultural exchanges between Ireland and southwest continental Europe is the most reasonable explanation of the data. During the process of human colonization of Ireland in the Mesolithic, or as a result of subsequent trading links, humans could have accidentally or deliberately transported a variety of species between these two areas."

Kingston and Waldren (2006): "There is evidence, however, of a founder effect in both *Daboecia cantabrica* and *Erica mackaiana*. This suggests that the populations have been separated for a considerable period, and points to them being native members of the Irish flora that arose through long distance dispersal north along the coastline of western Europe."

Rowe *et al*. (2006): On *Bufo calamita*: "Rapid warming after this glacial maximum around 20,000 years BP would have permitted population expansions from these non-Iberian refugia [perhaps in France], interrupted by the Younger Dryas climatic cooling (ca. 11,000 years ago), which was much less severe than the previous glacial maximum. ... A long-term Lusitanian refuge near Ireland throughout all the Pleistocene, however, is highly improbable. ... In the case

of *B. calamita* it appears that a modified version of the oldest Lusitanian hypothesis (Forbes, 1846), a local but relatively recent and short-lived refuge, is the most likely to be correct."

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RECORDS OF CHIRONOMIDAE (DIPTERA) IN IRELAND - TWENTY ADDITIONS AND NOTES ON FOUR MORPHOTYPES

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The recent inventory of Chironomidae in Ireland in the checklist of Irish Diptera by Chandler *et al.* (2008) updates the chironomid listing in Ashe *et al.* (1998) by including records, largely from Northern Ireland, by Langton (2002, 2004, 2005), Langton and Pinder (2007), Langton and Ruse (2006), McLarnon and Carter (2000) and other records from Murray (2000, 2006a), Murray and Baars (2006, 2007), Murray and Murray (2003, 2006) and Trodd and Murray (2004). The record of *Limnophyes platystylus* Murray, a species new to science from Co. Meath (Murray, 2007), was not available for inclusion in Chandler *et al* (2008). This paper provides data on new species records for the Irish chironomid checklist.

During projects supported by the Heritage Council of Ireland (Murray, 2005, 2006b) a number of additional, as yet unpublished, species records were obtained. Since 2006 seasonal collections of chironomid pupal exuviae have been regularly undertaken by field research staff of the Environmental Protection Agency from lakes in the Western, Northwestern, Shannon, Eastern and Southwestern River Basin Districts as part of the Agency's Lakes Monitoring Programme under the EU Water Framework Directive. While examining collections taken from 126 lakes in the years 2006, 2007 and 2008 for ecological assessment of lake water quality by the Chironomid Pupal Exuviae Technique -CPET (Wilson and Ruse, 2005) a more detailed study of some exuviae, readily identifiable to species level, has not only increased knowledge on the distribution of Chironomidae in Irish waters (4,600 species occurrence datapoints from examination of approximately 75,000 specimens) but has also resulted in some new records of species or taxa previously unknown from Irish waters. These records, together with others from

personal collections, including the unpublished data from the the above mentioned Heritage Council supported projects are presented here. Twenty species are reported from Ireland for the first time. Furthermore, the occurrence of three additional species in the Irish fauna is indicated by records of one known, but unnamed / undescribed species, and two unique pupal morphotypes. Approximately 510 chironomid species level taxa are now known from Ireland (Murray, Ashe and O'Connor, in prep.)

The following abbreviations are used in the text: BH - B. Hayes; BK - B. Kennedy; CB - C. Bradley; CP - C. Plant; DAM - D. A. Murray; DJD - D. J. Douglas; EPA - Environmental Protection Agency; GF - G. Free; JRB - J-R. Baars; LJH - L. J. Heneghan; PA - P. Ashe; PMC - P. McCreesh; RL - R. Little; WAM - W. A. Murray; WT -W. Trodd; Pe - pupal exuviae; Pm - pharate male; HCCIC - Heritage Council Collection of Irish Chironomidae (# numbers refer to numbered position in the reference collection in the National Museum of Ireland (NMI)).

Additions to the Irish faunal list

SUBFAMILY TANYPODINAE

***Labrundinia longipalpis* (Goetghebuer, 1921)** **New genus record for Ireland**

GALWAY: Lough Anaserd L605443, Pe 6 June 2007 and Pe 17 July 2007, RL-EPA.

According to Langton and Viser (2003), this species is widespread in Europe excluding Mediterranean regions. Larvae of *Labrundinia* are commonly reported from bog waters.

***Arctopelopia melanosoma* (Goetghebuer, 1933)**

KERRY: Lough Leane, Killarney V915888, ♂ 17 April 1973, DAM-DJD, #15 in HCCIC-NMI.

This record derives from re-examination of specimens collected in 1973 while assembling the HCCIC.

***Tanypus* (*Tanypus*) *kraatzi* (Kieffer, 1912)**

CORK: Lough Allua W180652, Pe 28 August 2008, CP-PMC-EPA; **MAYO**: Lough Knappabeg, Westport M010803, Pe 24 June 2008, BK-RL-EPA.

SUBFAMILY ORTHOCLADIINAE

***Bryophaenocladius aestivus* Brundin, 1947**

MAYO: Connemara National Park, Letterfrack L715575, ♂ on wing, 16 September 1986, LH, #67 in HCCIC -NMI.

This specimen had been previously misidentified and was noted in the re-examination of material being compiled for the HCCIC.

***Bryophaenocladius ictericus* (Meigen, 1830)**

DONEGAL: Glenveagh National Park C044228, ♂ at light near the Park Administration Office, 25 July 1985, LJH; **KERRY**: Eagles Lough, Knocknagantee V674782, Pe 25 April 2005, JRB, #174 in HCCIC-NMI.

***Bryophaenocladius xanthogyne* (Edwards, 1929)**

WEXFORD: Crossabeg stream, Castletown T023270, Pe 6 May 2006, DAM-WAM, #991 in HCCIC-NMI.

***Metriocnemus* (*Metriocnemus*) *inopinatus* Strenzke, 1950**

LEITRIM: Lough Allen G950145, Pe 9 September 2008, GF-WT-EPA.

***Rheocricotopus* (*Psilocricotopus*) *tirolus* Lehmann, 1969**

KERRY: Lough Brin V783775, Pe 18 June 2008 and 10 September 2008, CP-PMC-EPA.

***Smittia nudipennis* (Goetghebuer, 1913)**

WICKLOW: Glendasan, Wicklow Mountain National Park T1000982, ♂ 24 June 1996, DAM, #535 in HCCIC-NMI.

SUBFAMILY CHIRONOMINAE

Tribe Chironomini

***Cryptochironomus redekei* (Kruseman, 1933)**

GALWAY: Lough Ballynahinch L777478, Pe 6 June 2007 and 23 July 2007, RL-EPA; Lough

Caherglassaun M412061, Pe 13 June 2007 and 17 August 2007, RL-EPA; Lough Lettercraffroe M056376, Pe 14 June 2007, RL-EPA; Lough Tully N695618, Pe 5 June 2007, RL-EPA; **LEITRIM**: Lough Boderg N020910, Pe 25 June 2008, GF-EPA.

***Cladopelma bicarinatum* (Brundin, 1947)**

KERRY: Lough Guitane W025846, Pe 18 July 2008, CP-PMC-EPA; Lough Cummernamuck V745897, Pe 20 June 2008, CP-PMC-EPA; Lough Currane V535664, Pe 22 July 2008, CP-PMC-EPA; **LEITRIM**: Lough Annary G817338, Pe 10 June 2008 and 23 July 2008, GF-WT-EPA.

Brundin (1947) originally described this species in the genus *Harnischia* as *Harnischia bicarinata*. However, Spies and Sæther (2004) point out, from application of Article 31.2 of the International Code of Zoological Nomenclature (ICZN, 1999), that the ending of the species name should change to *bicarinatum* to match the neutral gender of the genus *Cladopelma.*

***Cladopelma virescens* (Meigen, 1818)**

CAVAN: Lough Atrain, Garbrattan H364051, Pe 16 September 2007, EPA; **GALWAY**: Lough Ross, Moycullen M188365, Pe 5 September 2007, EPA; **LEITRIM**: Acres Lough G968099, Pe 11 June 2008, GF-EPA; Lough Rinn N095943, Pe 18 July 2008, GF-WT-EPA; **TIPPERARY**: River Suir, Kilsheelin S285230, 1966, Pe, M. Kennedy, #630 in HCCIC-NMI (This specimen had been reported as *C. laccophilus* Kieffer in Murray (1972)).

***Demicryptochironomus* (*Irmakia*) *neglectus* Reiss, 1988**

MAYO: River Bunowen, Louisburg L807807, ♂ 5 August 2004, DAM-WAM.

***Parachironomus varus* (Goetghebuer, 1921)**

MAYO: Lough Carra M165680, Pe 19 June 2008, BK-RL-EPA.

Tribe Tanytarsini

***Cladotanytarsus iucundus* Hirvenoja, 1962**

CORK: Lough Ballin W199389, Pe 21 August 2008, CP-PMC-EPA; **KERRY**: Lough Gill Q603139, Pe 18 September 2008, CP-PMC-EPA; **MAYO**: Lough Moher L977766, Pe 24 June 2008, RL-EPA; **SLIGO**: Lough Easky G446230, Pe 18 June 2008, RL-EPA.

***Cladotanytarsus lepidocalcar* Krüger, 1938**

GALWAY: Lough Corrib-upper M138486, Pe 11 June 2007, BK-RL-EPA; Lough Ballyquirke M232317, Pe 8 August 2007, RL-EPA; **KERRY**: Lough Leane V931886, Pe 24 June 2008, CP-PMC-EPA; **LEITRIM**: Lough Rinn N095943, Pe 25 June 2008 and 10 September 2008, GF-EPA; **MONAGHAN**: Lough Inner H625173, Pe 6 June 2007 and 10 July 2007, EPA; **ROSCOMMON**: Cavetown lake M832974, Pe 17 July 2008, EPA; Lough Glinn M629870, Pe 12 June 2008, EPA; **WESTMEATH**: Lough Lene N510685, Pe 22 August 2006, CB-WT-EPA.

***Micropsectra roseiventris* (Kieffer, 1909)**

CLARE: Lough Acrow R193687, Pe 4 April 2006, EPA; **KERRY**: River Loo, Crohane W048790, ♂, PA (specimen in NMI (Ashe collection), determined T. Ekrem); **LEITRIM**: Lough Allen G966193, Pe 28 April 2008, WT-EPA; **MONAGHAN**: Lough Drumlona H636176, Pe, 4 April 2007, EPA.

Apart from the adult specimen from the River Loo in the Ashe collection (NMI) (determined by T. Ekrem), the remaining above records derive from pupal exuviae. In Langton and Viser (2003) these exuviae will run to *M. fusca* Meigen but Stur and Ekrem (2004), in their revision of west Palaearctic species of *Micropsectra*, use *M. roseiventris* (Kieffer) instead of *M. fusca* since the type of *M. fusca* is a female and there is no known or published association between the female morphotype and the immature stages described in Langton and Viser (*op. cit.*).

***Neozavrelia cuneipennis* (Edwards, 1929)**

GALWAY: Lough Nahasleam, Maam Cross L972440, Pe 16 May 2007, EPA; Lough Shindilla, Maam Cross L960460, Pe 16 May 2007, EPA; Lough Ballynahinch, Ballynahinch L777478, Pe 6 June 2007, EPA; Lough Beaghcaauneen, Ballinaboy L679470, Pe 18 July 2007, EPA; Lough Enask, Beaghcauneen L662468, Pe 17 July 2007, EPA; **MAYO**: Lough Feeagh, Furnace L975983, Pe 17 September 2008, EPA; Lough Levally G146043, Pe 23 September 2008, EPA.

In Langton and Viser (2003) and Wilson and Ruse (2005), exuviae of this taxon key to *Neozavrelia longappendiculata* Albu. However, Ekrem (2006) designated *N. longappendiculata* Albu, 1980 a junior synonym of *N cuneipennis* (Edwards). Originally described by Edwards

(1929) from Britain as *Tanytarsus* (*Stempellinella*) *cuneipennis*, the species is also known from Austria, Finland, Germany, Norway and Portugal (Ekrem, 2006). Although primarily associated with peat and mire pools, in southern Norway larvae have been recorded from the littoral of lakes and in rivers.

***Stempellina almi* Brundin, 1947**

CAVAN: Lough McNean H106378, Pe 7 June 2007 and 18 September 2007, EPA; **GALWAY**: Ballyquirke Lough M232317, Pe 8 August 2007; Ross Lough, Moycullen M188365, Pe 8 August 2007 and 5 September 2007, EPA; **LEITRIM**: Lough Belhavel G878288, Pe 10 June 2008 and 26 August 2008 EPA; Lough Bofin N036891, Pe 29 July 2008, EPA; Lough Rinn N095943, Pe 25 June 2008 and 18 July 2008, EPA; **ROSCOMMON**: Lough Annaghmore, Elphin M902838, Pe 2 September 2008; EPA; **SLIGO**: Lough Gill G782350, Pe 20 August 2008, EPA.

***Tanytarsus gibbosiceps* Kieffer, 1922**

KERRY: River Flesk, Flesk Bridge, Killarney V964894, Pe 24 July 1978, PA, specimen in NMI (Ashe collection, determined T. Ekrem).

***Tanytarsus lactescens* Edwards, 1929**

MAYO: Lough Doo, Delphi L835680, Pe 9 May 2006, EPA; **ROSCOMMON**: Lough Key G848040, Pe 11 June 2008, EPA.

***Tanytarsus palettaris* Verneaux, 1969**

TIPPERARY: River Nore, Nore Bridge S133816, Pe 27 July 1981, BH, #962 in HCCIC-NMI.

This specimen had been previously misidentified and was noted in the re-examination of material being compiled for the HCCIC.

Records and comments on four morphotypes

SUBFAMILY TANYPODINAE

***Macropelopia* Pe1 (*sensu* Langton and Viser, 2003)**

KERRY: Lough Caum Q597079, Pe 29 April 2008, CP-PMC-EPA.

One intact and two incomplete exuviae were recovered in the samples from Lough Caum. These exuviae are readily distinguished from other *Macropelopia* species by the characteristic thoracic horn which is rounded apically with an almost circular pastron plate connected by one or two narrow necks to the respiratory atrium. In addition, the dorsal abdominal setae of tergites III to V are filamentous in *Macropelopia* Pe1 as opposed to the apically hooked setae of other known *Macropelopia* species. Until now this morphotype is only known from a single specimen collected at Loch Vernacher, Scotland (Langton, 1991)

Procladius near ***vesus*** **Roback (*sensu* Langton and Viser, 2003)**

GALWAY: Lough Corrib-upper M138486, Pe and Pm, 14 August 2007, RL-BK-EPA.

Three subgenera, *Procladius sensu stricto*, *Holotanypus* and *Psilotanypus*, are currently recognised in *Procladius*. While the nominal subgenus *Procladius sensu stricto* does not occur in the Holarctic region, representatives of the subgenus *Holotanypus* are common in Irish waters with those of *Psilotanypus* less frequently encountered. Collections from Upper Lough Corrib on 14 August 2007 contained exuviae and pharate males of a distinct pupal morphotype readily assigned to the Nearctic *Procladius* (*Holotanypus*) *vesus* group (Fittkau and Murray, 1986) based on the triangular shaped anal lobe. The first, and until now only, Palaearctic records of this pupal morphotype were provided by Langton (1991) from Lochs Lomond and Strathbeg, Scotland. Langton (*op. cit.*) and Langton and Visser (2003) designated the taxon as "*Procladius* near *vesus* Roback" on the superficial similarity of exuviae with the North American species *Procladius vesus* described by Roback (1971). Further study on the associated pupal exuviae, pharate and partially emerged adult male specimens from Lough Corrib should elucidate the status of the morphotype. Fittkau and Murray (1986) remarked that "the genus *Procladius* is a species-rich taxon which is in urgent need of taxonomic revision" - a situation that still pertains.

SUBFAMILY ORTHOCLADIINAE

Parakiefferiella **Pe1 *sensu* Reiss, 1968**

CAVAN: Lough MacNean Lower H106378, Pe 7 June 2007, EPA; **CLARE**: Lough Bunny

R375967, Pe 10 May 2005, EPA; **LONGFORD**: Lough Forbes N081809, Pe and Pm 14 May 2008, EPA; Lough Ree N018485, Pe 25 April 2007, EPA; Lough Ree N050450, Pe 15 August 2007, EPA; **ROSCOMMON**: River Suck, Mount Talbot M813531, Pe 14 August 1988, BH; Cavetown Lake M832974, Pe 17 July 2008, EPA; Lough Key-site 2 G848040, Pe 11 June 2008, EPA; **LEITRIM**: Lough Boderg N013915, Pe 14 May 2008 and 10 September 2008, EPA; Lough Glenade SE G831457, Pe 10 June 2008 and 22 July 2008, EPA; **SLIGO**: Lough Talt G402151, Pe 18 June 2008, EPA.

The characteristic pupal exuviae of this taxon, known since Reiss (1968) described specimens from the pre Alpine Bodensee, Germany, over 40 years ago, remain unassociated with any existing described adult *Parakiefferiella* species. This morphotype was also found by Reiss in the oligotrophic Walchensee, Upper Bavaria (material seen by the author in Zoologische Staatssammlung Munich) and was recorded from Britain by Langton (1984) from the River Arrow, Hereford. Exuviae of this taxon were first collected in Ireland in 1988 by B. Hayes from the River Suck at Mount Talbot, Co. Roscommon. In the material examined from the 2008 EPA lakes monitoring fieldwork, a pharate adult specimen was found in material from Lough Forbes. Further detailed study of this material is required to resolve the specific identity of the taxon.

SUBFAMILY CHIRONOMINAE

Chironomus (*Chironomus*) sp a Pinder

GALWAY: Lough Corrib M150450, ♂, 1980, collected by B. Connolly; Lough Rea, Loughrea M615154, Pe and Pm 18 September 2007, EPA; **WESTMEATH**: Lough Owel N421566, south-east shore, canal feeder outlet, ♂ 22 May 1973, BH. #622 in HCCIC-NMI.

Pinder (1978) included this taxon as a discrete species in the key to British Chironomidae based on the unusually broad anal point of the adult male insect. This morphotype was first noted from Irish waters in collections by B. Hayes from emergence traps on Lough Owel in 1973. Although that specimen was without a formal name, it was included in the HCCIC

reference collection (Murray, 2005) since it was clearly a discrete form. The morphotype remains as "*Chironomus* sp a" in the recent keys to the adult Chironomidae of Britain and Ireland (Langton and Pinder, 2007).

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PARASTENOCARIS PHYLLURA, KIEFER, 1938 (COPEPODA: HARPACTICOIDA: PARASTINOCARIDIDAE), A SPECIES NEW TO IRELAND WITH A FEW NOTES ON POSSIBLE HABITAT PREFERENCES

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Representatives of the genus *Parastenocaris*, Kessler, 1913, occur almost exclusively in subterranean and interstitial habitats around the world. According to Dussart and Defaye (1990), the genus is widely distributed in Europe with most European species not appearing to cross the southern limit of the last glaciation age. Despite this acknowledged global distribution, no specimen of this genus has been recorded in Ireland before.

In the course of a study focusing on the hyporheic habitats of the Delour River (near Kinitty, Co. Laois, S292981) undertaken between March and September 2006 (Kibichii, 2009), numerous specimens of the genus were encountered in samples collected from the interstitial habitat in August and September. A single male specimen was positively identified as *Parastenocaris phyllura* Kiefer, 1938. The study had been designed to sample interstitial habitats of the surface-ground water interface (Fig. 1), to identify distribution patterns of species across a gradient from the surface water-saturated sub-stream (SS) gravel below the flowing stream to the interstitial habitat below the exposed gravel ecotone (EC) between the stream and the adjacent terrestrial habitat. This junction between interstitial habitats also extends into the true groundwater found below the soil surface extending outwards from the terrestrial margin (TM).

An analysis of physico-chemical data from points where specimens were collected showed that *P. phyllura* was most abundant at 0.2m below the water table under the exposed gravel (EC) than elsewhere (Table 1). In August and September, 2006, this part of the interstitial habitat was oxygen-poor with dissolved oxygen (D.O.) levels ranging from 0.4 to 5.7 mgL^{-1} (average=2.4 mgL^{-1}). Individual samples along different transects on the Delour River recorded variable abundances with two particular samples recording high numbers: an August ecotone sample (486 individuals $10L^{-1}$) and a September ecotone sample (1787 individuals $10L^{-1}$), both collected at 0.2m. Incidentally, the two samples were collected at locations with low D.O. and high conductivities compared to the rest of the samples, thereby indicating the affinity of *Parastenocaris* for groundwater habitats (see Dole-Olivier *et al.*, 2000). Several groundwater-affiliated ostracod and copepod species were also encountered in the same habitats. Most notable among them were: cyclopid (*Acanthocyclops venustus* (Norman and Scott)) and harpacticoid copepods (*Bryocamptus pygmaeus* (Sars), *B. zschokkei* (Schmeil) and *Epactophanes richardi* Mrázek) and the two ostracod species *Cryptocandona vavrai* Kaufmann and *Pseudocandona* sp. It is noteworthy that *E. richardi* was recorded only in two previous collections in Ireland (Gurney, 1932). While bank sediments are regularly or occasionally inundated with water when there is an increase in river discharge, it is likely that individuals of *P. phyllura* leave their preferred but resource-poor groundwater habitat to aggregate near the stream margin in order to take advantage of deposited fine particulate organic matter on which they feed (Dole-Olivier *et al.*, 2000).

Further surveys of rivers in Co. Carlow, like the Dinin (S582690), Douglas (S626849), Barrow (S695671), and Fushogue rivers (S674800) recorded further specimens of *P. phyllura*, but abundances were comparatively low (1-54 individuals $10L^{-1}$). Despite concerted efforts, no male specimen of *Parastenocaris*, which is required for positive species identification, was found in any of the additional samples apart from those collected from the Delour River and therefore we cannot confirm if those additional specimens were of *P. phyllura*. Given that species of *Parastenocaris* are highly endemic (Galassi and Laurentiis, 2004), it is likely that

there are more than one species in Ireland, particularly so because of the wide distribution of the genus even in areas of different geological settings. Further research is definitely needed to study the ecological and taxonomic diversities of this genus in Ireland. It would appear also that *Parastenocaris*, and most importantly *P. phyllura*, prefers interstitial habitats of clean rivers, and perhaps those with well preserved wooded riparian zones.

Several specimens of *P. phyllura* have been deposited in the National Museum of Ireland.

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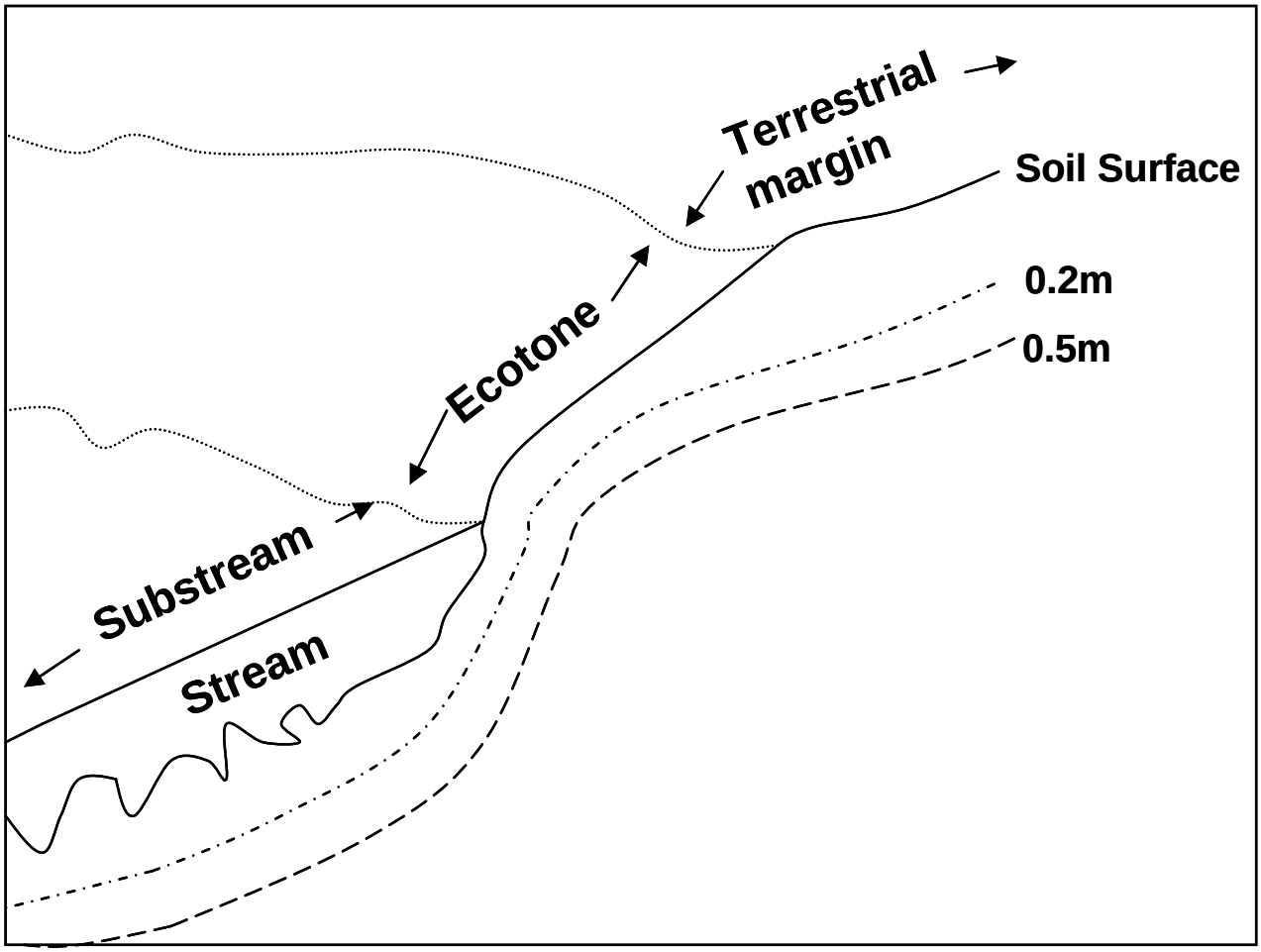
TABLE 1. The abundances of *P. phyllura* collected in the different parts (SS- sub stream, EC – ecotone, TM- terrestrial margin) of the interstitial habitat and at different depths within each of these habitats of the Delour River, and the corresponding physico-chemical measurements.

Month	Habitat[a]	Depth	Abundance	Temp.	D.O.	pH	Conductivity
Aug.	EC	0.2m	486	14.3	5.7	7	202
Aug.	TM	0.2m	8	14.3	3.4	7.2	142
Aug.	EC	0.5m	1	14.1	2.5	7.5	172
Sept.	SS	0.2m	51	14.5	3.56	6.4	210
Sept.	SS	0.2m	4	16.2	5.92	7.5	111
Sept.	SS	0.2m	121	15.1	4.46	6.6	153
Sept.	EC	0.2m	1787	14.5	4.47	6.5	256
Sept.	EC	0.2m	47	14.4	0.42	6.5	133
Sept.	EC	0.2m	17	16	2.62	6.9	114
Sept.	EC	0.2m	159	15.7	2.52	6.8	115
Sept.	EC	0.2m	19	14.6	1.9	6.4	123
Sept.	TM	0.2m	21	14.6	0.51	6.9	290
Sept.	TM	0.2m	7	13.9	0.68	6.5	135
Sept.	SS	0.5m	31	14.2	0.41	6.5	198
Sept.	SS	0.5m	139	14.6	1.65	6.6	111
Sept.	SS	0.5m	2	16.2	5.92	7.5	117
Sept.	SS	0.5m	3	15.3	2.22	6.9	114
Sept.	EC	0.5m	3	13.9	0.72	6.4	317
Sept.	EC	0.5m	10	14	0.91	6.5	224
Sept.	TM	0.5m	1	14.4	1.65	6.6	182

[a] Collection sites with similar habitat codes and depth were collected from different transects along a 500m stretch of the Delour River.

FIGURE 1. An illustration of the sampling zones and depths.



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CRUSTACEAN RECORDS FROM LOUGH HYNE (INE), CO. CORK, IRELAND: PART IX

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This is the ninth contribution in a series on the crustacean fauna of Lough Hyne (Ine) (W0928), the marine nature reserve in West Cork, and reports additions and amendments to earlier lists (e.g. Holmes, 1980, 1996). Four of the listed species are new to Ireland.

All the material was collected by the author, in some cases with an underwater light-trap (Holmes and O'Connor, 1988). New Irish records are indicated by *. Voucher specimens have been deposited in the National Museum of Ireland (NMI).

PODOCOPIDA

***Heterocythereis albomaculata* (Baird, 1838)**

Scyllium Bay (W099281), shallow water weed, several specimens, 18 July 1984.

This species is abundant and widespread all around Ireland (Norman, 1905), but has not been previously recognised in Lough Hyne.

***Cytherois fischeri* (G. O. Sars, 1866)**

Castle Island (W196283), brackish bog-pool, numerous specimens, 26 June 2001.

An abundant and widespread species, in brackish and shallow marine environments around Ireland.

***Paradoxostoma ensiforme* Brady, 1868**

South Basin (W097280), shallow-water weed and sponges, ♂ 3 August 1985.

This well-known species has been recorded all around Ireland (e.g. Norman, 1905).

***Paradoxostoma fleetense* Horne and Whittaker, 1985**

Barloge (W100279), light-trap, 2m depth in *Zostera*, several specimens, 23 July 2006.

Recently recorded in Ireland for the first time (Holmes and Dale, 2008) from the Lough Hyne Marine Nature Reserve and from Ventry, Co. Kerry. Otherwise, this species is known from the south coast of England and from the Channel Islands (Athersuch *et al*., 1989), living in shallow-water marine or slightly brackish conditions.

***Sphaeromicola dudichi* Klie, 1938** **New to Ireland**

West shore near the Goleen (W094280), Lough Hyne, sunken wood infested with gribble (*Limnoria*) and with the amphipod *Chelura terebrans* Philippi, several specimens, 19 July 1991.

This ostracod is known to be closely associated with the wood-inhabiting amphipod *Chelura terebrans* Philippi (Roelofs, 1968). The amphipod burrows into submerged and waterlogged timber which has already been attacked by wood-boring isopods (Lincoln, 1979).

HARPACTICOIDA

***Nitocra pusilla* G. O. Sars, 1911**

West end of Castle Island (W095283), shallowly submerged rocks, ♂♀ 22 September 2003.

Other Irish records are from the Dalkey area in Co. Dublin (Roe, 1958).

***Rhizothrix curvata* Brady, 1880**

North Basin (W097285), fine gravel, 2♂♂ 12 July 1990.

Recorded from shallow marine mud and sand at several localities around the coast of Ireland (Holmes and O'Connor, 1990).

***Pontophonte* sp.** **New to Ireland**

South shore (W099282), littoral weed, ♂ 10 August 1989.

The single found specimen conforms to the diagnosis of the genus *Pontophonte* Lee and Huys, 1999, a genus known hitherto only from the Black Sea (Lee and Huys, 1999). In a recent tabular key to harpacticoids of the world by Wells (2007), it keys out unamiguously to *Pontophonte grigae* Lee and Huys, 1999. However, there are differences of detail between the Lough Hyne specimen and the original description and figures of *P. grigae* (as described by Griga, 1963, under the name *Laophonte brevifurca*). Also, it shows similarities to *P. leuke* Por,

1959.

***Loureirophonte cesareae* (Por, 1964)** **New to Ireland**

Rapids area (W100282), shallow sub-littoral rocks, ♂♀ 16 July 1993.

This Mediterranean species has been reported from only the northern Israeli coast (Fiers, 1993). As with *Pontophonte*, a member of the same family, the *Loureirophonte* species are found amongst shallow-water fouling organisms that might well be found attached to yachts and other shipping. This could explain their discontinuous distribution.

***Laophontodes typicus* T. Scott, 1894**

Rapids area (W100282), shallow sub-littoral rocks, 2♂♂♀ 16 July 1993.

The only other Irish record is of a single ♂ from Dalkey Island, Co. Dublin (Roe, 1958).

SIPHONOSTOMATOIDA

***Asterocheres mucronipes* Stock, 1960** **New to Ireland**

North Basin (W092284), weed and rocks, 2♂♂2♀♀ 9 July 1982; South Basin (W099283), scraping from a rock, ♂ 15 July 1991; Rapids area (W100282), algal holdfast, ♀ 8 August 1992; South Basin (W099283), rocks, ♂♀ 8 July 1999; West end of Castle Island (W095283), weed and rock, ♀ 27 June 2002.

Asterocheres mucronipes was first described from the Mediterranean coast of France, associated with sponges (Stock, 1960). It was previously mistaken by the author for other *Asterocheres* species, and it is not mentioned in a guide to marine invertebrate-associated copepods by Gotto (2004).

A record of *Asterocheres stimulans* Giesbrecht, 1897 by Holmes (1991) was based on the above cited material from 1982 and 1991, and that species should be removed from the Irish list. Furthermore, a record of *Asterocheres ellisi* Hamond, 1968 by Holmes (2008) was identified from the 1992 and 2002 individuals. *A. ellisi* has not yet been reported from Lough Hyne but it has been found elsewhere in Ireland. Two female specimens of the genuine *A. ellisi* were discovered by the author in a sample collected by B. O'Connor in July 1980, from a

Serpula reef in the Salt (or Ardbear) Lake (L6649), near Clifden, Co. Galway.

POECILOSTOMATOIDA

***Pseudanthessius thorelli* (Brady, 1880)**

(*Pseudanthessius dubius* G. O. Sars, 1918)

Rapids area (W100282), shallow sub-littoral rock, ♀ 16 July 1993.

P. thorelli was recorded (as *P. dubius* Sars), in washings from the starfish *Asterias rubens* L. at the same site near the Rapids in Lough Hyne (Holmes, 1996). *P. dubius* is now recognised to be a juvenile copepodid stage of *P. thorelli*. It belongs to a group of invertebrate-associated copepods but the true host remains uncertain. It has been found in Sweden, associated with *A. rubens*. (Bresciani and Lützen, 1962). Elsewhere in Ireland it was recorded from Kenmare Bay (Minchin, 1987).

LEPTOSTRACA

***Nebalia herbstii* Leach, 1814**

South Basin (W099282), light-trap, 20m, 11 July 1982; off Castle Island (W095283), light-trap, 20m, 14 July 1990.

For many years, the conventional wisdom was that there was only one species, *Nebalia bipes* (O. Fabricius, 1780) and that its range included the Arctic and Mediterranean. As a result, extensive voucher collections were not kept by the author. Holmes (1985) included *N. bipes* in a list of crustaceans from Lough Hyne. Following a revision of the group by Dahl (1985), it became apparent that there are several species around western Europe. The true *N. bipes* is a north-boreal species found in Canada, Iceland, Norway and sites in the Arctic. It does not occur around the British Isles. A re-examination of the preserved voucher specimens revealed most individuals from Lough Hyne belonged to *N. herbstii*. However, some specimens were too juvenile for identification. Dahl (1985) listed *N. herbstii* from Dublin Bay, from off south-west Ireland, and from sites along western and southern coasts of Britain and along the Atlantic coast of France.

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HETEROCERIDAE (COLEOPTERA) IN IRELAND

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Introduction

This paper arose as a result of the examination of the material held by the National Museum of Ireland (NMI) in Dublin. In trying to reconcile the specimens with the known written records, it became apparent that there had been some misidentifications in the past, largely based on confusing two species. It is hoped that this analysis will bring forward more records of this family in Ireland.

Records arising from the comparison of Johnson and Halbert (1902) with the National Museum of Ireland Collection

The collection has representatives of four species in Ireland. The missing species, *H. fenestratus* (Thunberg), is represented by English material in the collection, as are *H. fusculus* Kiesenwetter and *H. obsoletus* Curtis, also a German *Augyles hispidulus* (Kiesenwetter). These notes follow the sequence of names in Johnson and Halbert (1902), with quotations from that work in bold.

***Heterocerus flexuosus* Stephens, 1829**

Heterocerus arenarius Kiesenwetter, 1851

Heterocerus arenosus MS misspelling

Heterocerus var. *sabulosus* nomen nudum sensu Haliday in Hogan, 1855

Heterocerus femoralis Krynicki, 1832

Heterocerus pulchellus auct.

not *pulchellus* Kuwert 1890 [= *fusculus* Kiesenwetter, 1843]

Johnson and Halbert (1902) noted **Down ("Belfast Lough shore, '47.7.5" H. coll.; Strangford**

Lough, Ht., coll. B.). – Sligo (Enniscrone, J.). – Dublin (North Bull salt-marsh, under stones in July, '00 Ht. 3).

Gratifyingly, the Haliday specimen, a female, is in the NMI collection labelled as stated, 47.7.5 being 5 July 1847, labelled "*littorale*" and "*flexuosus* G.C.C.", G. C. C. being Champion, who made several comments on this family for the benefit of Johnson and Halbert's list. There are two other specimens of *flexuosus*, both male, labelled as from Belfast on 28 September 1901, which do not appear to feature in Johnson and Halbert (1902).

The NMI collection has five specimens of *flexuosus*, all female, from Strangford Lough, two of them labelled as from C. W. Buckle, the "B" of the reference. Johnson and Halbert (1902) further noted **Mr. C.W. Buckle obtained a large and very variable series on the shores of Strangford Lough."** Halbert annotated his copy "Strangford Lough, between Comber and Newtonards (B. '02).

The Sligo record is also annotated by Halbert as from 1902. There are two females of *flexuosus*, but standing as *marginatus*, in the NMI collection labelled as from Sligo. The accession number (318.1902) refers to a collection of insects given by the Royal Irish Academy Fauna and Flora Committee supposedly, but surely not in this case, taken in June at Lough Neagh by J. N. Halbert.

Although there are no specimens in the NMI collection that can be identified with Halbert's North Bull find of 1900, there are ten specimens of *flexuosus* taken by Eugene O'Mahony labelled as from there, eight on 29 May 1941 and two on 13 July 1941, all originally standing as *flexuosus*.

Under *flexuosus* Halbert further annotated "Baldoyle 6/02 Kemp. Portrush ?. (??. '05). Killarney, Hardy." There is a male *marginatus* originally standing as *flexuosus* in the NMI collection labelled "Killarney (Hardy)" and 35.1910, indicating donation from J. R. Hardy of Manchester, but no specimens assignable to the other two localities other than two specimens of *flexuosus* from Baldoyle, taken much later, on 22 May 1927.

A most interesting specimen in the NMI collection is a male of *flexuosus* labelled in pencil "Clifden Shore end May" and the printed label "Haliday." Clifden was Haliday's house name,

not a local name as suggested below. As the only specimen labelled associated with Clifden and Haliday, this must be the specimen referred in the following entry in Johnson & Halbert (1902) under *britannicus* Kuw., a synonym of *maritimus*.

There is an example [of *britannicus*] **in the Haliday collection labelled "Clifden shore" which, Mr. Buckle informs us, may be a part of the shore near Bangor, locally known by that name. We are indebted to Mr. G.C. Champion for the verification of the Haliday specimens.**

This rather undermines confidence in the use of Champion as an adviser. At 3.2mm the specimen is a little larger than most *maritimus*.

There are ten other Irish specimens now identified as *flexuosus* in the NMI collection, seven of them having stood as *marginatus*. Possibly the most important are two males bearing the handwritten labels "*Heterocerus arenosus* Ksw." and "See Haliday Nat. Hist. Rev. Vol. 2. p. 119.", and the printed accession label "Haliday" with "220-1910" handwritten. Dr O'Connor has noted that this accession number refers to a small box of insects given by the executors of the late Dr E. P. Wright, being part of the collection of Haliday. Haliday (1855, p. 119) noted "The *Heterocerus*, given as *femoralis* in the list of Dublin Coleoptera (*Nat. Hist. Rev*., vol. i., p. 34), was shown. Kiesenwetter has described it as a new species, *H. arenosus* [*sic*]: but with doubt expressed, having only two specimens before him". It is assumed that "*arenosus*", as opposed to *arenarius*, is a *lapsus calami*. One of the specimens, a teneral *flexuosus*, has the aedeagophore's flagellum extended, making the aedeagophore longer than that of the other specimen. In fact the aedeagophore is smaller overall than that of the other specimen: the beetle also bears a label printed on green paper "Ireland" with a question mark added in handwriting. Hogan (1855) had previously noted in his catalogue of the Coleoptera of Dublin "*Heterocerus femoralis*, Kies. Baldoyle: the var. called *sabulosus* (Hal.) also occurs here" so the specimen or specimens of "*arenosus*" above must be from Baldoyle. Use of the name *sabulosus* has not been encountered elsewhere.

The specimen with the larger aedeagophore is a *fossor* and it carries in addition the handwritten label on green paper, "Dundrum (Co. Down) June. A.H.H.", which might be the locality for the other specimen.

Three other specimens are also from Haliday's collection, each labelled "Hday." A male and a female are labelled "Co. Donegal" and a female labelled "Co. Antrim", all three bearing the label "display", having been put on public display at some time and then returned to the collections.

Four specimens of *flexuosus*, mounted in pairs on two cards, are labelled in handwriting "Buncrana" on green paper. Their accession labels "81.98" and "202.1897" indicate their origin around the turn of the 19th Century. These are almost certainly the specimens referred to as *marginatus* by Johnson and Halbert (1902) taken by Commander J. J. Walker in 1895. Confirmation of this comes from ten specimens of *flexuosus*, mounted in five pairs, now including dissected males, in the Oxford University Museum of Natural History, and labelled as from Buncrana in May 1895 and bequeathed to the museum by Walker.

Further concerning the NMI collection there is a male *flexuosus* originally standing and labelled as *marginatus*, also labelled as from Kilbarrack, County Dublin, taken by O'Mahony on 20 March 1927. Unfortunately this, and O'Mahony's Baldoyle female referred to above, undermine O'Mahony's (1928) note of "*Heterocerus marginatus* F., Sutton, Baldoyle and North Bull". Kilbarrack is just to the west of Sutton and to the south-west of Baldoyle. These records of *marginatus* must be regarded as unsafe.

Finally Roger Booth has checked on the following material in the Natural History Museum, London, all identified as *flexuosus* by Robin O.S. Clarke. Eleven specimens originating from Tramore, County Waterford, were taken by L. H. B. Wyse in 1927 and 1928. There are also three females of *flexuosus* corresponding to the record against Walker for Buncrana, being labelled "Buncrana 5-95", "JJW/Champion coll", "*H. pulchellus* det. ?", "G.C. Champion B.B. 1964-540", plus Clarke's determination labels from 1970.

H. marginatus is a freshwater insect whereas *H. flexuosus* is confined to brackish water (Clarke, 1973) so the confinement of *marginatus* to Killarney, and the transfer of all coastal records to *flexuosus* is as might be expected.

***Heterocerus fossor* Kiesenwetter, 1843**

Heterocerus arenarius auct. Johnson and Halbert, 1902

Heterocerus femoralis auct.

Helophorus rectus Waterhouse, 1859

The next entry by Johnson and Halbert (1902) is for "*H. arenarius*, Kies.", and they discuss at length their concerns about which name to apply to this species, plumping for *arenarius* as the name first applied to Irish specimens. The records they list are:- **Down (Strangford Lough, Ht., coll. B.). – Dublin (Baldoyle and Portmarnock, H. coll.).**

There are six Irish specimens in the NMI collection from Haliday that can be confirmed as *fossor*. The male from Dundrum has already been referred to under *flexuosus*. Another male, from Portmarnock (also labelled as "*rectus* G.C." and "*femoralis*") and a female labelled as from Baldoyle (also labelled as "*rectus* G.C." and "*arenosus* Ksw") confirm Johnson and Halbert's (1902) entries and indicate that Haliday encountered both *flexuosus* and *fossor* together at least at Baldoyle. The other three bear more general labels, the most specific being Dublin. Unfortunately the five specimens in the NMI collection labelled as from Strangford Lough are all female, as referred to above under *flexuosus*. The accession number for three of them, "318.01", refers to C. W. Buckle, the collector noted as "B." above.

The Oxford University Museum of Natural History has five specimens of *fossor* from Strangford Lough, donated by Horace Donisthorpe, and dated 1902.

Buckle (1902) provided the most detailed observations ever made on *Heterocerus* in Ireland, so much so that there is little point in providing any other account of their ecology. He referred to three species, *flexuosus, arenarius* and *britannicus*, occurring in company in September and October, probably in 1901. It is reasonable to assume that these were *flexuosus, fossor* and *maritimus* respectively.

"All from shore of Strangford Lough, between Comber and Newtownards, with numerous varieties. The first two occur in company, rather below H.W. mark of O.S.T., the borings of *flexuosus* – in the situation in which I met with them – being from half inch to one inch deep, seldom more; while *arenarius* bores from not less than one inch to about two and a half inches

deep. *H. britannicus* occurs up the creek leading to Comber, rather above H.W. mark., its borings not being more than one inch deep at most. Out of the large series of three species which were taken, not in a single instance did I find two beetles in the same burrow; but, earlier in the season, doubtless the sexes would be found in the same burrow."

***Heterocerus marginatus* (Fabricius, 1787)**

Johnson and Halbert (1902) note:- **Donegal (Buncrana, '95 Wr.). – Antrim (Belfast, J., coll. Pn.) – Sligo (Enniscrone, J.).**

Rare. Mr. J.J. Walker records it as occurring plentifully at Buncrana in company with *Bledius spectabilis*. "varying to a handsome unicolorous dark fuscous form, with the usual yellow markings on elytra quite obsolete."

Halbert's annotations read "Sutton, Baldoyle and N. Bull (om. '28.2)".

Unfortunately the only Irish specimen in the NMI Collection that can be identified as *marginatus* is Ray Hardy's specimen from Killarney, originally identified as *flexuosus* (*qv*.). The reverse is the case for most of the other material. The other nine specimens of *marginatus* in the collection are from England and Scotland. Walker's Buncrana material has been identified (see above) as *flexuosus*.

***Augyles maritimus* (Guérin-Méneville, 1844)**

Heterocerus britannicus, Kuwert, 1890

Heterocerus marshami sensu Haliday MS

Under *H. britannicus*, Kuw., and in addition to discussion about the specimen from the Clifden shore of Belfast Lough, assigned to *flexuosus* above, Johnson and Halbert (1902) note:- **Down (river bank between Comber and Strangford Lough. Ht., coll. B.). – Cork (shore of the Owenberg River, Cork Harbour. '55 H. 1).**

Haliday (1855, p. 117)) noted *Heterocerus marshami* "Last September [1854] on the banks of the creek at Owenbeg river, Cork Harbour". There are six specimens in the NMI Collection that originated in Ireland. Two can be assigned to Belfast, which is the best, albeit very poor, fit

to the Strangford Lough reference. Also, in the Oxford University Museum of Natural History are three specimens of *A. maritimus* from the J. J. Walker bequest and bearing the label, in blue, "Belfast", which almost certainly refers to Haliday's original Belfast Lough site. Finally in NMUI, there is a female bearing various early Haliday labels confirming the Cork record, being labelled Carrigaline, a town on the Owenboy River in West Cork. Another specimen, labelled "202.97", "Co. Galway" and "display" at least indicates that the species occurs on the west coast.

More recent records

Remarkably few modern records of Heteroceridae are available. John Owen (1997) recorded *Heterocerus fenestratus* (Thunberg, 1784) new for Ireland, from Lough Gash in County Clare. Unfortunately there are no Irish specimens among the ten specimens standing as *fenestratus* in Professor Owen's collection in the Royal Scottish Museum. Jervis Good (1998) surveyed eight Irish sandflats for beetles and reported *flexuosus* as the only heterocerid. He found it at Ballybeg, County Sligo and Inch in South Kerry. Mark Telfer has generated recent records of two species, *H. fossor* in Sligo and *A. maritimus* in Londonderry (Table 1). According to the CEDaR records data-base held by the Ulster Museum, Roy Anderson has noted *H. flexuosus* in Down in 1980 and *H. fossor* in Antrim in 2009 (Table 1).

Identification

Anderson, Nash and O'Connor (1997) list five species of Heteroceridae as Irish, the only change here being to transfer *H. maritimus* to the genus *Augyles*. Nevertheless, the identification of much historical material has been found wanting. Ordinarily the coleopterists' traditional approach to display of beetles, mounting them dry, dorsal side uppermost, with particular attention to teasing out the appendages, and rarely if ever dissecting the genitalia, has served them well. Neatly displayed beetles can usually be sorted into different species with confidence to the extent that one is often surprised by the ability of previous generations to

distinguish species without reference to underside characters or to the genitalia. The genus *Heterocerus* provides an exception, with many mistakes being made through over reliance on valueless characters in the past. The elytral pattern is too variable to be easily defined, with the possible exception of the wholly black front margin of the elytra in *marginatus*, and appendage colour is also variable, again an exception being the yellow femora of *fenestratus*, to be seen in the field as emphasised by Clarke (1973). The small size of *maritimus*, 2.5-3.3mm, is useful but *fenestratus* and *marginatus* can be as small as 3.1mm long.

It appears essential to dismount carded material and to display at least the abdomen ventral side uppermost. This will ensure detection of the postmetacoxal ridge, an internal extension of the outer stridulatory ridge on the first visible sternite, a character separating the genus *Augyles* with its sole Irish representative, *maritimus*.

The female genitalia are membranous so any sclerotised structure found will prove to be male! Charpentier (1965), in his study of African Heteroceridae, illustrated the female reproductive system, including the accessory glands of ten species, but did not use them in his keys. The structure of the male genitalia is unusual, with the parts modified from the basic beetle plan and partly folded into an "N" making it difficult to view each part distinctly. The main structure is supported by a wishbone-like strut which should be removed to minimise obscuring detail. The extreme apex of the genitalia is made up of the almost completely fused parameres, the median lobe lying ventrally and being enfolded by this structure. The median lobe, which is slightly to one side, usually has a flagellum, a long process with bristles packed inside, the whole being folded back into the main body of the structure and adding yet further to the complex appearance of the contents. Sometimes the flagellum is found thrown forward to protrude well beyond the parameres. In copulation, it would appear to be everted to produce a cup-shaped structure with the bristles projecting outwards. In some species, the attachments of the flagellum appear as a series of loops just below the tip of the median lobe. In *H. fenestratus* the flagellum appears to be replaced by a bladder-like structure which lies crumpled within the body of the aedeagophore. The rearward pointing extensions of the parameres are usually the most heavily sclerotised parts of the whole structure, especially so in *H. fenestratus* and *H.*

marginatus. Two other processes project rearwards, the basal part of the "tegmen" within which can be seen quite heavily sclerotised "median struts", the basal part of the median lobe. Ulf Drechsel (1979), in his treatment of the family in *Die Käfer Mitteleuropas* ("Freude-Harde-Lohse") provides by far the best illustrations of the male genitalia, covering all the British and Irish species. He provides outline drawings of the whole structure and more detailed drawings of the three main parts of the structure. Whilst this is helpful in understanding some of the detail of the structure, particularly how the median lobe looks when removed from the parameres and basal piece, identifiers cannot be expected to dissect the aedeagophore into its constituent parts. Rather, the attempt here is to improve on the drawings provided by Clarke (1973), trying to highlight the features distinguishing each species. Sizes given for aedeagophores in the key are generally important and are from the base to the apex excluding the wishbone-like strut.

Many characters have been claimed for the differentiation of these species and it has to be said that most of them fail spectacularly, even those that supposedly allow one to sex specimens on external appearance. Species differences in the darkening of the antennae and legs, apart from the pale femora of *fenestratus*, simply do not exist, or at least do not transcend the variability within each species. The worst problem is the differentiation of *flexuosus* from *fossor*. It is essential to examine with care the fine structure of the male genitalia of these two species.

Key to adults of Irish Heteroceridae

1	First abdominal sternite with a postmetacoxal ridge; length 2.5-3.3mm; elytral markings vague; legs all pale; aedeagophore narrow and less than 0.7mm long	*A. maritimus* (Guérin-Méneville)
-	First abdominal sternite without a postmetacoxal ridge; aedeagophore broad or narrow	*Heterocerus* 2
2	Rear edge of pronotum demarcated by a distinct ridge, best viewed obliquely on the outer parts of the prothorax not attached to the rest of the body – also often best seen at low power; aedeagophore broad	3
-	Posterior edge of pronotum without a "structural" ridge separating the top from the rear – the hairs of this area may be formed up to resemble a ridge but it is not structural; aedeagophore narrow	4
3	Base of elytra entirely dark (clean the surface and wet with alcohol if necessary); femora and epipleurs dark; length 3.2-4.4mm. The apex of the aedeagophore, i.e. the paramere tips, appears to be distinctive in being broad with a pale edge, the darkened part looking like a mask with eyeholes cut out.	*H. marginatus* (Fab.)
-	Base of elytra with at least some yellow colour. Femora always pale yellow, and epipleurs also pale; length 3.1-4.7mm. Aedeagophore broader, parameres without clear areas below their tips.	*H. fenestratus* (Thunberg)
4	Postmesocoxal ridge complete and partly curved. Aedeagophore typically just short of 1mm. Tip of median lobe with a large clear area beyond where the base of the flagellum is folded backwards. Lips at tip of parameres dark. Body length 3.6-5.1mm.	*H. flexuosus* Stephens
-	Postmesocoxal ridge straight or incomplete. Aedeagophore 1.1 or more mm long. Tip of median lobe with a small clear area beyond where the base of the flagellum is folded backwards. Lips at tip of parameres transparent. Body length 4.4-5.9mm.	*H. fossor* Kiesenwetter

Conclusions

In the recent analysis of the conservation status of Irish water beetles (Foster, Nelson and O Connor, 2009), the five Irish species of *Heterocerus* were all listed as data-deficient and it does not require a complex definition of that expression to show that this is true even after this review. Heterocerids are not ordinarily encountered as part of aquatic surveys based on pond-netting and they are adept at escaping capture when other methods are employed. Their habitat, mud be it in saltmarsh, on wet cliffs or the banks of fresh water sites is rarely investigated. The few specialist surveys that have been undertaken, in particular by Jervis Good, have yielded comparatively few records. Although it would be unwise to claim that they are endangered based on so little data it seems that, unlike other saltmarsh species, heterocerids are particularly sensitive to habitat changes as well as, of course, to habitat loss. It is to be hoped that these notes generate new information to counter the possibility, suggested by some of the maps, that heterocerids are endangered in Ireland.

Acknowledgements

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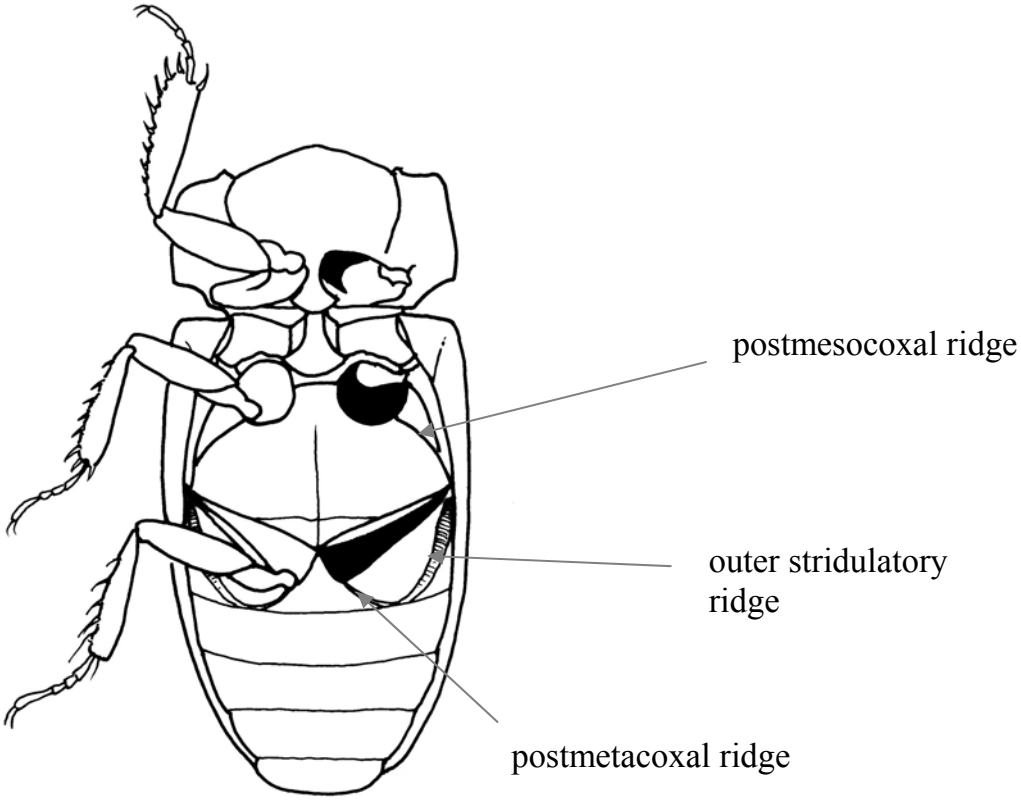
FIGURE 1. Underside of a heterocerids stylised to show ridges (redrawn from Pacheco, 1964).



FIGURES 2-6. Ventral views of the aedeagophores of Irish Heteroceridae.

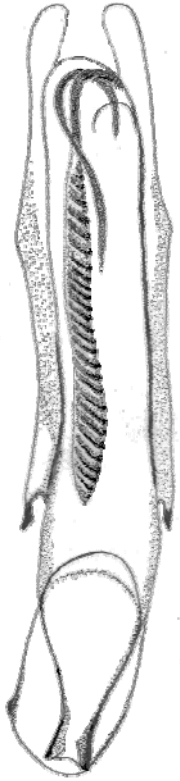
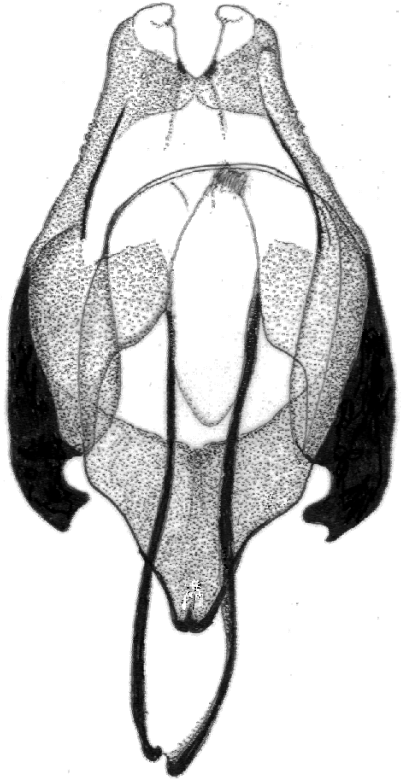
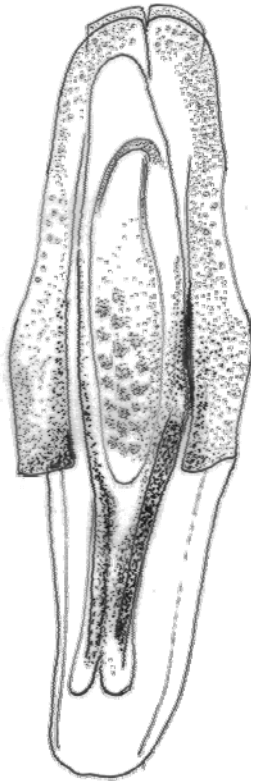
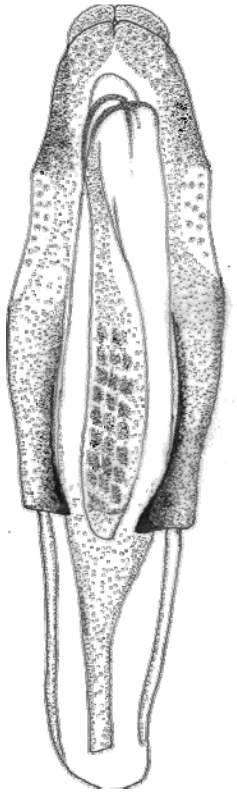
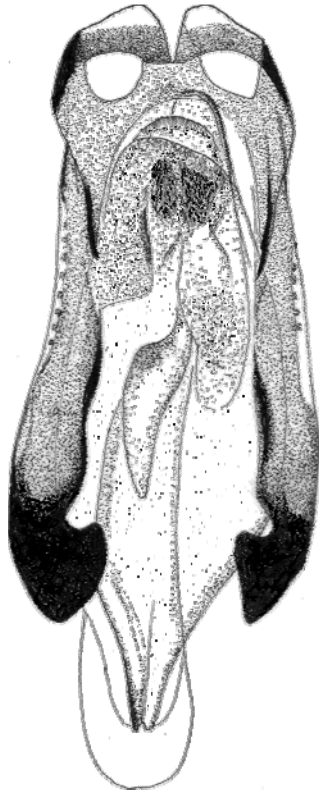
				

FIGURE 2. *Augyles maritimus*	**FIGURE 3.** *Heterocerus fenestratus*	**FIGURE 4.** *Heterocerus flexuosus*	**FIGURE 5.** *Heterocerus fossor*	**FIGURE 6.** *Heterocerus marginatus*

FIGURES 7-10. Distribution maps of the Irish Heteroceridae.

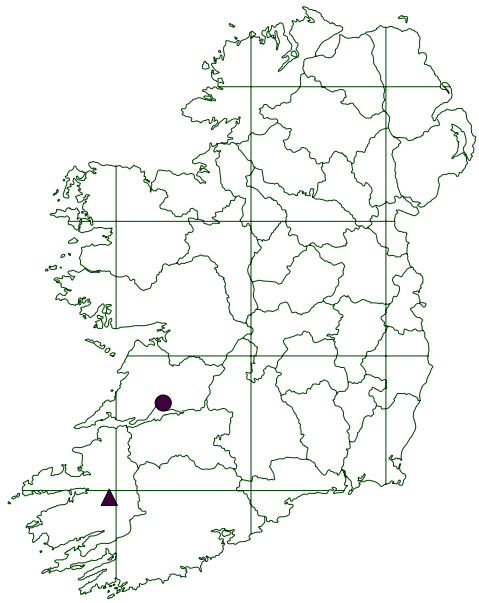


FIGURE 7. Distributions of *Heterocerus fenestratus* (circle) and *H. marginatus* (triangle).

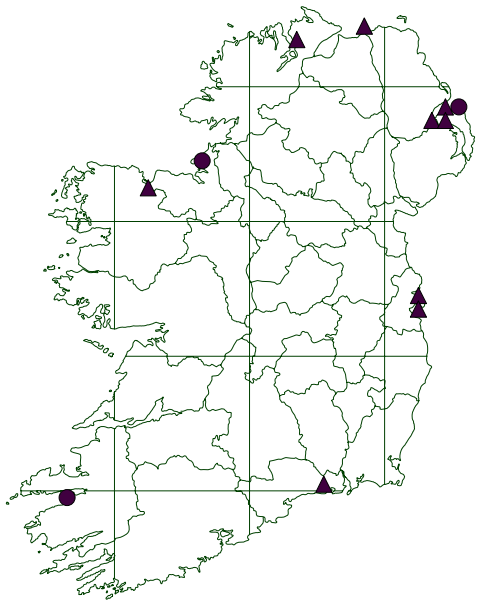


FIGURE 8. Distribution of *Heterocerus flexuosus* (triangles before 1980; circles 1980 onwards).

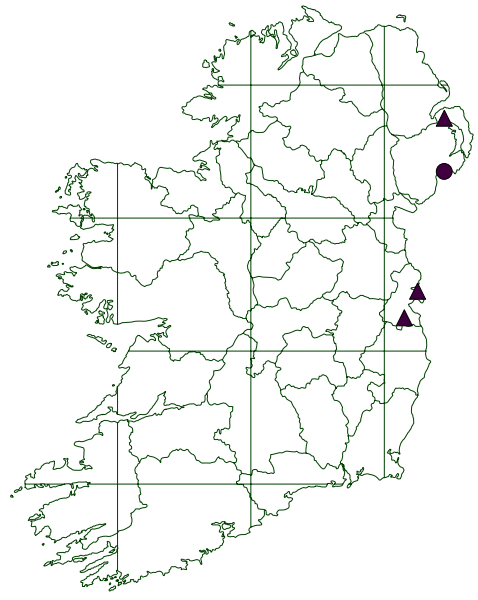


FIGURE 9. Distribution of *Heterocerus fossor*(triangles before 1980; circle 1980 onwards).

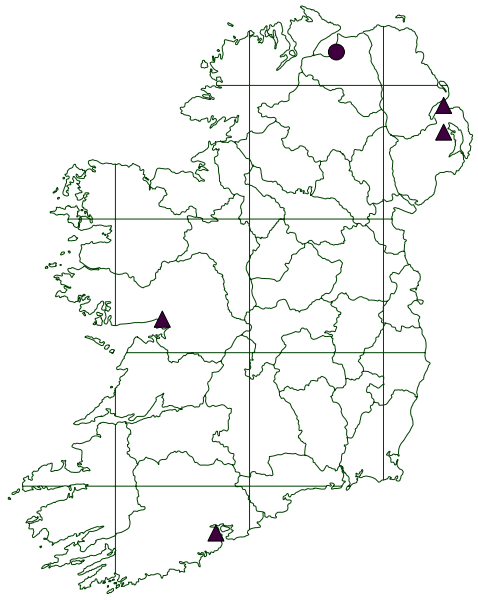


FIGURE 10. Distribution of *Augyles maritimus* (triangles before 1980; circle 1980 onwards).

TABLE 1. Summary of records considered reliable for Irish Heteroceridae. Locations are italicised if estimated.

Species	**Vice-county**	**No.**	**Locality**	**NGR**	**Collector**	**Determiner**	**Date**	**Source**
fenestratus	Clare	H9	Lough Gash	R3967	J.A. Owen	J.A. Owen	7 July 1996	Owen (1997)
flexuosus	Down	H38	Buncrana	*C3432*	J.J. Walker	R.O.S. Clarke	May 1895	NHM R. Booth 3 ♀♀
flexuosus	Down	H38	Strangford Lough, between Comber and Newtonards	*J4871*	C.W. Buckle	GNF	September and October 1901	J&H; Buckle 1902; NMI 5♀♀
flexuosus	Down	H38	Belfast Lough shore	*J3477*	A.H. Haliday	G.C. Champion *teste* GNF	5 July 1847	J&H; NMI 1♀
flexuosus	Down	H38	Clifden shore near Bangor	*J4981*	A.H. Haliday	GNF	May in 19th C	J&H; NMI 1♂
flexuosus	Dublin	H21	Baldoyle	*O24*	A.H. Haliday	GNF	1854	Hogan (1855); Haliday (1855)
flexuosus	Dublin	H21	North Bull	*O23*	Halbert		July 1900	J&H
flexuosus	Down	H38	Belfast	*J3477*		GNF	28 September 1901	NMI 2♂♂
flexuosus	Waterford	H6	Tramore	*S5801*	L.H.B. Wyse	R.O.S. Clarke	1927 & 1928	NHM R. Booth 11 specimens
flexuosus	Sligo	H28	Enniscrone	*G2829*	W.F. Johnson	GNF	1902 or earlier	J&H; NMI 2♀♀

TABLE 1. (Continued)

Species	**Vice-county**	**No.**	**Locality**	**NGR**	**Collector**	**Determiner**	**Date**	**Source**
flexuosus	Dublin	H21	Baldoyle	*O24*	Kemp		June 1902	Halbert annotation to J&H
flexuosus	Antrim	H39	Portrush	*C8541*			1905	Halbert annotation to J&H
flexuosus	Dublin	H21	Kilbarrack	*O2339*	E. O'Mahony	GNF	20 March 1927	NMI 1♂
flexuosus	Dublin	H21	Baldoyle	*O24*	E. O'Mahony	GNF	22 May 1927	NMI 1♀
flexuosus	Dublin	H21	North Bull	*O23*	E. O'Mahony	GNF	29 May 1941	NMI 7
flexuosus	Dublin	H21	North Bull	*O23*	E. O'Mahony	GNF	13 July 1941	NMI 3
flexuosus	Sligo	H28	Ballybeg	G6441	J.A. Good	JAG	27 September 1991	Good (1998)
flexuosus	S. Kerry	H1	Inch	V6797	J.A. Good	JAG	1991 and 1994	Good (1998)
flexuosus	Down	H38	Ballymacormick Point	J5383	M.G. Telfer	MGT	21 May 2007	pers. comm.
flexuosus	Antrim	H39	Magheramorne Spit, Larne	D444983	R. Anderson	RA	30 June 2009	pers. comm.
fossor	Down	H38	Strangford Lough, between Comber and Newtonards	*J4871*	C.W. Buckle		September and October 1901	J&H; Buckle 1902

TABLE 1. (Continued)

Species	**Vice-county**	**No.**	**Locality**	**NGR**	**Collector**	**Determiner**	**Date**	**Source**
fossor	Down	H38	Strangford Lough	*J4871*		GNF	-1902	ex coll. Donisthorpe OUMNH 5
fossor	Dublin	H21	Dundrum	*O12*	A.H. Haliday	GNF	early 19th C	NMI 1♂
fossor	Dublin	H21	Portmarnock	*O24*	A.H. Haliday	GNF	early 19th C	J&H; NMI 1♂
fossor	Dublin	H21	Baldoyle	*O24*	A.H. Haliday	GNF	early 19th C	J&H; NMI 1♀
fossor	Down	H38	Dundrum Inner Bay	J403356	R. Anderson	RA	24 May 1980	pers. comm.
fossor	Down	H38	Green Isle and	J411371	R. Anderson	RA	26 May 1994	pers. comm.
marginatus	N. Kerry	H2	Killarney	*V99*	J.R. Hardy	GNF	early 20th C	NMI 1
maritimus	Galway	*H17 ?*	Galway	*M32*	A.H. Haliday	GNF		NMI 1
maritimus	Down	H38	Belfast	*J37*		GNF		NMI 2
maritimus	Down	H38	Belfast	*J37*	J.J. Walker	GNF		OUMNH 3

TABLE 1. (Continued)

Species	**Vice-county**	**No.**	**Locality**	**NGR**	**Collector**	**Determiner**	**Date**	**Source**
maritimus	W. Cork	H3	Carrigaline	*W7162*	A.H. Haliday	GNF	September 1854	Haliday (1855); J&H; NMI 1
maritimus	London-derry	H40	Roe Estuary	C644294	M.G. Telfer	MGT	26 April 2007	pers. comm...
maritimus	Down	H38	in the creek leading to Comber	*J4668*	C.W. Buckle		September and October 1901	Buckle 1902

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AQUATIC MACROINVERTEBRATE BIODIVERSITY OF AN IRISH CONSTRUCTED WETLAND SYSTEM, TWO YEARS AFTER CONSTRUCTION

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Keywords: Ireland, macroinvertebrates, ponds, constructed wetlands, wastewater treatment

Abstract

Constructed wetlands have the potential to support a wide variety of aquatic and semi-aquatic biota. However, there is a lack of knowledge concerning the invertebrates that colonize such wetlands. This paper provides information on the macroinvertebrates that occur in constructed wetlands in Baileborough, Co. Cavan, Ireland. The study was initiated shortly after the construction of the system and so provides an insight into its early colonization. The results show that within two years of establishment, these wetland cells were colonized by a good range of taxa (39), principally dipteran larvae. The abundance and richness of the taxa recorded in the final marsh were higher compared than those in the first two wetland cells. However, the final cell did not support any Ephemeroptera, Plecoptera and Trichoptera (EPT). The addition of another cell might provide a habitat with improved water quality which would be suitable for colonization by the more pollution-sensitive taxa, thereby increasing the biodiversity potential of the whole wetland system.

Introduction

Ponds are considered to significantly contribute to both local and regional biodiversity (Williams *et al*., 2003). In Ireland, relatively few natural or farm ponds remain due largely to land reclamation and drainage. However, there is an increasing use of constructed wetlands to

treat various types of organic wastes. These wetland systems consist of a series of interconnected vegetated ponds or marshes with varying amounts of open water. They are considered to have the additional benefit of providing a habitat for a wide range of aquatic and semi-aquatic biodiversity and may compensate to some degree for the loss of ponds in the landscape. However, apart from the studies of Becerra Jurado *et al.* (2010), there is a lack of knowledge on the invertebrates that colonise constructed wetlands. Furthermore, it is not known how quickly colonization takes place. The present study was initiated shortly after the construction of a system in Co. Cavan and provides an insight into its early colonization by macroinvertebrates.

Materials and methods

The study site was a wetland system constructed to reduce nutrients in wastewater discharged from the effluent treatment plant at Baileborough Foods/Bailie Foods Ltd., Baileborough, Co. Cavan. The Baileborough wetland system comprises a vegetated, lined inlet marsh (area of 7,600m^2 with an operating depth of 250mm and a volume of 1900m^3) where the treated effluent first enters. The marsh was heavily planted with common bulrush *Typha latifolia* L. The second cell of the wetland is a large facultative pond, 7,900m^3 in volume with an estimated 14 day residence time, the purpose of which is to re-establish anaerobic/aerobic conditions and thus promote denitrification. This pond is unlined and had only sparse marginal vegetation at the time of the study. It had the largest area of open-water, followed by the final marsh while the first one was almost totally vegetated. The final cell of the wetland is an unlined vegetated marsh with flote-grass *Glyceria fluitans* (L.) and common reed *Phragmites australis* (Cav.) Trin. ex Steudel. It is the smallest cell with only an area of 2,700m^2, allowing the final purification of wastewater before discharge into the River Lear. The three cells represent a pollution gradient with the highest organic pollutant concentrations in the inlet marsh. For example, phosphorus concentrations averaged 9mg/l P in the inlet marsh and fell to

circa 6mg/l P in the pond and to just over 5mg/l p in the final marsh (Freeman *et al.,* 2010). The Biological Oxygen Demand (BOD) loading was high and followed this pattern.

Three sweep samples were collected from each of the wetland cells using a standard 1mm pond net (frame size 20 x 25cm; mesh 0.5mm) following the multihabitat technique recommended by the U.K. Pond Survey (Biggs *et al*., 1998). In addition, 10 activity traps (bottle traps) were placed in each mesohabitat for two consecutive nights to capture highly mobile macroinvertebrates according to the method recommended by Becerra Jurado *et al.* (2008). The samples were taken in mid-June 2009. The Coleoptera, Hemiptera and Crustacea were identified to species level where possible. The Chironomidae were only identified to sub-family level.

Results

A total of 39 taxa were recorded using both sweep-netting and activity traps. The taxa in the sweep-netting and activity traps are given respectively in Tables 1 and 2. These comprised: Coleoptera (15), Diptera (13), Hemiptera (7), Lepidoptera (1) and 3 non-insect taxa.

A total of 29 taxa were caught by sweep-netting. Twenty-two of these were captured in the final marsh with a slightly lower total in the first marsh (16) and pond (19). A similar pattern occurred in terms of abundance. In all the cells, Diptera dominated representing over 96% of the total. The Coleoptera were represented by nine species, with the highest richness occurring in the final wetland cell. The Crustacea were represented by *Asellus aquaticus* (L.) and *Gammarus duebeni* Liljeborg in the pond and by just *Asellus* in the final marsh.

The traps recorded 35 taxa. Here again, the final marsh had the highest diversity (25) followed by the pond (18) and inlet marsh (15). The numbers caught by the traps were as expected, low. However, the Diptera were again numerically dominant except for the inlet marsh where a large number of oligochaetes were captured in one of the ten trap sets.

As expected, different assemblages of beetles (Coleoptera) were captured by the two methods. The small dytiscids *Hydroporus obsoletus* Aubé, *Hygrotus inaequalis* (Fabr.) and

Laccophilus sp., the elmid *Elmis aenea* (Müller) and the hydrophilid *Anacaena limbata* (Fabr.) were exclusive to the sweep-netting whereas the dytiscids *Ilybius* sp., *Agabus* sp., *Colymbetes fuscus* (L.) and *Dytiscus* sp., and the gyrinid *Orectochilus villosus* (Müller) were caught using only the activity traps. When the checklists of taxa caught by both methods are combined, the taxon richness count for the whole wetland system rises to 28, 24 and 22 respectively for the final marsh, the pond and inlet marsh.

Discussion

The results show that within two years of establishment, the cells were colonized by a good range of taxa (39), principally dipteran larvae. The work of Becerra Jurado *et al.* (2010) on constructed wetland, established for about ten years, recorded a total of 134 taxa from both netting and activity traps. These comprised: Coleoptera (66), Hemiptera (20), Diptera (11), Gastropoda (11), Trichoptera (9) and Hirudinea (5). Although the number of taxa obtained in the present study was low compared to the number recorded by Becerra Jurado *et al.* (*op. cit.*), the distribution of taxa is about the same. The small number of taxa obtained could be due to the high pollution level in these ponds as observed by Freeman *et al.* (2010) where mean concentrations of BOD, phosphorus and ammonia in the wetland and mass loading of each exceeded the design specifications especially during the summer months. Furthermore, the smaller number of ponds sampled, younger age and size of the ponds may also contribute to the difference in taxon diversity (Oertli *et al.*, 2002; Briers and Biggs, 2005; Fairchild *et al.*, 2000).

The abundance and richness of taxa captured in the final marsh were the highest when compared to the first two wetland cells. This is consistent with the findings of Spieles and Mitsch (2000) and Becerra Jurado *et al.* (2010) who found that the lower end of the treatment process hosted the highest total taxon richness, whereas the sites situated nearest to the wastewater inflow had the lowest diversity values. The results of this study also showed that among these taxa, Diptera dominated the ponds followed by Coleoptera, Hemiptera and non-insect invertebrates. This is similar to results of Della Bella *et al.* (2005), who reported a high

diversity of Diptera as well as Coleoptera. On the other hand, Becerra Jurado *et al*. (2010) found that the highest taxon diversity was recorded for Coleoptera followed by Hemiptera. These differences in dominant taxa could be due to the water quality, as Diptera (especially Chironomidae) are more pollution-tolerant than Coleoptera (Williams *et al.*, 1986). Alternatively, it may take more than two years for Coleoptera to colonise and reach the species complement reported by Becerra Jurado *et al.* (2010).

The study showed that both methods of sampling (netting and traps) captured a number of exclusive taxa. Some of the taxa taken exclusively by the activity traps included *Ilybius* sp., *Agabus* sp., *Colymbetes fuscus*, *Dytiscus* sp., and *Orectochilus villosus*, while *Elmis aenea*, *Hydroporus obsoletus*, *Hygrotus inaequalis*, *Anacaena limbata* and *Laccophilus* sp. were exclusive to sweep-netting. Hilsenhoff (1991), Turner and Trexler (1997) and Becerra Jurado *et al.* (2008) achieved similar findings in a comparative study of netting and activity traps. Becerra Jurado *et al*. (2008) showed that on average, 19.9% of the taxa were exclusive to traps, 26.2% were exclusive to nets and 53.9% were common to both methods. Hilsenhoff (1991) suggested that large active adults and larvae in most genera of Dytiscidae were more effectively collected with traps, while netting methods more effectively collected small and less active genera of Dytiscidae and Hydrophilidae.

The complete lack of Ephemeroptera, Plecoptera and Trichoptera taxa suggests that all three ponds do not reach the required water quality (supported by Freeman *et al.* 2010) which would allow colonization by these sensitive taxa. As a group, they are considered to be three of the more pollution-sensitive aquatic insect orders. Consequently, the greater their contribution to diversity, the healthier the community (Barbour *et al*., 1999). The addition of another wetland cell might provide a habitat with improved water quality suitable for colonization by the more pollution-sensitive taxa, thereby increasing the biodiversity potential of the whole wetland system (Scholz *et al.*, 2007).

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TABLE 1. Checklist of taxa and their average abundance in each cell of the constructed wetlandfrom sweep-netting.

CLASS/ORDER	FAMILY	SUBFAMILY	Genus species	INLET MARSH	POND	FINAL MARSH
DIPTERA	Chironomidae	Orthocladiinae	Larvae	4.7	101.3	116.3
		Tanypodinae	Larvae	-	1.7	29.3
		Chironominae	*Chironomus* sp. (larvae)	-	3905.3	3980.7
			Larvae and pupae	6	185.7	84.3
	Psychodidae	Psychodinae	*Psychoda* sp. (larvae)	94.7	0.7	3
			Pericoma sp. (larvae)	22.3	-	0.3
	Ephydridae		Larvae and pupae	423.7	0.3	2.3
			Pupae	189.7	-	-
	Ptychopteridae		*Ptychoptera* sp.(larvae and pupae)	63.3	-	-
	Tipulidae	Tipulinae	Larvae	0.7	-	-
	Syrphidae		Larvae	0.7	-	3
	Limoniidae	Chioneinae	*Molophilus* sp.	2	-	-
	Culicidae	Culicinae	Larvae and pupae	-	5.7	109.7
	Sciomyzidae		Larvae and pupae	4.7	-	-
COLEOPTERA	Chrysomelidae		Larvae	3.3	0.7	1.7
	Dytiscidae	Hydroporinae	*Hydroporus tesselatus* (adults)	-	0.7	0.7
			Hydroporus obsoletus (adults)	1	-	-
			Coelambus confluens (adults)	-	-	0.7
			Hygrotus inaequalis (adults)	-	-	0.3
		Laccophilinae	*Laccophilus* sp. (larvae)	-	0.3	0.7
	Elmidae		*Elmis aenea* (adults)	-	0.3	-
	Helophoridae		*Helopphorus* sp.(larvae and pupae)	3.3	1	2.3
	Hydrophilidae	Hydrophilinae	*Hydrobius* sp. (larvae)	-	1	1.7
	Hydrophilidae		*Anacaena limbata* (adults)	-	-	0.3

HEMIPTERA	Corixidae	*Sigara lateralis*	-	3.3	5.7
	Corixidae	*Sigara concinna*	-	-	0.3
	Corixidae	*Sigara* sp.	0.7	0.3	1.7
	Corixidae	Larvae	-	159	150.7
OLIGOCHAETA	Oligochaeta		2.3	0.3	-
MALACOSTRACA	Asellidae	*Asellus aquaticus*	-	4	0.3
	Gammaridae	*Gammarus duebeni*	-	0.3	-
TAXON RICHNESS			16	19	22

TABLE 2. Checklist of taxa and their average abundance in each cell of the constructed wetland system from activity traps.

CLASS/ORDER	FAMILY	SUBFAMILY	Genus species	INLET MARSH	POND	FINAL MARSH
DIPTERA	Chironomidae	Orthocladiinae	Larvae	3.2	87.3	26.6
		Tanypodinae	Larvae	-	0.3	3.2
		Chironominae	*Chironomus* sp. (larvae)	1.2	133.7	128.3
			Larvae and pupae	1.5	5.6	3.7
	Psychodidae	Psychodinae	*Psychoda* sp. (larvae)	6.3	-	-
		Psychodinae	*Pericoma* sp. (larvae)	0.3	-	-
			Pupae	12.3	-	-
	Ephydridae		Larvae and pupae	59.3	0.4	1.9
	Ptychopteridae		*Ptychoptera* sp. (larvae)	0.7	-	-
	Syrphidae		Larvae	0.4	0.2	0.3
	Limoniidae	Chioneinae	*Ormosia* sp. (larvae)	0.8	-	-
	Culicidae	Culicinae	Larvae and pupae	0.1	1.4	73.4
	Dixidae		*Dixella* sp. (larvae)	-	-	0.1
LEPIDOPTERA			Larvae	-	0.1	-
COLEOPTERA	Chrysomelidae		Larvae	0.8	0.1	-
	Dytiscidae	Colymbetinae	*Ilybius fuliginous* (adults)	-	-	0.2
			Agabus bipustulatus (adults)	0.1	0.1	0.7
			Agabus sp. (adults and larvae)	-	0.2	-

			Colymbetes fuscus (adults)	-	0.2	0.1
		Hydroporinae	*Hydroporus tesselatus* (adults)	-	-	0.2
			Porhydrus lineatus (adults)	-	-	0.1
			Coelambus confluens (adults)	-	-	0.6
		Dytiscinae	*Dytiscus* sp. (larvae)	-	-	0.1
	Gyrinidae	Gyrininae	*Orectochilus villosus* (larvae)	-	0.1	-
	Helophoridae		*Helophorus brevipalpis* (adults)	-	-	0.1
	Hydrophilidae	Hydrophilinae	*Hydrobius fuscipes* (adults)	-	-	0.4
HEMIPTERA	Corixidae		*Corixa* sp. (adults)	-	0.1	-
			Sigara lateralis	-	-	6.6
			Sigara concinna	-	-	0.3
			Callicorixa praeusta	-	-	0.1
			Larvae	-	1	25.1
	Notonectidae		*Notonecta* sp.	-	0.1	0.2
	Nepidae		*Nepa cinerea*	-	-	0.1
	Veliidae		*Velia* sp.	-	-	0.1
OLIGOCHAETA				46.9	0.1	-
COLLEMBOLA				0.1	0.1	1.1
ARACHNIDA	Hydracarina			0.1	-	-
MALACOSTRACA	Asellidae		*Asellus aquaticus*	-	0.9	2.9
TAXON RICHNESS				15	18	25

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OBSERVATIONS ON *THORON METALLICUM* AND *TELEAS MEDON* (HYMENOPTERA: PLATYGASTROIDEA, SCELIONIDAE) IN THE HALIDAY COLLECTION, NATIONAL MUSEUM OF IRELAND

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Introduction

The Scelionidae (Hymenoptera) are endoparasitoids of the eggs of insects and some other arthropods. The family is a large one and some species are important as biocontrol agents (Gauld and Bolton, 1988). The entomological collection of Alexander Henry Haliday (1806-1870) housed in the National Museum is an important nineteenth-century one containing *inter alia* many types of Diptera, Hymenoptera and Thysanoptera (O'Connor and Nash, 1982). In the Hymenoptera, there are types of scelionid species described by both Haliday and Francis Walker. An account of Walker's life will be found in Graham (1979). As part of their research on the Irish Scelionidae, the authors have been examining the types in the Haliday Collection and in some species, have found new characters which were not given in the original descriptions. By improving the morphological definition of the species, the identification of specimens will be made easier. This paper deals with *Thoron metallicum* Haliday, 1833 and *Teleas medon* Walker, 1836.

***Thoron metallicum* Haliday, 1833** (Figs 1-6)

Haliday (1833) described both the genus and the species (as *metallicus*) but gave no information on the number of specimens or where the material was collected. However, Walker (1836) states that the species was found in Ireland by Mr Haliday at the edges of ponds, among roots of aquatic plants, and on the water, at Holywood (Co. Down). The generic name is derived from the Swedish god Thor or Thoron (thor(ium) + *-on*) i.e. the thunder.

JPOC discovered three syntypes (♂2♀♀) of *T. metallicum* in storebox number H23 of the Haliday Collection. All three were mounted on card and were labelled by M. W. R. de V. Graham as 557, 558 and 560. Two were entire individuals but one (557) had been dissected by Haliday, presumably to faciltate his drawing of the habitus in Walker (1836). The specimens were sent to the senior author to be examined by him. We have dealt mainly with the dissected specimen which is designated here as the lectotype; the remaining female and male are considered to be paralectotypes.

The dissected female consists of both sets of wings, both antennae (one missing a clava) with a remnant of the head, the thorax with all the legs (one of the first pair mounted separately), the mandibles and the maxillae with the labium and palps. The complete antenna, a set of wings, maxillae and labium, and one mandible were remounted by GM on a slide and these are figured in this paper (Figs 1-5). The other remnants were left on the card. Haliday's original drawing in Walker (1836) is also reproduced with some modifications (Fig. 6). The rubbed striations on the habitus have been corrected while the pigmented basalis, overlooked by Haliday, has been added to the wing. Haliday might have been uncertain about the number of antennomeres in the subcompact clava and thus removed the missing clava for examination on a slide under a higher power than was possible with the carded material.

The genus was revised by Johnson and Masner (2004).

***Teleas medon* Walker, 1836** (Figs 7-8)

Teleas medon was described by Walker (1836) from female material collected in October at London. The species was synonymized with *Xenomerus ergenna* Walker, 1836 by Graham (1984) who found five female syntypes in the Natural History Museum, London and in the National Museum of Ireland. Four of these occurred in the Haliday collection and were labelled 56, 57, 596 and 597. Numbers 56 and 57 were located by JPOC in Haliday box number H23 and sent to GM for study. Number 57 corresponded to *X. ergenna*. GM has added a red label stating "♀ Xenomerus ergenna Walker det. Mineo 2010". However, number 56 belonged to *X. canariensis* Huggert, 1974. The left antenna and forewing has been dissected by GM and slide mounted (Figs 7 and 8). The forewing corresponds to the drawing of Huggert (1974) including

the pigmentation around the uncus of the stigmal vein. The pinned specimen has a red label with "♀ Xenomerus canariensis Huggert det Mineo, forewing + antenna on slide", the slide has a red label "♀ (1) Xenomerus canariensis Huggert det Mineo, forewing + antenna". JPOC has added a label stating "*Teleas medon* Walker". The NMI *Teleas medon* Walker is therefore a mixture of at least two species of *Xenomerus*.

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FIGURE 1. *Thoron metallicum*. ♀ lectotype. Antenna.

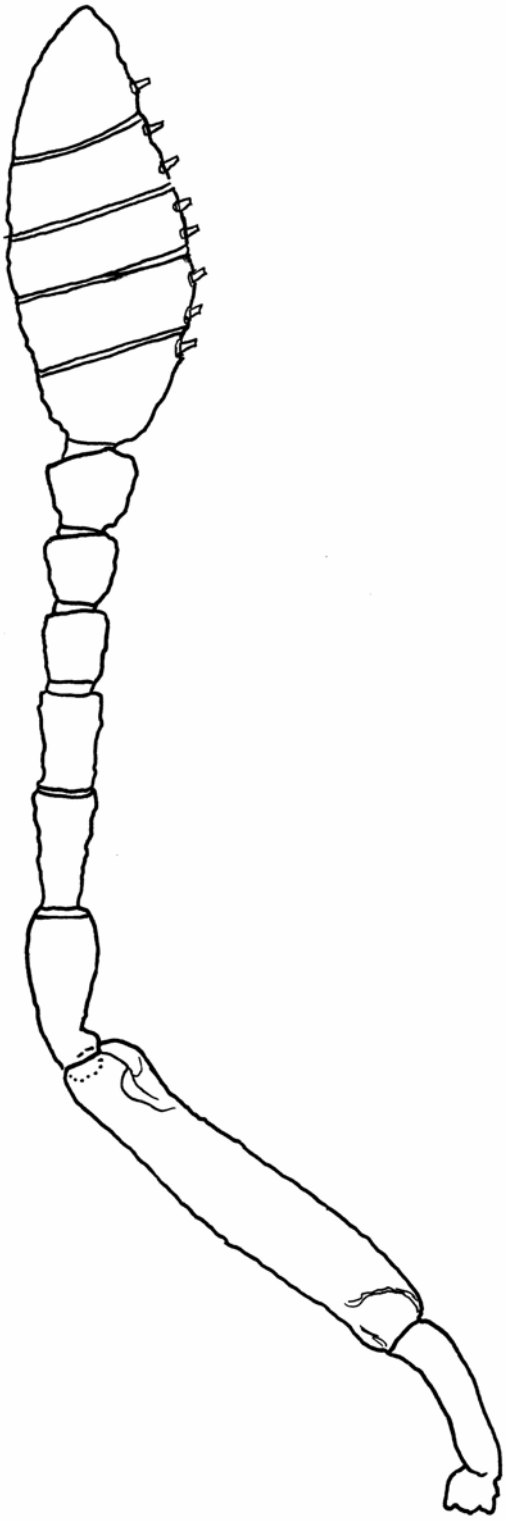


FIGURE 2. *Thoron metallicum*. ♀ lectotype. Forewing.

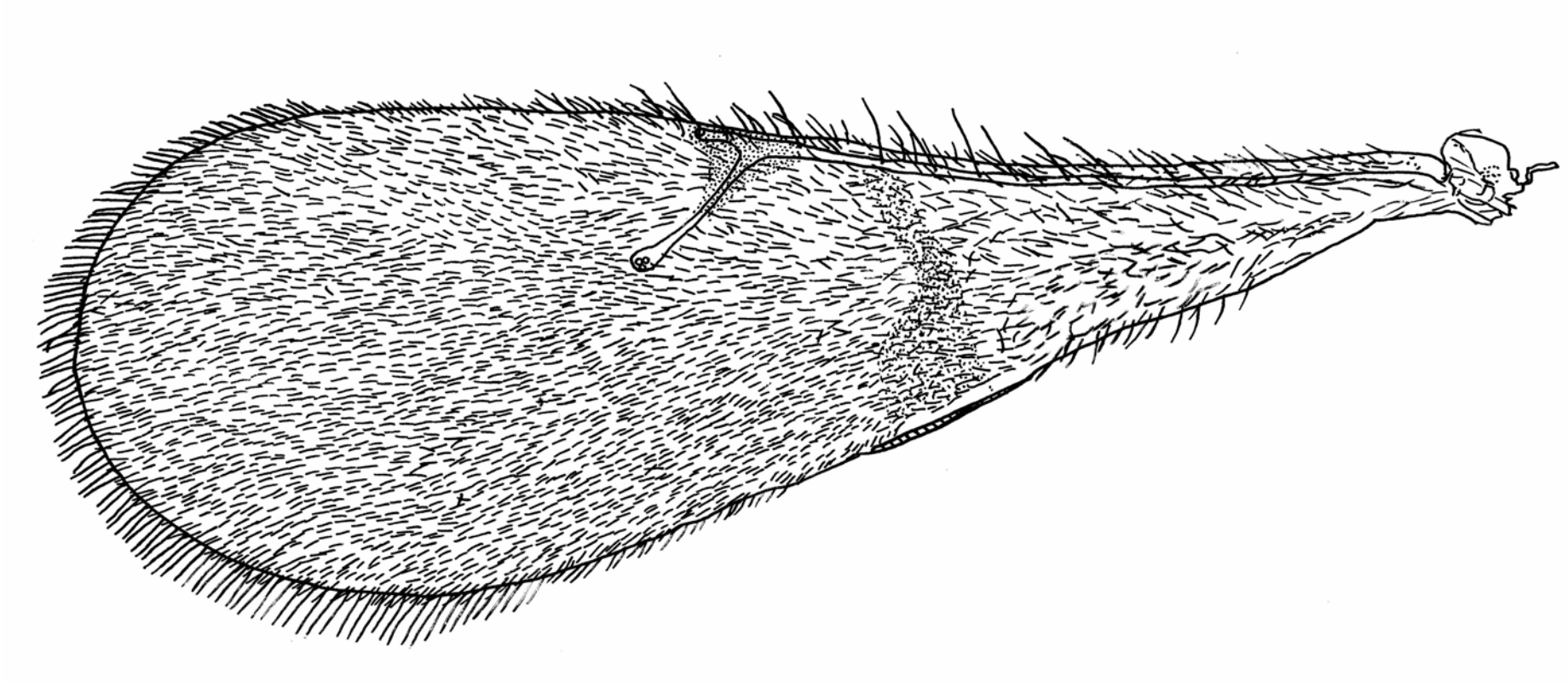


FIGURE 3. *Thoron metallicum*. ♀ lectotype. Hindwing. A portion of the bottom of the wing margin is missing and is indicated by dashed lines.

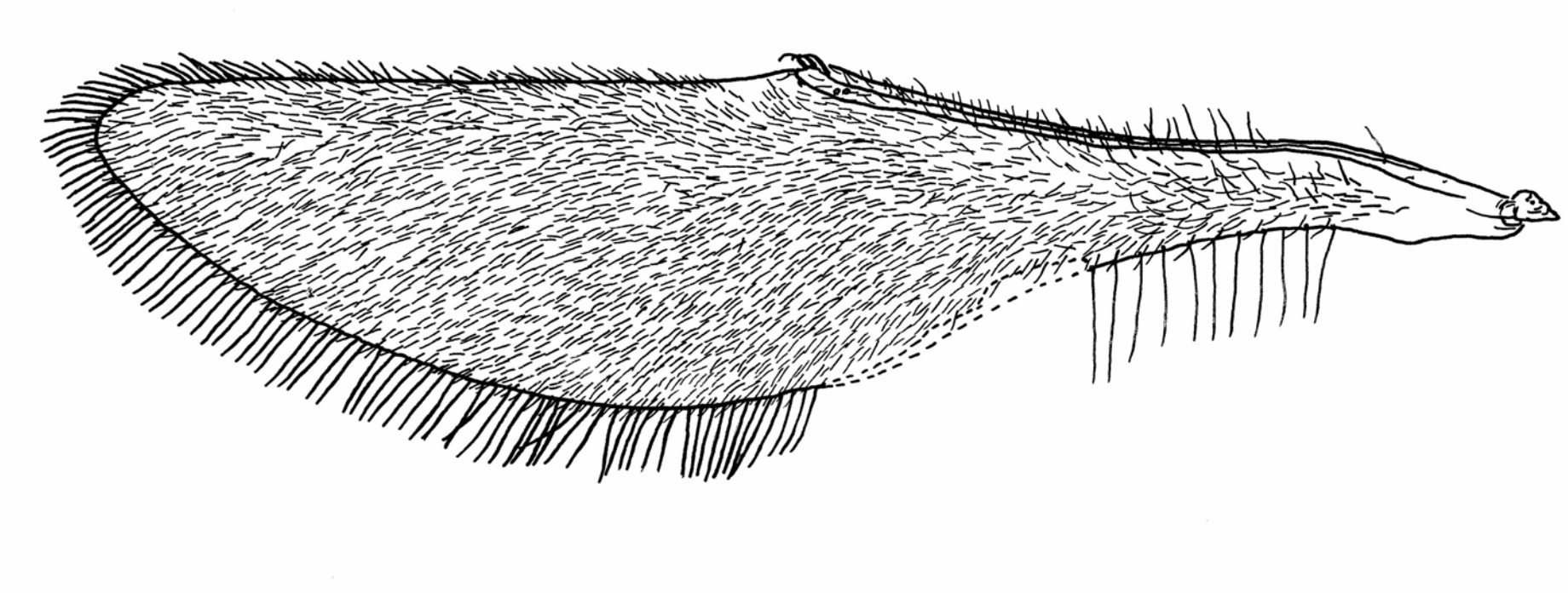


FIGURE 4. *Thoron metallicum*. ♀ lectotype. Mandible.

FIGURE 5. *Thoron metallicum*. ♀ lectotype. Moutparts. Maxillary palp = mxp; labial palp = lp. The latter had broken off on the slide.

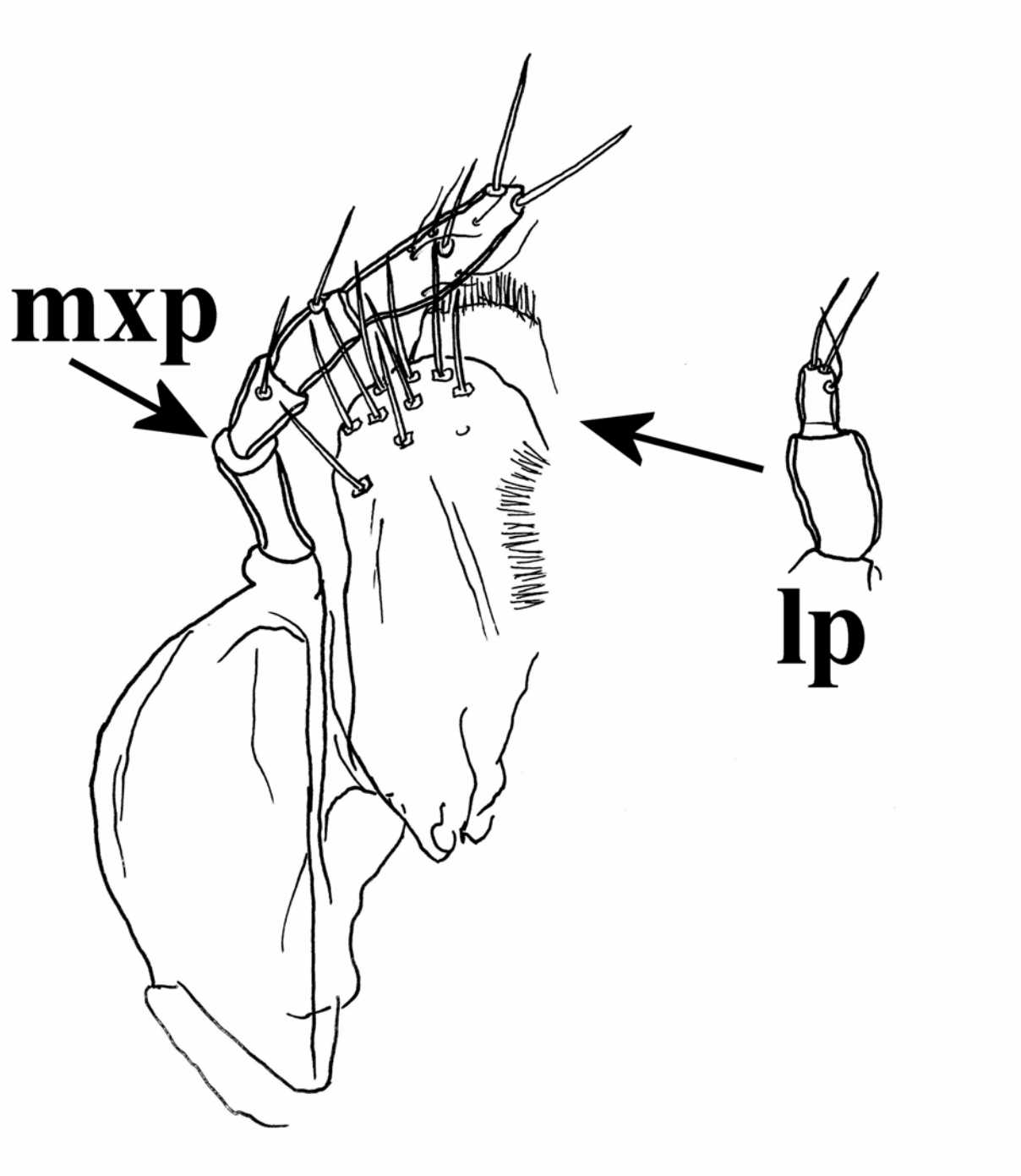


FIGURE 6. *Thoron metallicum*. Habitus of ♀ modified from Haliday's figure 11 on plate XIII in Walker (1836).

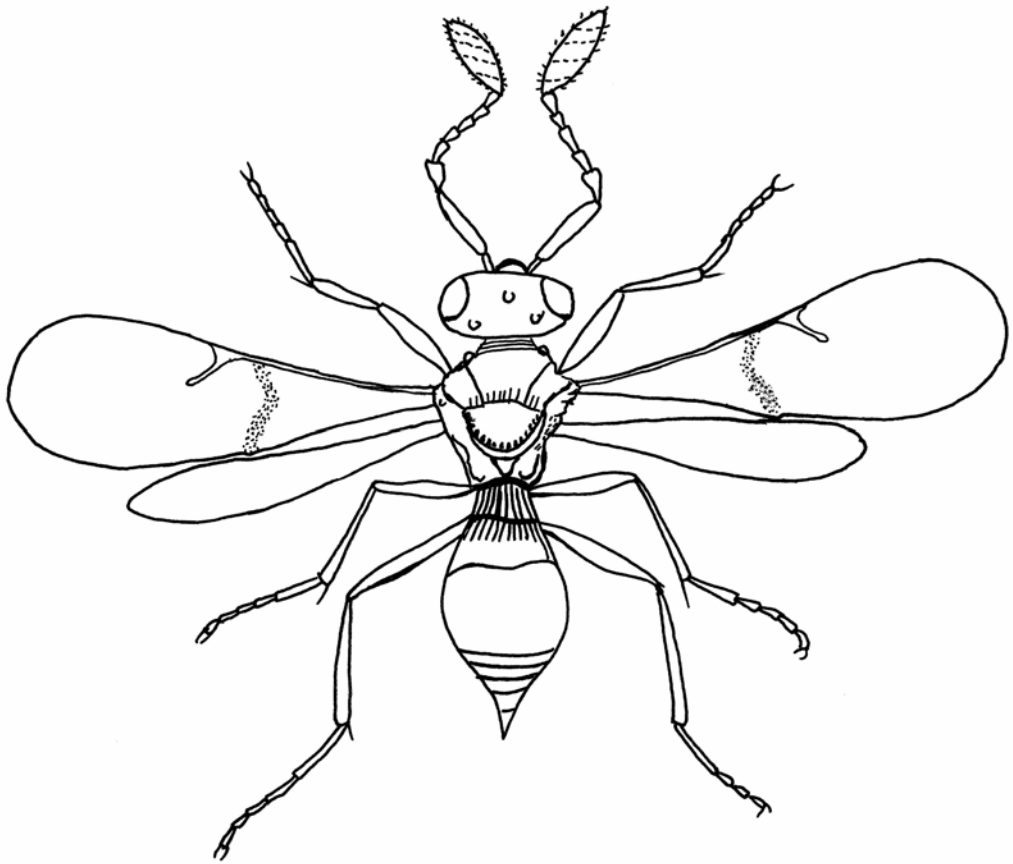


FIGURE 7. *Teleas medon*. ♀ antenna.

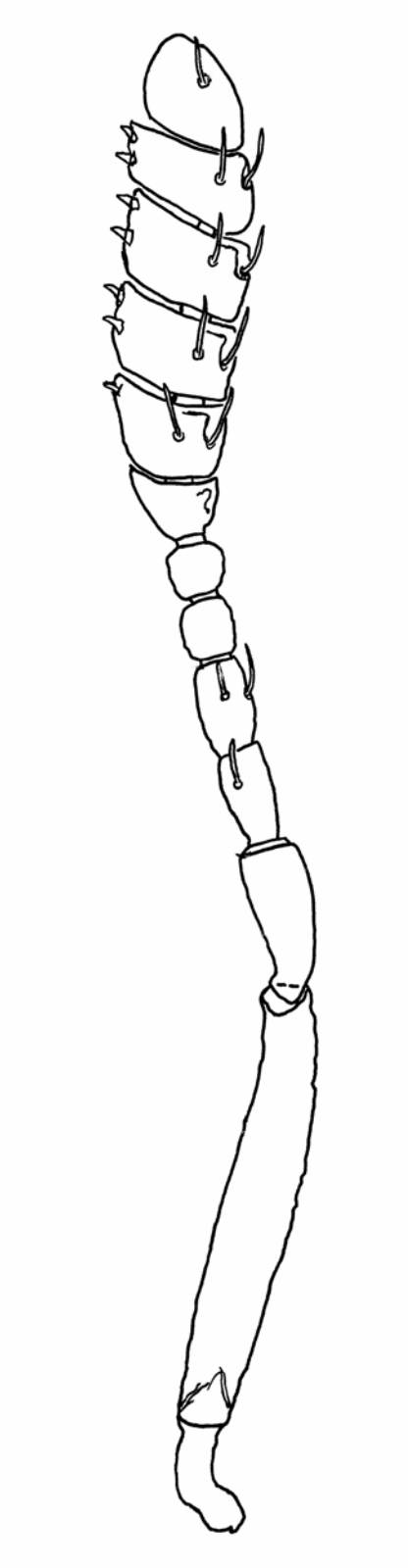
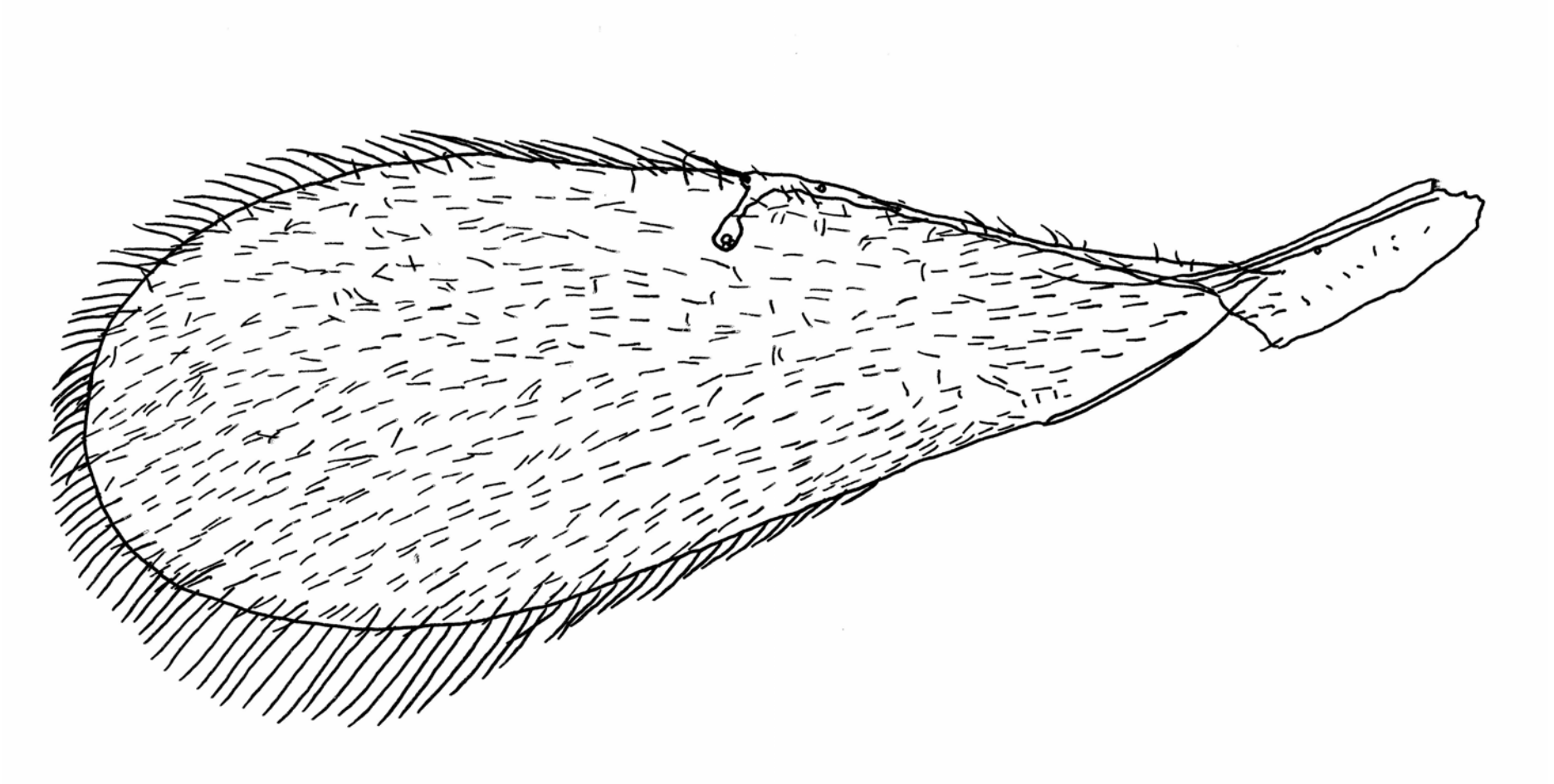


FIGURE 7. *Teleas medon*. ♀ forewing. The base of the wing was twisted and torn.



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FAUNISTICS DATA FOR SCIOMYZIDAE (DIPTERA) IN THE WEST OF IRELAND WITH DISTRIBUTION MAPS, SPECIES ACCOUNTS AND COMMENTS ON COMMUNITY STRUCTURE

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Abstract

Date-locality records for 21 species of Sciomyzidae (Diptera) are presented for the west of Ireland (Cos Galway, Mayo, Roscommon, Westmeath and Clare). These data comprise 1894 individuals and include 24 new county records (nine for Roscommon, six for Galway, four for Mayo, four for Westmeath and one for Clare). Details on habitats, phenology and feeding behaviour are provided as are a series of maps which illustrate our records for the 21 species. We also include a set of maps detailing our records for seven Irish species of *Tetanocera* Duméril. The raw data for the latter were obtained from Williams *et al.* (2007 *Bulletin of the Irish Biogeographical Society* **31**: 268-295). The two studies combined report date-locality information for a total of 2378 sciomyzid individuals which allows commentary on ecological factors that are likely to be playing a role in the distribution of these species and consequently this information represents valuable baseline data for future studies.

Introduction

The provision of distributional data is a crucial component of biogeography and ecology but it is particularly important for taxa which have a role to play in applied ecological research. An excellent example in this regard is the Sciomyzidae, which have potential as biological control agents of snail-borne trematode diseases of humans (Maharaj *et al.*, 1992) and livestock (Mc Donnell and Gormally, 2007; Mc Donnell *et al.*, 2005; Gormally, 1988) and of pestiferous molluscs of agricultural (Coupland and Baker, 1995) and horticultural importance (Knutson *et al.*, 1965). They are also being used as a model system to investigate the evolution of saprophage-predator-parasitoid transitions (Knutson and Vala, 2002,in press) and to investigate the adaptive radiation of aquatic-terrestrial transitions (Chapman *et al.*, 2006). More recently, they have proven useful as bioindicators on a variety of wetland habitats particularly in agricultural landscapes in Ireland (Speight, 2001, 2004; Williams, Sheahan and Gormally, 2009; Williams *et al.*, 2009).

There are currently 57 species recorded in Ireland (Staunton *et al.*, 2008). Recent additions to the national fauna include *Pherbellia stackelbergii* Elberg, 1965 by Staunton *et al.* (2008) and *Pherbellia dorsata* (Zetterstedt, 1846) and *Colobaea pectoralis* (Zetterstedt, 1847) by Gittings and Speight (2008). In Ireland, data on the distributions of species throughout the island were compiled by Chandler (1972) whereas Williams *et al.* (2007) presented data for the genus *Tetanocera* in the west.

The aim of this paper is to present date-locality data for 21 species of Sciomyzidae (Diptera) collected in the west of Ireland from 1999-2008. In addition to the raw data, habitat associations are presented in Figure 1 and the phenologies of the different species are given in Figure 2. Information on larval feeding behaviour is also provided. Many of the sites are turloughs (i.e. groundwater dependent seasonal lakes), but we differentiate between poor grassland "edge communities" and sedge and wetland plant dominated "turlough-proper" communities. We include collections from wet woodlands, river floodplains, lake edges, drainage ditches and roadside verges. We also include a distribution map for each species based on our records (Figs

3-23), including the seven species of *Tetanocera* (Figs 24-30) covered by Williams *et al.* (2007), as the latter publication only provided date-locality data. Finally an aggregated map (Fig. 31) is presented which illustrates all of the date-locality data for the twenty-eight species.

Materials and methods

Collections of adults were typically made with a standard sweep net (0.5m diameter, bag depth 0.67m, handle length 0.31m) and traditional mouth pooters but some adults were caught using yellow pan-traps (20cm diameter, height 50cm). Captures of larvae and puparia were made with a standard pond net (25cm diameter). Adult sciomyzids were identified to species level using Rozkošný (1987).

Results

All records are for adults unless otherwise specified. PT indicates collection by yellow pan-trap rather than by a sweep-net, which was used for all other captures.

TRIBE SCIOMYZINI

(1.) *Colobaea bifasciella* (Fallén, 1820)

(A) Co. Galway

(1) Ballinduff turlough M4608, ♀ 6.vii.2004 *Carex nigra* zone; 1 empty puparium in *Lymnaea fusca* 29.iv.2005, *Phalaris arundinacea* zone; 1 empty puparium in *Radix balthica* 12.v.2005, *Carex nigra* zone.

(2) Killeenavarra turlough M4212, 1 empty puparium in *Galba truncatula* 8.xi.2005, *Carex nigra* zone; 1 empty puparium in *Galba truncatula* 26.i.2005, poor grassland zone; *Eleocharis palustris* zone; 1 empty puparium in *Galba truncatula* 15.iii.2006, *Carex nigra* zone.

(B) Co. Mayo

(1) Skealoghan turlough M2563, 1 empty puparium in *Galba truncatula* 6.xii.2005, *Carex nigra* zone.

(2.) *Pherbellia argyra* Verbeke, 1967

(A) Co. Galway

(1) Lough Mannagh turlough M4001, ♀ 3.viii.2004, *Carex elata* zone.

(2) Killenavara turlough M4212, ♀ 15.viii.2005, poor grassland zone.

(B) Co. Roscommon

(1) Lough Croan turlough M8849, ♀ 29.vi.2004, *Eleocharis-Glyceria* zone; ♀ 12.vii.2004, *Carex rostrata* zone; 2♂♂ 3.ix.2004, *Carex rostrata* zone; 2♀♀ 29.viii.2005, *Eleocharis-Glyceria* zone.

(2) Ballinturly turlough M8460, ♂ 1.vii.2004, *Carex nigra* zone; 3♂♂ 1.vii.2004, *Eleocharis palustris* zone; 6♂♂6♀♀ 3.ix.2004, *Eleocharis palustris* zone.

(3.) *Pherbellia brunnipes* (Meigen, 1838)

(A) Co. Roscommon

(1) Ballinturly turlough M8460, ♀ 1.vii.2004, *Carex nigra* zone; ♀ 1.vii.2004, *Eleocharis palustris* zone; ♂ 6.vii.2004, *Carex nigra* zone.

(4.) *Pherbellia cinerella* (Fallén, 1820)

(A) Co. Galway

(1) Killenavara turlough M4212, ♂ 15.viii.2005, poor grassland zone.

(2) Killenavara turlough M4212, ♀ 12.v.2005, poor grassland zone.

(B) Co. Roscommon

(1) Ballinturly turlough M8460, ♀ 1.vii.2004, poor grassland zone; ♂ 20.viii.2004, poor grassland zone; ♀ 4.v.2005, poor grassland zone; ♀ 16.viii.2005, poor grassland zone; ♀ 29.viii.2005, poor grassland zone.

(5.) *Pherbellia dubia* (Fallén, 1820)

(A) Co. Galway

(1) Portumna Forest Park M849034, ♂ 25.v.2003, lake edge.

(6.) *Pherbellia nana nana* (Fallén, 1820)

(A) Co. Galway

(1) Termon North turlough R4197, ♀ 15.vi.2004, *Carex nigra* zone.

(2) Lough Mannagh turlough M4001, ♂♀ 6.vii.2004, *Carex nigra* zone.

(3) Ballinduff turlough M4608, 9♂♂7♀♀ 17.vi.2004, *Carex nigra* zone; 2♂♂♀ 6.vii.2004, *Carex nigra* zone.

(4) Killenavara turlough M4212, ♂♀ 25.vi.2004, *Eleocharis palustris* zone; ♂ 9.vii.2004, *Eleocharis palustris* zone.

(5) Croaghill turlough M6071, 5♂♂5♀♀ 2.vii.2004, *Carex nigra* zone; ♂ 6.viii.2004, *Eleocharis palustris* zone.

(6) Ballindooley M307314, ♂ 12.viii.2000, grazed drainage ditch.

(B) Co. Mayo

(1) Skealoghan turlough, Ballinrobe M2563, 2♂♂ 2.vi.2004, sedge fen zone; ♂ 2.vi.2004, *Eriophorum angustifolium* zone; ♀ 16.vi.2004, *Carex nigra* zone; ♀ 7.vii.2004, *Carex nigra* zone; ♂ 15.v.2005, *Carex nigra* zone.

(2) Ardkill turlough M2763, ♂♀ 21.vi.2004, *Carex nigra* zone; ♂ 21.vi.2004, *Phalaris arundinacea* zone; ♂♀ 21.vi.2004, *Eleocharis palustris* zone; 3♂♂♀ 21.vii.2004, *Eleocharis palustris* zone.

(C) Co. Roscommon

(1) Ballinturly turlough M8460, 2♂♂ 1.vii.2004, *Eleocharis palustris* zone; ♀ 1.vii.2004, poor grassland zone; ♂ 12.vii.2004, *Eleocharis palustris* zone; ♀ 22.vii.2004, *Eleocharis palustris* zone; ♀ 3.ix.2004, poor grassland zone.

(7.) *Pherbellia schoenherri schoenherri* (Fallén, 1826)

(A) Co. Galway

(1) Cregaclare South turlough M4711, ♂16.vii.2004, *Carex nigra* zone; ♂ 16.vii.2004, *Magnocaricion* zone.

(2) Termon North turlough R4197, 2♀♀ 5.vii.2004, *Phalaris-Eleocharis* zone; 2♀♀ 27.vii.2004, *Carex nigra* zone; ♂ 27.vii.2004, *Phalaris-Eleocharis* zone; ♀ 9.viii.2004, *Carex nigra* zone.

(3) Lough Mannagh turlough M4001, ♂ 6.vii.2004, *Carex nigra* zone; ♀ 19.vii.2004, *Carex nigra* zone; ♂ 19.vii.2004, *Carex elata* zone; ♂ 3.viii.2004, *Carex nigra* zone; 3♂♂ 3.viii.2004, *Carex elata* zone; 2♀♀ 9.viii.2004, *Carex elata* zone; 3♀♀ 25.iv.2005, *Carex nigra* zone; 2♀♀ 20.v.2005, *Carex nigra* zone.

(4) Ballinduff turlough M4608, 2♂♂ 6.vii.2004, *Phalaris arundinacea* zone; 2♂♂♀ 19.vii.2004, *Phalaris arundinacea* zone; ♂♀ 27.vii.2004, *Phalaris arundinacea* zone; ♂ 10.viii.2004, *Phalaris arundinacea* zone.

(5) Killenavara turlough M4212, ♂♀ 9.vii.2004, *Carex nigra* zone; 2♂♂2♀♀ 9.vii.2004, *Eleocharis palustris* zone; 2♂♂♀ 19.vii.2004, *Carex nigra* zone; 7♂♂♀ 19.vii.2004, *Eleocharis palustris* zone; 2♂♂♀ 3.viii.2004, *Carex nigra* zone; 10♂♂6♀♀ 3.viii.2004, *Eleocharis palustris* zone; ♂♀ 10.viii.2004, *Eleocharis palustris* zone; ♀ 31.viii.2004, *Eleocharis palustris* zone; ♀ 14.ix.2004, *Carex nigra* zone; 3♂♂ 12.v.2005, *Eleocharis palustris* zone; ♂ 26.vii.2005, poor grassland zone; ♀ 26.vii.2005, *Eleocharis palustris* zone; 2♂♂ 15.viii.2005, *Eleocharis palustris* zone; 4♂♂♀ 30.viii.2005, *Carex nigra* zone; ♂ 30.viii.2005, *Eleocharis palustris* zone; 2♀♀ 26.ix.2005, *Carex nigra* zone; ♂5♀♀ 26.ix.2005, *Eleocharis palustris* zone; 4♂♂2♀♀ 12.x.2005, *Carex nigra* zone; 5♂♂7♀♀ 12.x.2005, *Eleocharis palustris* zone.

(6) Ballindooley M307314, ♂ 18.vii.2000, ungrazed drainage ditch.

(7) Menlo M283283, 2♂♂3♀♀ 29.ix.2000, wet flush at river edge.

(8) Barna Woods M243242, ♂ 30.iv.2001, *Alnus glutinosa* stand.

(9) Oranbeg M3824, 2♂♂♀ 11.v.2005, overgrown disused quarry.

(B) Co. Mayo

(1) Ardkill turlough M2763, ♀ 1.ix.2004, *Phalaris arundinacea* zone; 2♂♂ 25.iv.2005, *Phalaris arundinacea* zone; ♀ 15.v.2005, *Phalaris arundinacea* zone.

(C) Co. Roscommon

(1) Lough Croan turlough M8849, ♀ 12.vii.2004, *Carex rostrata* zone; ♂ 3.ix.2004, *Carex nigra* zone; ♀ 3.ix.2004, *Eleocharis-Glyceria* zone; ♀ 4.v.2005, *Carex nigra* zone; ♂ 12.vii.2005, *Carex nigra* zone.

(D) Co. Westmeath

(1) Hare Island, Lough Ree, Athlone N473046, ♀ 10.ix.2006, dry grassland lightly grazed by sheep; 2♀♀ 10.xi.2006, lake shore.

(8.) *Pherbellia ventralis* (Fallén, 1820)

(A) Co. Roscommon

(1) Lough Croan turlough M8849, 3♂♂ 4.v.2005, *Carex nigra* zone.

(2) Killenavara turlough M4212, ♀ 12.v.2005, *Carex nigra* zone; ♀ 12.v.2005, *Eleocharis palustris* zone.

TRIBE TETANOCERINI

(9.) *Coremacera marginata* (Fabricius, 1775)

(A) Co. Roscommon

(1) Ballinturly turlough M8460, ♂ 4.ix.2006, turlough edge.

(2) Curramore, Kiltoom M984452, 2♂♂♀ 15.ix.2006, lightly grazed grassland.

(10.) *Elgiva cucularia* (Linnaeus, 1767)

(A) Co. Galway

(1) Labane Turlough M4610, ♂ 30.vii.2002, turlough edge.

(B) Co. Mayo

(1) Moran's Carrowkeel turlough (ungrazed), Ballinrobe M217614, 3♂♂♀ 18.v.2001, emergent vegetation at turlough edge.

(11.) *Elgiva solicita* (Harris, 1780)

(A) Co. Galway

(1) Lismanny (close to Laurencetown), Ballinasloe M264892, ♀ 14.ix.2006, *Iris pseudacorus* stand on callow.

(B) Co. Mayo

(1) Skealoghan turlough, Ballinrobe M2563, ♀ 8.ix.2006.

(12.) *Hydromya dorsalis* (Fabricius, 1775)

(A) Co. Galway

(1) Cregaclare South turlough M4711, ♀ 16.vii.2004, *Carex nigra* zone; ♂ 16.vii.2004, *Magnocaricion* zone; ♀ 27.vii.2004, *Carex nigra* zone; ♂ 10.ix.2004, *Magnocaricion* zone.

(2) Lough Mannagh turlough M4001, ♂ 17.vi.2004, *Carex elata* zone; ♀ 6.vi.2004, *Carex elata* zone; 2♂♂ 19.vii.2004, *Carex elata* zone; 2♂♂ 3.viii.2004, *Carex elata* zone; ♂ 9.viii.2004, *Carex elata* zone; ♂ 25.iv.2005, *Carex nigra* zone.

(3) Ballindooley M306309, ♀ 18.vii.2000, grazed dry grassland.

(4) Ballindooley M307314, ♂ 18.vii.2000, ungrazed drainage ditch.

(5) Barna Woods M243242, 30.iv.2001 ♂, *Alnus glutinosa* stand.

(6) Oranbeg M3824, 5♂♂ 11.v.2005, overgrown disused quarry.

(B) Co. Mayo

(1) Ardkill turlough M2763, ♂ 21.vi.2004, *Eleocharis palustris* zone.

(C) Co. Roscommon

(1) Lough Croan turlough M8849, 2♂♂ 12.vii.2004, *Carex rostrata* zone; ♂ 22.vii.2004, *Carex rostrata* zone; ♂♀ 2.vii.2005, *Carex nigra* zone; ♂♀ 16.viii.2005, *Carex nigra* zone; ♂

16.viii.2005, *Carex rostrata* zone.

(2) Ballinturly turlough M8460, ♀ 1.vii.2004, *Eleocharis palustris* zone.

(D) Co. Westmeath

(1) Lough Ree near Coosan Point, Athlone N451041, ♂ 10.ix.2006, wet flush (fed by underground spring) on edge of the lough.

(13.) *Ilione albiseta* (Scopoli, 1763)

(A) Co. Galway

(1) Cregaclare South turlough M4711, 14♂♂10♀♀ 15.vi.2004, *Carex nigra* zone; 7♂♂♀ 15.vi.2004, *Magnocaricion* zone; ♂ 15.vi.2004, poor grassland zone; 17♂♂6♀♀ 5.vii.2004, *Carex nigra* zone; 17♂♂19♀♀ 17.vii.2004, *Carex nigra* zone; 5♂♂5♀♀ 16.vii.2004, *Magnocaricion* zone; 10♂♂5♀♀ 27.vii.2004, *Carex nigra* zone; ♂4♀♀ 27.vii.2004 *Magnocaricion* zone; 14♂♂6♀ 9.viii.2004, *Carex nigra* zone; 7♂♂5♀♀ 9.viii.2004, *Magnocaricion* zone; 18♂♂8♀♀ 30.viii.2004, *Carex nigra* zone; 4♀♀ 30.viii.2004 *Magnocaricion* zone; 3♂♂5♀♀ 10.ix.2004, *Carex nigra* zone; 8♂♂ 10.ix.2004, *Magnocaricion* zone; 2 3rd instar larvae collected 29.xi.2004, *Carex nigra* zone (died 4.ii.2005 and 2.i.2005); 4 3rd instar larvae collected 7.i.2005, *Magnocaricion* zone (1 died 16.i.2005, 1 died 22.i.2005 and 2 died 24.i.2005); 1 2nd instar larvae collected 16.vi.2006, permanent pool near swallow hole.

(2) Termon North turlough R4197, 3♂♂ 15.vi.2004, *Carex nigra* zone; ♀ 15.vi.2004, *Phalaris-Eleocharis* zone.

(3) Lough Mannagh turlough M4001, 4♂♂3♀♀ 17.vi.2004, *Carex nigra* zone; 3♂♂ 17.vi.2004, *Carex elata* zone; 2♀♀ 6.vii.2004, *Carex elata* zone; ♂ 19.vii.2004, *Carex elata* zone; 3♂♂♀ 3.viii.2004, *Carex elata* zone; 2♂♂ 9.viii.2004, *Carex nigra* zone; 4♂♂2♀♀ 9.viii.2004, *Carex elata* zone; 2♂♂ 31.viii.2004, *Carex nigra* zone; 4♂♂ 31.viii.2004, *Carex elata* zone; ♂ 13.ix.2004, *Carex elata* zone; ♂♀ 20.v.2005, *Carex nigra* zone. 12 3rd instar larvae collected 30.xi.2005, *Carex nigra* zone.

(4) Ballinduff turlough M4608, 3♀♀ 17.vi.2004, *Carex nigra* zone; 4♂♂3♀♀ 17.vi.2004, *Phalaris arundinacea* zone; ♂ 6.vii.2004, *Phalaris arundinacea* zone; ♂2♀♀ 19.vii.2004, *Phalaris arundinacea* zone; 2♂♂4♀♀ 27.vii.2004, *Carex nigra* zone; 4♂♂♀ 27.vii.2004, *Phalaris arundinacea* zone; ♂2♀♀ 9.viii.2004, *Phalaris arundinacea* zone; ♂3♀♀ 30.viii.2004, *Carex nigra* zone; ♂ 30.viii.2004, *Phalaris arundinacea* zone; ♂ 13.ix.2004, *Carex nigra* zone; 3♂♂ 13.ix.2004, *Phalaris arundinacea* zone.

(5) Killenavara turlough M4212, 2♂♂2♀♀ 25.vi.2004, *Carex nigra* zone; 29♂♂10♀♀ 25.vi.2004, *Eleocharis palustris* zone; 14♂♂5♀♀ 9.vii.2004, *Carex nigra* zone; 7♂♂3♀♀ 9.vii.2004, *Eleocharis palustris* zone; 7♂♂4♀♀ 19.vii.2004, *Carex nigra* zone; ♀ 19.vii.2004, poor grassland zone; ♂ 19.vii.2004, *Eleocharis palustris* zone; 4♂♂5♀♀ 27.vii.2004, *Carex nigra* zone; 3♂♂3♀♀ 3.viii.2004, *Eleocharis palustris* zone; 9♂♂4♀♀ 10.viii.2004, *Carex nigra* zone; 1♂ 3♀♀ 10.viii.2004, *Eleocharis palustris* zone; 2♀♀ 31.viii.2004, *Carex nigra* zone; 4♂♂ 14.ix.2004, *Carex nigra* zone; 4♂♂ 14.ix.2004, *Eleocharis palustris* zone; 3♂♂♀ 11.vii.2005, *Carex nigra* zone; ♀ 11.vii.2005, poor grassland zone; ♂♀ 11.vii.2005, *Eleocharis palustris* zone; 3♂♂♀ 26.vii.2005, *Carex nigra* zone; 2♀♀ 26.vii.2005, *Eleocharis palustris* zone; 4♂♂3♀♀ 15.viii.2005, *Carex nigra* zone; 2♂♂2♀♀ 15.viii.2005, *Eleocharis palustris* zone; 3♀♀ 30.viii.2005, *Eleocharis palustris* zone; ♀ 26.ix.2005, *Eleocharis palustris* zone; 4♂♂♀ 12.x.2005, *Carex nigra* zone; ♂ 12.x.2005, *Eleocharis palustris* zone; 1 third instar larva 8.xi.2005 in *Galba truncatula*, turlough-proper; 1 larva 8.xi.2005, *Carex nigra* zone.

(6) Croaghill turlough M6071, 3♂♂♀ 2.vii.2004, *Carex nigra* zone; 4♂♂ 12.vii.2004, *Carex nigra* zone; 6♂♂3♀♀ 12.vii.2004, *Eleocharis palustris* zone; ♀ 26.vi.2004, *Carex nigra* zone; 3♂ 26.vii.2004, *Eleocharis palustris* zone; ♂♀ 23.viii.2004, *Carex nigra* zone; ♀ 23.viii.2004 *Eleocharis palustris* zone; 2♂♂ 6.ix.2004, *Eleocharis palustris* zone; ♂ 22.ix.2004, *Carex nigra* zone.

(7) Ballindooley M306315, ♂7♀♀ 18.vii.2000, ungrazed river edge; ♀ 29.viii.2000, grazed river edge.

(8) Ballindooley M307314, 2♀♀ 18.vii.2000, ungrazed drainage ditch; 5♂♂♀ 29.viii.2000, ungrazed drainage ditch.

(9) Ballindooley M306309, ♀ 29.viii.2000, grazed dry grassland.

(10) Labane Turlough M4610, 3♂♂2♀♀ 30.vii.2002, turlough edge.

(11) Bullock Island N020178, ♂ 25.v.2003, callow.

(12) Lismanny (close to Laurencetown), Ballinasloe M264892, 11♂♂3♀♀ 14.ix.2006, grazed (cattle) callow.

(13) Ballyforan M817464, 5♂♂4♀♀ 15.ix.2006, grazed wet grassland.

(14) Corrib village M288269 1 third instar larva 1.xi.2005, found in puddle (dead).

(B) Co. Mayo

(1) Skealoghan turlough Ballinrobe M2563, 2♂♂ 9.vi.2004, *Eriophorum angustifolium* zone; 13♂♂10♀♀ 16.vi.2004, *Eriophorum angustifolium* zone; 5♂♂3♀♀ 16.vi.2004, *Carex nigra* zone; ♂ 24.vi.2004, unflooded calcareous grassland zone; 14♂♂ 3♀♀ 24.vi.2004, *Eriophorum angustifolium* zone; ♂ 24.vi.2004, sedge fen zone; ♂ 24.vi.2004, *Carex nigra* zone; 7♂♂2♀♀ 30.vi.2004, *Eriophorum angustifolium* zone; ♂ 30.vi.2004, *Carex nigra* zone; 9♂♂3♀♀ 7.vii.2004, *Eriophorum angustifolium* zone; ♂ 7.vii.2004, sedge fen zone; 7♂♂3♀♀, 7.vii.2004, *Carex nigra* zone; ♂6♀♀ 14.vii.2004, *Eriophorum angustifolium* zone; 3♂♂♀ 14.vii.2004, *Carex nigra* zone; 8♂♂2♀♀ 21.vi.2004, *Eriophorum angustifolium* zone; 4♂♂ 21.vi.2004, *Carex nigra* zone; 5♂♂2♀♀ 28.vii.2004, *Eriophorum angustifolium* zone; 4♂♂2♀♀ 28.vii.2004, *Carex nigra* zone; ♂♀ 4.viii.2004, *Eriophorum angustifolium* zone; ♀ 4.viii.2004, sedge fen zone; 5♂♂2♀♀ 4.viii.2004, *Carex nigra* zone; 2♂♂2♀♀ 10.viii.2004, *Carex nigra* zone; ♀ 11.viii.2004, *Eriophorum angustifolium* zone; ♂ 11.viii.2004, *Carex nigra* zone; 2♂♂♀ 23.viii.2004, *Eriophorum angustifolium* zone; 2♂♂♀ 23.viii.2004, *Carex nigra* zone; ♂ 1.ix.2004, *Eriophorum angustifolium* zone; ♂2♀♀ 1.ix.2004, *Carex nigra* zone; ♂♀ 9.ix.2004, *Carex nigra* zone; ♀ 15.ix.2004, *Carex nigra* zone; 2♂♂ 22.ix.2004, *Carex nigra* zone; 6 3rd instar larvae collected 6.xii.2005, *Carex nigra* zone; 1 2nd instar larva collected 6.xii.2005, *Carex nigra* zone ♀10-14.vii.2006, PT, *Eriophorum angustifolium* zone; ♂ 14-21.vii.2006, PT, *Carex nigra* zone; ♂ 21-27.vii.2006, PT, *Carex nigra* zone; ♀ 3-10.viii.2006,

PT, *Carex nigra* zone; ♂♀ 17-25.viii.2006, PT, *Carex nigra* zone; ♀ 1-8.ix.2006, PT, sedge fen zone; ♀ 8-15.ix.2006, PT, sedge fen zone.

(2) Ardkill turlough M2763, ♂ 21.vi.2004, *Carex nigra* zone; 2♂♂♀ 21.vi.2004, *Eleocharis palustris* zone; ♂ 8.vii.2004, *Carex nigra* zone; ♂ 8.vii.2004, *Eleocharis palustris* zone; ♀ 21.vii.2004, *Carex nigra* zone; ♀ 4.viii.2004, *Phalaris arundinacea* zone; 5♂♂2♀♀ 4.viii.2004, *Eleocharis palustris* zone; 2♂♂♀ 16.viii.2004, *Carex nigra* zone; 2♂♂3♀♀ 16.viii.2004, *Phalaris arundinacea* zone; 3♂♂2♀♀ 16.viii.2004, *Eleocharis palustris* zone; 4♂♂♀ 1.ix.2004, *Phalaris arundinacea* zone; 2♂♂ 1.ix.2004, *Eleocharis palustris* zone; 2♂♂♀ 14.ix.2004, *Eleocharis palustris* zone.

(3) Moran's Carrowkeel turlough (ungrazed), Ballinrobe M217614, ♂♀ 28.vi.2001, emergent vegetation at turlough edge.

(C) Co. Roscommon

(1) Lough Croan turlough M8849, 2♂♂♀ 29.vi.2004, *Eleocharis-Glyceria* zone; ♂♀ 29.vi.2004, *Carex rostrata* zone; 5♂♂♀ 12.vii.2004, *Carex nigra* zone; 2♂♂ 12.vii.2004, *Carex rostrata* zone; ♂3♀♀ 12.vii.2004, *Eleocharis-Glyceria* zone; 3♂ 22.vii.2004, *Carex rostrata* zone; ♀ 22.vii.2004, *Eleocharis-Glyceria* zone; ♂♀ 5.viii.2004, *Carex rostrata* zone; ♂ 5.viii.2004, *Eleocharis-Glyceria* zone; ♂ 20.viii.2004, *Eleocharis-Glyceria* zone; ♀ 3.ix.2004, *Carex rostrata* zone; ♂ 12.vii.2005, *Carex nigra* zone; ♀ 12.vii.2005, *Carex rostrata* zone; ♂ 12.vii.2005, *Eleocharis-Glyceria* zone.

(2) Ballinturly turlough M8460, 14♂♂5♀♀ 1.vii.2004, *Carex nigra* zone; 15♂♂18♀♀ 1.vii.2004, *Eleocharis palustris* zone; 19♂♂8♀♀ 12.vii.2004, *Carex nigra* zone; 7♂♂13♀♀ 12.vii.2004, *Eleocharis palustris* zone; ♂ 12.vii.2004, poor grassland zone; 8♂♂3♀♀ 22.vii.2004, *Carex nigra* zone; 32♂♂18♀♀ 22.vii.2004, *Eleocharis palustris* zone; 15♂♂♀ 5.viii.2004, *Carex nigra* zone; 27♂♂10♀♀ 5.viii.2004, *Eleocharis palustris* zone; 3♂♂ 20.viii.2004, *Carex nigra* zone; 14♂♂3♀♀ 20.viii.2004, *Eleocharis palustris* zone; 2♂♂♀ 3.ix.2004, *Carex nigra* zone; 14♂♂4♀♀ 3.ix.2004, *Eleocharis palustris* zone; ♂ 29.ix.2004,

Carex nigra zone; 2♂♂ 29.ix.2004, *Eleocharis palustris* zone; 4♂♂2♀♀ 12.vii.2005, *Eleocharis palustris* zone; ♂ 25.vii.2005, *Eleocharis palustris* zone; ♂ 16.viii.2005, *Carex nigra* zone; ♀ 19.viii.2005, *Carex nigra* zone; ♂ 19.viii.2005, *Eleocharis palustris* zone.

(D) Co. Clare

(1) Carran Turlough, Burren R2999, ♀ 14.viii.2001, turlough edge.

(E) Co. Westmeath

(1) Hare Island, Lough Ree N473046, ♂ 10.xi.2006, lake shore.

(14.) *Ilione lineata* (Fallén, 1820)

(A) Co. Galway

(1) Cregaclare South turlough M4711, 2♂♂4♀♀ 15.vi.2004, *Carex nigra* zone; 9♂♂12♀♀ 15.vi.2004, *Magnocaricion* zone; 4♂♂3♀♀ 5.vii.2004, *Carex nigra* zone; 5♂♂2♀♀ 5.vii.2004, *Magnocaricion* zone; 2♂♂ 16.vii.2004, *Carex nigra* zone; 5♂♂3♀♀ 16.vii.2004, *Magnocaricion* zone; 4♂♂♀ 27.vii.2004, *Carex nigra* zone; 2♂♂4♀♀ 27.vii.2004, *Magnocaricion* zone; 2♀♀ 9.viii.2004, *Carex nigra* zone; 6♂♂2♀♀ 9.viii.2004, *Magnocaricion* zone; ♀ 10.ix.2004, *Carex nigra* zone.

(2) Lough Mannagh turlough M4001, 2♂♂♀ 6.vii.2004, *Carex nigra* zone; ♂ 19.vii.2004, *Carex nigra* zone.

(3) Ballinduff turlough M4608, 3♂♂ 19.vii.2004, *Carex nigra* zone; 3♂♂3♀♀ 19.vii.2004, *Phalaris arundinacea* zone; 2♂♂♀ 27.vii.2004, *Phalaris arundinacea* zone; 5♂♂♀ 10.viii.2004, *Phalaris arundinacea* zone; ♀ 30.viii.2004, *Carex nigra* zone; ♂ 13.vi.2005, *Phalaris arundinacea* zone.

(4) Menlo M283283, ♀ 29.ix.2000, wet flush at river edge.

(5) Barna Woods M243242, ♀ 5.ix.2006, *Alnus glutinosa* stand; ♂♀ 21-29.viii.2008, *Alnus glutinosa* stand, PT.

(B) Co. Mayo

(1) Skealoghan turlough, Ballinrobe M2563, 3♂♂♀ 16.vi.2004, sedge fen zone; ♂ 24.vi.2004,

Eriophorum angustifolium zone; ♂♀ 24.vi.2004, sedge fen zone; ♂ 7.vii.2004, sedge fen zone; ♀ 7.vii.2004, *Carex nigra* zone; ♂ 14.vii.2004, *Eriophorum angustifolium* zone; ♂ 14.vii.2004, *Carex nigra* zone; 2♂♂ 21.vii.2004, *Carex nigra* zone; ♂ 28.vii.2004, *Carex nigra* zone; 2♀♀ 4.viii.2004, *Eriophorum angustifolium* zone.

(C) Co. Roscommon

(1) Lough Croan turlough M8849, ♀ 22.ix.2004, *Eleocharis-Glyceria* zone; ♂ 16.viii.2005, *Carex rostrata* zone.

(2) Ballinturly turlough M8460, ♂ 16.viii.2005, *Eleocharis palustris* zone.

(15.) *Limnia paludicola* Elberg, 1965

(A) Co. Galway

(1) Cregaclare South turlough M4711, ♀ 9.viii.2004, poor grassland zone.

(2) Killenavara turlough M4212, ♂ 25.vi.2004, poor grassland zone; ♂ 19.vii.2004, poor grassland zone.

(3) Ballindooley M306309, ♀ 18.vii.2000, ungrazed dry grassland

(B) Co. Roscommon

(1) Lough Croan turlough M8849, ♀ 12.vii.2005, *Carex nigra* zone.

(2) Ballinturly turlough M8460, ♂ 22.vii.2004, *Eleocharis palustris* zone; ♂ 5.viii.2004, *Eleocharis palustris* zone; ♀ 20.viii.2004, poor grassland zone.

(16.) *Limnia unguicornis* (Scopoli, 1763)

(A) Co. Galway

(1) Cregaclare South turlough M4711, ♂♀ 5.vii.2004, poor grassland zone.

(2) Ballindooley M306309, ♂2♀♀ 18.vii.2000, ungrazed dry grassland; 2♂♂, 12.viii.2000, ungrazed dry grassland.

(B) Co. Mayo

(1) Skealoghan turlough, Ballinrobe M2563, ♂ 14.vii.2004, sedge fen zone.

(C) Co. Roscommon

(1) Ballinturly turlough M8460, 2♀♀ 22.vii.2004, *Eleocharis palustris* zone; ♀ 15.vi.2005, *Eleocharis palustris* zone; ♀ 12.vii.2005, *Eleocharis palustris* zone.

(17.) *Pherbina coryleti* (Scopoli, 1763)

(A) Co. Galway

(1) Cregaclare South turlough M4711, 8♂♂9♀♀ 15.vi.2004, *Carex nigra* zone; 4♂♂3♀♀ 15.vi.2004, *Magnocaricion* zone; 13♂♂11♀♀ 5.vii.2004, *Carex nigra* zone; 2♂♂9♀♀ 5.vii.2004, *Magnocaricion* zone; 23♂♂13♀♀ 16.vii.2004, *Carex nigra* zone; 6♂♂6♀♀ 16.vii.2004, *Magnocaricion* zone; 6♂♂5♀♀ 27.vii.2004, *Carex nigra* zone; 2♂♂4♀♀ 9.viii.2004, *Carex nigra* zone; 2♂♂2♀♀ 9.viii.2004, *Magnocaricion* zone; ♂♀ 10.ix.2004, *Carex nigra* zone; ♂ 10.ix.2004, *Magnocaricion* zone; 14 3rd instar larvae 29.xi.2004, *Carex nigra* zone; 2 3rd instar larvae 7.i.2005, *Magnocaricion* zone.

(2) Termon North turlough R4197, ♂ 5.vii.2004, *Carex nigra* zone; ♀ 5.vii.2004, *Phalaris-Eleocharis* zone; ♀ 9.viii.2004, *Carex nigra* zone; ♂ 9.viii.2004, *Phalaris-Eleocharis* zone.

(3) Lough Mannagh turlough M4001, ♂2♀♀ 17.vi.2004, *Carex nigra* zone; 4♂♂2♀♀ 17.vi.2004, *Carex elata* zone; 2♂♂♀ 6.vii.2004, *Carex elata* zone; 6♂♂3♀♀ 19.vii.2004, *Carex elata* zone; ♀ 3.viii.2004, *Carex nigra* zone; 5♂♂ 3.viii.2004, *Carex elata* zone; 3♂♂2♀♀ 9.viii.2004, *Carex elata* zone; ♂ 13.ix.2004, *Carex elata* zone; 1 3rd instar larva 30.xi.2005, *Carex nigra* zone.

(4) Ballinduff turlough M4608, ♀ 19.vii.2004, *Carex nigra* zone; ♀ 27.vii.2004, *Phalaris arundinacea* zone; ♂♀ 10.viii.2004, *Phalaris arundinacea* zone.

(5) Killenavara turlough M4212, 2♂♂♀ 25.vi.2004, *Eleocharis palustris* zone; 2♂♂4♀♀ 9.vii.2004, *Carex nigra* zone; 3♂♂ 9.vii.2004, *Eleocharis palustris* zone; 2♂♂ 19.vii.2004, *Carex nigra* zone; 3♂♂♀ 3.viii.2004, *Carex nigra* zone; ♂ 3.viii.2004, *Eleocharis palustris* zone; ♂♀ 10.viii.2004, *Carex nigra* zone; ♀ 10.viii.2004, poor grassland zone; ♀ 31.viii.2004, *Eleocharis palustris* zone; ♂ 14.ix.2004, *Carex nigra* zone; ♂ 26.vii.2005, *Carex nigra* zone;

♂♀ 26.vii.2005, *Eleocharis palustris* zone; 2♂♂♀ 15.viii.2005, *Carex nigra* zone; 2♂♂♀ 15.viii.2005, *Eleocharis palustris* zone; ♂ 30.viii.2005, *Eleocharis palustris* zone; 1 3rd instar larva 15.iii.2006, *Carex nigra* zone.

(6) Ballindooley M306315, ♀ 18.vii.2000, grazed river edge; ♂♀ 18.vii.2000, ungrazed river edge; 4♂♂ 29.viii.2000, grazed river edge; 2♂♂ 29.viii.2000, ungrazed river edge.

(7) Ballindooley M307314, 13♂♂9♀♀ 18.vii.2000, ungrazed drainage ditch; ♂ 12.viii.2000, grazed drainage ditch; 4♂♂3♀♀ 12.viii.2000, ungrazed drainage ditch; 2♂♂♀ 29.viii.2000, grazed drainage ditch; ♀ 29.viii.2000, ungrazed drainage ditch.

(8) Ballindooley M306309, ♀ 29.viii.2000, ungrazed dry grassland.

(9) Menlo M283283, ♀ 29.ix.2000, wet flush at river edge; ♂ 5.ix.2006, wet flush at river edge.

(10) Cregaclare turlough M4711, ♀ 30.vii.2002, turlough edge.

(11) Labane Turlough M4610, 4♂♂2♀♀ 30.vii.2002, turlough edge.

(12) Lismanny (close to Laurencetown), Ballinasloe M264892, 5♂♂♀ 14.ix.2006, grazed (cattle) callow.

(B) Co. Mayo

(1) Skealoghan turlough, Ballinrobe M2563, ♂ 9.vi.2004, *Eriophorum angustifolium* zone; 2♀♀ 16.vi.2004, *Eriophorum angustifolium* zone; ♂ 16.vi.2004, *Carex nigra* zone; ♂ 24.vi.2004, *Eriophorum angustifolium* zone; ♀ 7.vii.2004, *Eriophorum angustifolium* zone; ♀ 7.vii.2004, sedge heath zone; ♀ 7.vii.2004, *Carex nigra* zone; ♀ 21.vii.2004, sedge fen zone; 1 3rd instar larva 6.xii.2005, *Carex nigra* zone; ♀ 14-21.vii.2006, PT, *Carex nigra* zone; ♀ 10-17.viii.2006, PT, *Carex nigra* zone.

(2) Ardkill turlough M2763, 2♂♂2♀♀ 21.vi.2004, *Carex nigra* zone; ♀ 21.vi.2004, *Eleocharis palustris* zone; 2♂♂♀ 4.viii.2004, *Eleocharis palustris* zone; 2♀♀ 16.viii.2004, *Eleocharis palustris* zone.

(3) Moran's Carrowkeel turlough (ungrazed), Ballinrobe M217614, ♂ 18.v.2001, emergent vegetation at turlough edge; ♂ 28.vi.2001, emergent vegetation at turlough edge.

(C) Co. Roscommon

(1) Lough Croan turlough M8849, ♂ 29.vi.2004, *Eleocharis-Glyceria* zone; ♂3♀♀ 12.vii.2004, *Carex rostrata* zone; 2♀♀ 22.vii.2004, *Carex rostrata* zone; ♂ 5.viii.2004, *Carex rostrata* zone; ♂ 5.viii.2004, *Eleocharis-Glyceria* zone; ♀ 20.viii.2004, *Carex rostrata* zone; ♀ 20.viii.2004, *Eleocharis-Glyceria* zone; ♀ 3.ix.2004, *Carex rostrata* zone; ♂2♀♀ 12.vii.2005, *Eleocharis-Glyceria* zone.

(2) Ballinturly turlough M8460, 2♀♀ 1.vii.2004, *Carex nigra* zone; ♀ 12.vii.2004, *Carex nigra* zone; 3♂♂♀ 12.vii.2004, *Eleocharis palustris* zone; 7♂♂5♀♀ 22.vii.2004, *Eleocharis palustris* zone; 4♂♂ 5.viii.2008, *Eleocharis palustris* zone; ♂ 3.ix.2004, *Eleocharis palustris* zone; ♂♀ 12.vii.2005, *Eleocharis palustris* zone; ♂ 29.viii.2005, *Eleocharis palustris* zone; ♀ 29.viii.2005, poor grassland zone; 3♂♂2♀♀, 4.ix.2006, turlough edge.

(D) Co. Clare

(1) Carran Turlough, Burren R2999, ♀ 14.viii.2001, turlough edge.

(18.) *Renocera pallida* (Fallén, 1820)

(A) Co. Galway

(1) Barna Woods M243242, 2♂♂ 30.iv.2001, *Alnus glutinosa* stand; 2♂♂♀, 21-29.viii.2008, *Alnus glutinosa* stand, PT.

(2) Portumna Forest Park M847034, ♂ 25.v.2003, wet woodland.

(3) Oranbeg M3824, 2♂♂ 11.v.2005, ungrazed wet grassland.

(19.) *Sepedon sphegea* (Fabricius, 1775)

(A) Co. Galway

(1) Cregaclare South turlough M4711, ♂ 5.vii.2004, *Carex nigra* zone; ♀ 16.vii.2004, *Carex nigra* zone.

(2) Ballindooley M307314, ♀ 18.vii.2000, grazed drainage ditch; ♂ 18.vii.2000, ungrazed drainage ditch; ♂ puparium 2.iii.2006, collected floating on the open water of a drainage ditch

(adult emerged 23.iii.2006).

(3) Lismanny (close to Laurencetown), Ballinasloe M2689, ♂ 14.ix.2006, ungrazed callow.

(B) Co. Mayo

(1) Skealoghan turlough, Ballinrobe M2563, ♀ 10-14.vii.2006, PT, *Carex nigra* zone; ♀ 10-17.viii.2006, PT, poor grassland zone.

(2) Ardkill turlough M2763, ♂ 21.vi.2004, *Eleocharis palustris* zone.

(3) Moran's Carrowkeel turlough (ungrazed), Ballinrobe M217614, ♀ 18.v.2001, emergent vegetation at turlough edge; 3♂♂5♀♀ 28.vi.2001, emergent vegetation at turlough edge.

(C) Co. Roscommon

(1) Lough Croan turlough M8849, ♀ 16.viii.2005, *Carex rostrata* zone; ♂ 29.viii.2005, *Carex rostrata* zone.

(2) Ballinturly turlough M8460, ♂2♀♀ 12.vii.2005, *Eleocharis palustris* zone; 8♂♂2♀♀, 4.ix.2006, turlough edge.

(D) Co. Westmeath

(1) Carrickynaghtan and Garrynagalvna Bog, Clonown, Athlone N025378, ♀ 31.viii.2006, wet depression on track beside a raised bog.

(2) Lough Ree near Coosan Point, Athlone N451041, ♀ 10.ix.2006, wet flush (fed by underground spring) on edge of the lough.

(20.) *Sepedon spinipes* (Scopoli, 1763)

(A) Co. Galway

(1) Cregaclare South turlough M4711, 3♀♀ 15.vi.2004, *Carex nigra* zone; ♂ 5.vii.2004, *Carex nigra* zone; ♀ 30.viii.2004, *Carex nigra* zone; ♀ 10.ix.2004, *Carex nigra* zone.

(2) Coole Park M432042: 10♀♀ 6.v.2001, turlough edge on grazed vegetation.

(3) Bullock Island N020178, ♂ 25.v.2003, callow.

(B) Co. Mayo

(1) Moran's Carrowkeel turlough (ungrazed), Ballinrobe M217614, ♀ 25.iv.2001, emergent

vegetation at turlough edge; 4♂♂11♀♀ 9.v.2001, emergent vegetation at turlough edge; 14♂♂10♀♀ 18.v.2001, emergent vegetation at turlough edge; 4♂♂4♀♀ 28.vi.2001, emergent vegetation at turlough edge.

(2) Skealoghan turlough, Ballinrobe M2563, 2♂♂ 7.ix.2006, species-poor grassland.

(C) Co. Roscommon

(1) Lough Croan turlough M8849, 2♂♂ 16.viii.2005, *Carex rostrata* zone.

(2) Ballinturly turlough M8460, ♂ 4.ix.2006, turlough edge.

(D) Co. Westmeath

(1) Lough Ree near Coosan Point, Athlone N451041, ♀ 10.ix.2006, wet flush (fed by underground spring) on edge of the lough.

(2) Hare Island, Lough Ree, Athlone N473046, ♂ 10.ix.2006, dry grassland lightly grazed by sheep.

(21.) *Trypetoptera punctulata* (Scopoli, 1763)

(A) Co. Westmeath

(1) Curraghnaboll N022322, ♂ 7.vi.2007, under trees on the margin of some waste ground.

Discussion

Due to unequal sampling efforts, different sampling techniques and a mixture of qualitative and quantitative sampling strategies, it is necessary to look at the relative abundance of each species in a particular habitat rather than the absolute abundances. The proportional abundances show that there are quite different community constants and associates in each habitat type, which reflect the autecology of each particular species (Fig. 1). We also summarize flight periods in the form of phenology plots (Fig. 2) and larval resources (from previously published studies) to highlight the autecological differences between species in the discussion. The geographical data from the present study are summarised in distribution maps (Figs 3-23).

For the 21 species listed above, at least basic life cycles are known and the immature stages of all have been described. In addition, all of the species can be placed among the 17 behavioural groups described by Knutson and Vala (2002, in press). In fact, several of the species have been the subject of extensive field and laboratory experimental studies (*Ilione albiseta, Pherbellia s. schoenherri, Sepedon sphegea* and *Sepedon spinipes*) which are summarised in Knutson and Vala (in press). We also direct readers to the sciomyzid website (http://www.sciomyzidae.info) where additional information on the biology, ecology and systematics of the family can be found.

SPECIES ACCOUNTS

TRIBE SCIOMYZINI

(1.) *Colobaea bifasciella*

A single imago from a turlough in Co. Galway (new county record) and seven puparia in snail shells from turloughs in Cos Galway and Mayo were collected during this survey (Fig. 3). This Palaearctic sciomyzid is a parasitoid of pulmonate freshwater snails with each larva developing to a pupa in a single snail individual (Knutson and Bratt, in prep.). The puparia in this study were found inside the shells of *Galba truncatula* (O. F. Müller), *Lymnaea fusca* (Pfeiffer) and *Radix balthica* (L.), which had obviously served as prey for the developing larvae. In fact, collapsed eggs of this sciomyzid were found on two of the empty *Galba truncatula* shells. In terms of phenology, *Colobaea bifasciella* is bi- or univoltine and overwinters in the puparium as a pupa or pharate adult (Knutson and Bratt, in prep.).

(2.) *Pherbellia argyra*

This Holarctic species was first discovered in Ireland in 1976 (Speight and Nash, 1977) and records since then have been rare. During our surveys, 24 individuals were collected at turloughs in Cos. Galway and Roscommon and these are the first records of the species in both counties (Fig. 4). The species, although confined to the turlough habitat in this study, was not

found to be a significant component of either the turlough edge (Fig. 2b) or the turlough proper (Fig. 2a) communities. Bratt *et al*. (1969) cited marshes and other aquatic situation where there is an annual temporary drop in the water level during the summer as suitable habitat, which could explain its presence exclusively on turloughs during our collections. According to Bratt *et al*. (1969), *Pherbellia argyra* is a multivoltine sciomyzid overwintering in the puparium as a pupa or pharate adult. In terms of feeding behaviour, the species is a predator/saprophage of pulmonate freshwater snails exposed on moist surfaces by fluctuating water levels.

(3.) *Pherbellia brunnipes*

The Palaearctic *Pherbellia brunnipes* was first reported in Ireland by Chandler (1972) and since then there have been only two published records (Speight, 1977; Ryder *et al*., 2003). During our surveys three individuals were collected from a single turlough and these represent the first records of the species in Co. Roscommon (Fig. 5). The species overwinters in the puparium (Bratt *et al*., 1969) and it is thought to be a predator/saprophage of pulmonate freshwater snails exposed on moist surfaces by fluctuating water levels (Knutson and Vala,in press).

(4.) *Pherbellia cinerella*

Seven individuals of this Palaearctic species were collected in Cos Galway (first records for this county) and Roscommon (Fig. 6). *Pherbellia cinerella* is a common species in grasslands and in this study it was found only at the turlough edge (Fig. 2b) but it was not particularly abundant in this habitat. *Pherbellia cinerella* is a multivoltine predator/saprophage of non-operculate terrestrial snails and can overwinter either as an adult or in the puparium (Bratt *et al*., 1969). Chandler (1972) cites *P. cinerella* as a species of open areas.

(5.) *Pherbellia dubia*

Pherbellia dubia (Palaearctic) is a species of wet woodlands and only a single specimen was collected during our surveys, at the edge of a lake in a forest in Co. Galway (Fig. 7). *Pherbellia dubia* is a parasitoid of terrestrial pulmonate snails and it overwinters in the puparium (Bratt *et al*., 1969).

(6.) *Pherbellia nana nana*

Although Walker (1853) stated that this Holarctic species was 'not common' in Ireland, we collected 58 individuals in Cos Galway, Mayo and Roscommon (Fig. 8). The species was present, but not abundant in turloughs (both turlough edge – Fig. 2a and turlough proper – Fig. 2b - communities). It was, however, a significant component of the grazed drainage ditch community (Fig. 2f). *Pherbellia n. nana* is a multivoltine species overwintering in the puparium as a pupa or pharate adult. It is a non-host-specific predator/saprophage of pulmonate freshwater snails exposed by fluctuating water levels (Bratt *et al*., 1969).

(7.) *Pherbellia schoenherri schoenherri*

Pherbellia schoenherri schoenherri is a Palaearctic subspecies with a second subspecies (*Pherbellia schoenherri maculata* (Cresson)) in the Nearctic. It was the most common (131 individuals) member of the Sciomyzini recorded during our surveys and the third most common sciomyzid overall. It was collected in Cos Galway, Mayo (new county record), Roscommon and Westmeath (Fig. 9). The species may be described as a companion species in the turlough proper community (Fig. 1a), but is a less common occasional species in the turlough edge community (Fig. 1b). It is dominant in the lake shore community (Fig. 1k) and is sub-dominant in the river edge (ungrazed) community (Fig. 1d). It is very occasional in both the drainage ditch (ungrazed) (Fig. 1f) and grazed dry grassland (Fig. 1g) communities. It occurred as a singleton in both the wet woodland (Fig. 1l) and the disused quarry (Fig. 1m) communities. Although *P. s. schoenherri* was characterised as a parasitoid or parasitoid/predator associated with Succineidae snails by Moor (1980) and Vala and Ghamizi (1992), Mc Donnell *et al*. (2004) recorded *Galba truncatula* as suitable prey for the species in the west of Ireland. *P. s. schoenherri* is a multivoltine species that overwinters as an adult.

(8.) *Pherbellia ventralis*

Five individuals of this Palaearctic species were collected, all in Co. Roscommon (Fig. 10). It was present as a rarity in the turlough proper (Fig. 1a) community. According to Bratt *et al*. (1969), this species is multivoltine and overwinters in the puparium as a pupa or pharate adult.

In terms of feeding behaviour, *Pherbellia ventralis* is a predator/saprophage of pulmonate freshwater snails exposed on moist surfaces by fluctuating water levels.

TRIBE TETANOCERINI

(9.) *Coremacera marginata*

Four individuals of this Palaearctic species were collected in the present study and they represent new county (Roscommon) records (Fig. 11). *Coremacera marginata* is a species of dry grassland and unsurprisingly our specimens were swept in the poor grassland edge habitats of a turlough and in a lightly grazed dry grassland (Figs 1b and 1g). It is a predator/saprophage of non-operculate terrestrial snails and in terms of phenology, it is univoltine and overwinters as a larva and then in the puparium (Knutson, 1973).

(10.) *Elgiva cucularia*

Five individuals of the Palaearctic *Elgiva cucularia* were collected in Cos Galway and Mayo (Fig. 12) on two turlough-edge, poor grassland habitats. These are the first records of the species for both counties. *E. cucularia* is characterised as a predator of pulmonate snails at or just below the surface and occasionally on emergent vegetation and on exposed moist surfaces (Knutson and Berg, 1964). It is a multivoltine species and overwinters as a diapausing adult.

(11.) *Elgiva solicita*

This Holarctic species appears to be relatively rare in Ireland and was first collected here by Speight (1988). In this study, only two specimens were collected, one from the wetter part of a turlough in Co. Mayo and another from a stand of *Iris pseudacorus* on a callow in Co. Galway (Fig. 13). Both specimens represent new county records. As with *Elgiva cucularia* above, this is a multivoltine species which overwinters as an adult and feeds as a predator of pulmonate snails at or just below the surface, on emergent vegetation and on exposed moist surfaces (Knutson and Berg, 1964).

(12.) *Hydromya dorsalis*

Twenty-five individuals of this Palaearctic species were collected in four counties with a

new county record for Westmeath (Fig. 14). Although it occurred in five of the habitats surveyed, it never achieved a high abundance. It was, however, dominant in the disused quarry (Fig. 1m). It also occurred as an occasional species in the turlough proper community (Fig. 1a), but did not occur in the turlough edge community. It was present as a singleton in the drainage ditch (ungrazed), dry grassland, lake shore and wet woodland communities (see Figs 1e, g, k and l, respectively). The species is, therefore, best described as a rather eurytopic companion species. *Hydromya dorsalis* is classed as a predator/saprophage of pulmonate snails, primarily those exposed on moist surfaces by fluctuating water levels. It is a multivoltine species which overwinters in the puparium as a pupa or pharate adult (Knutson and Berg, 1963).

(13.) *Ilione albiseta*

This Palaearctic sciomyzid was the most frequently collected species in the study (Fig. 15) with a total of 1038 individuals collected in five counties (Galway, Mayo, Roscommon, Clare and Westmeath). The individuals collected in Cos Roscommon and Westmeath represent new county records. *Ilione albiseta* was the obvious dominant in wet grassland, callow, ungrazed river-edge and turlough proper habitats (see Figs 1j, i, d and a, respectively). This is consistent with its univoltine phenology, which makes it an ideal exploiter of wetland snails in temporary (autumnal) ponds (Berg *et al.*, 1982). The species also occurs, at a lower absolute and relative abundance, in the turlough edge and grazed river-edge habitats suggesting that it is sensitive to changes in hydrology and vegetation structure (as a result of grazing). The species was absent in wet woodland, dry grassland, and drainage ditch habitats. In the other communities, the species is often subdominant.

(14.) *Ilione lineata*

One hundred and fifteen individuals of this Palaearctic species were collected in Cos Galway, Mayo and Roscommon (Fig. 16). These are the first records of the species for the latter. It occurred only in the turlough proper and wet woodland habitats. It was never dominant and can be regarded as a companion species in these wetlands (Figs 1a and 1l). *Ilione lineata* is one of the few insect species which feeds obligately on pea mussels and finger nail clams (Sphaeriidae) (Foote and Knutson, 1970). It is univoltine and the availability of food and water

is thought to determine whether it overwinters in either the egg or larval stage (Knutson and Berg, 1967).

(15.) and (16.) *Limnia paludicola* and *L. unguicornis*

These closely related Palaearctic species were uncommon (eight individuals of *Limnia paludicola* and twelve of *L. unguicornis*) in this study with the former collected in Cos Galway and Roscommon (Fig. 17) and the latter in these counties and Mayo (Fig. 18). These are the first records of both species for Co. Roscommon. *Limnia paludicola* and *L. unguicornis* occurred together in low numbers on turlough edge and ungrazed dry grassland habitats (Fig. 1b, h). This is consistent with knowledge of their host / prey; the species are predators and / or parasitoids of terrestrial snails and will facultatively take slugs (Vala and Knutson, 1990). Both species are univoltine and overwinter in the puparium

(17.) *Pherbina coryleti*

After *Ilione albiseta*, this Palaearctic species was the second most common sciomyzid with 349 individuals collected in Cos Clare, Galway, Mayo, and Roscommon (Fig. 19). These are the first records for the species in the latter two counties. According to our data, *Pherbina coryleti* often occurs as a companion species to *I. albiseta*. It can, however, sometimes attain a higher abundance than the latter, particularly in habitats subject to management. It is a fundamental species in both grazed and ungrazed drainage ditches (Figs 1e, f) and in grazed river edge habitats (Fig. 1c). *P. coryleti* is univoltine, overwinters in the larval stage and feeds as a predator/saprophage of non-operculate snails exposed on moist surfaces by receding or fluctuating water levels (Knutson *et al.*, 1975).

(18.) *Renocera pallida*

Eight individuals of this Palaearctic sciomyzid were collected during our surveys in Co. Galway (Fig. 20). It is a species of wet woodlands and unsurprisingly it was dominant in this habitat in our study where it occurred with *Ilione lineata* (Fig. 1l). Interestingly, as with the latter species, *Renocera pallida* feeds exclusively on fingernail clams and pea mussels but on

wet substrates and not submerged (Horsáková, 2003). Apparently, it is a bi- or univoltine species overwintering in the puparium.

(19.) *Sepedon sphegea*

Thirty-three individuals of the Palaearctic *Sepedon sphegea* were collected in Cos Galway, Mayo, Roscommon and Westmeath (Fig. 21). These are the first records for the species in Galway. According to our data this species is quite eurytopic with an affinity for wetland habitats, in general, though it never attains dominance and can, like *Hydromya dorsalis*, be described as an aquatic companion species. It occurs as a companion species in the turlough proper and edge habitats (Figs 1a, b) and occurs as a singleton in callow, lake shore and grazed drainage ditch habitats (Figs 1i, k and f, respectively). *S. sphegea* is characterised as a predator of pulmonate snails at or just below the surface and occasionally on emergent vegetation and on exposed moist surfaces. It is multivoltine and overwinters as a diapausing adult (Neff and Berg, 1966).

(20.) *Sepedon spinipes*

Sixty-nine individuals of the Palaearctic *Sepedon spinipes* were collected in four counties and these appear to be the first published records for the species in Mayo, Roscommon and Westmeath (Fig. 22). It was dominant in the turlough edge habitat (Fig. 1b), which is unusual given its aquatic larval feeding behaviour. The species may be prone to wander as has been reported for *Tetanocera robusta* Loew(see Speight, 2004; Williams *et al.*, 2007). Its presence on a dry grassland in Co. Westmeath also suggests a wandering behaviour for this aquatic species. As with *S. sphegea, S. spinipes* is multivoltine and feeds as a predator of pulmonate snails at or just below the surface, on emergent vegetation and on exposed moist surfaces. It overwinters as an adult or in the puparium (Neff and Berg, 1966). Mc Donnell and Gormally (2007) and Mc Donnell *et al*. (2005) provide detailed information on the development of immature stages and on the potential use of this sciomyzid as a biological control agent in Ireland.

(21.) *Trypetoptera punctulata*

Only one individual of this Palaearctic species was collected under a tree near some waste

ground and represents a new county record for Westmeath (Fig. 23). *Trypetoptera punctulata* is univoltine, overwinters in the puparium and is a predator/saprophage of pulmonate terrestrial snails (Vala, 1986).

For similar information on the genus *Tetanocera,* see Williams *et al.* (2007) and Figures 24 to 30 below.

Acknowledgements

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FIGURE 1. Relative abundance of Sciomyzidae in each of the surveyed habitats. Additional to those illustrated, a single individual of *Trypetoptera punctulata* was collected on waste ground in Co. Westmeath and a single *Sepedon sphegea* was collected in a wet depression in that county.

FIGURE 1a. Turlough proper community.

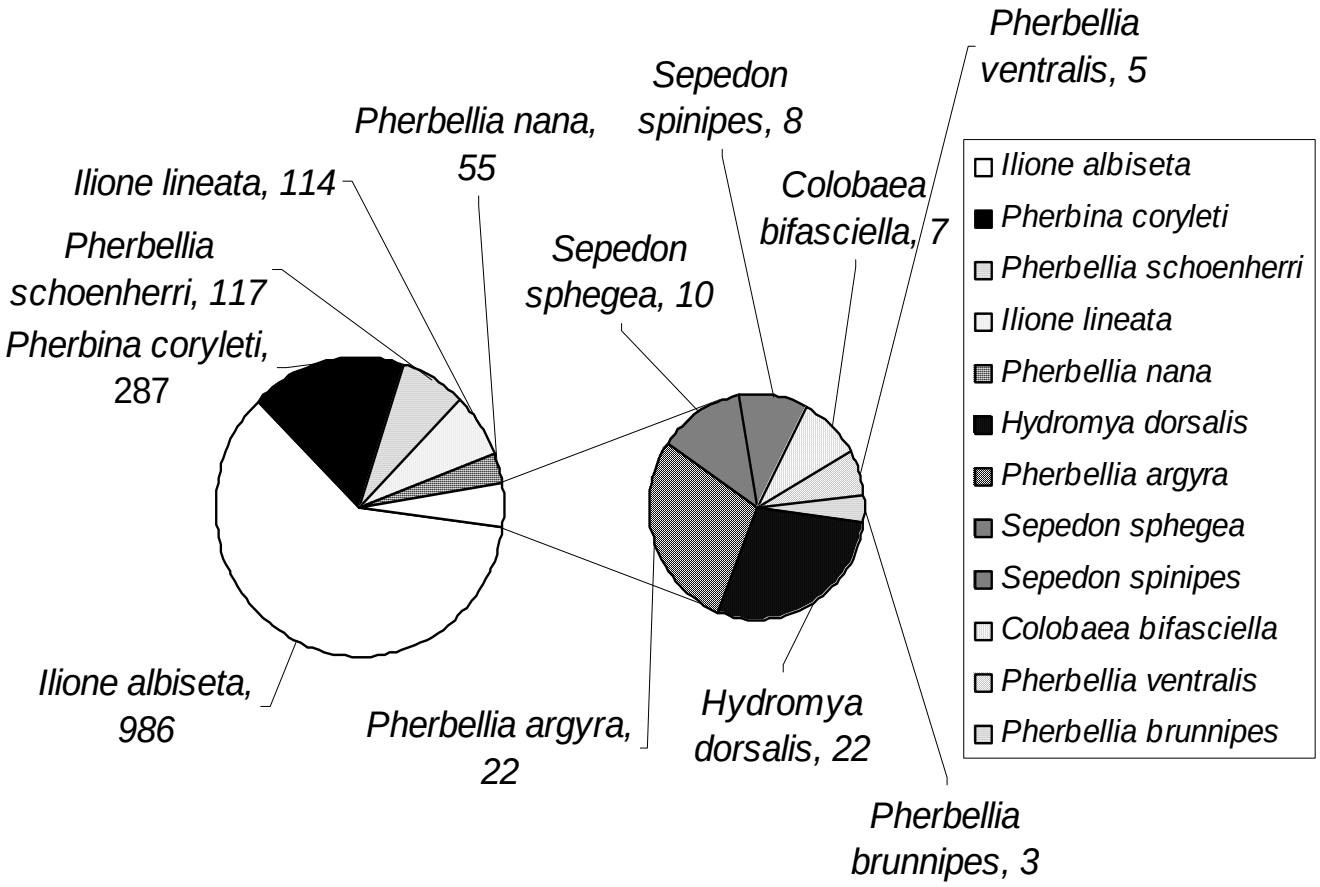


FIGURE 1b. Turlough edge community.

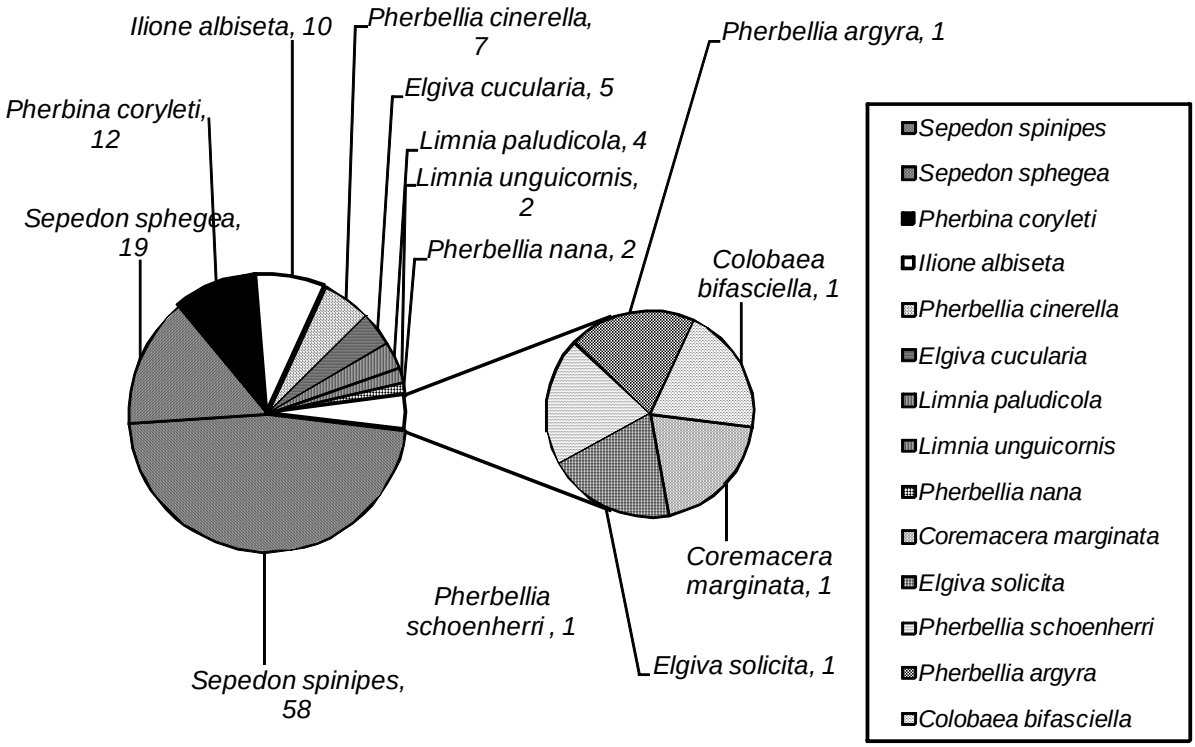


FIGURE 1c. River edge (grazed) community.

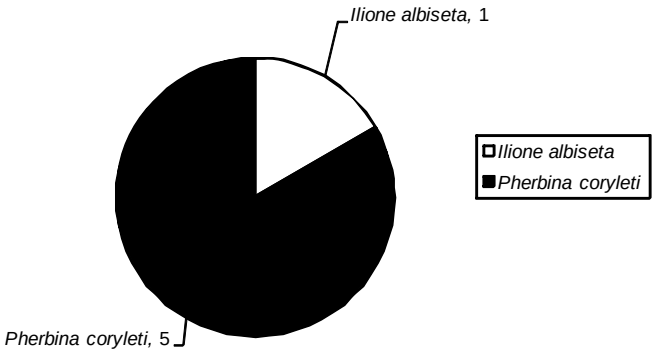


FIGURE 1d. River edge (ungrazed) community.

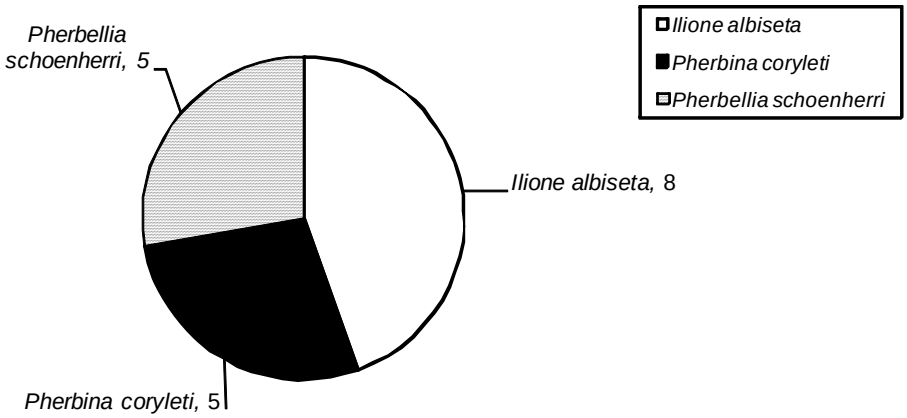


FIGURE 1e. Drainage ditch (ungrazed) community.

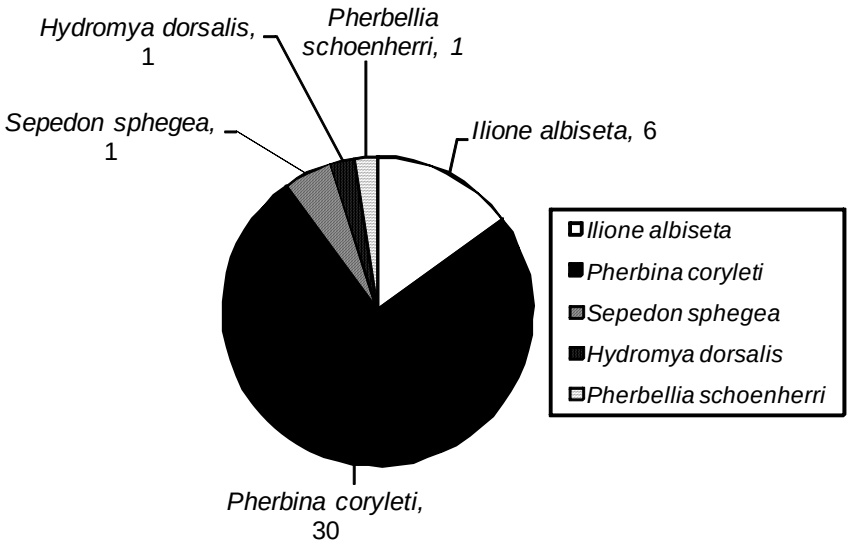


FIGURE 1f. Drainage ditch (grazed) community.

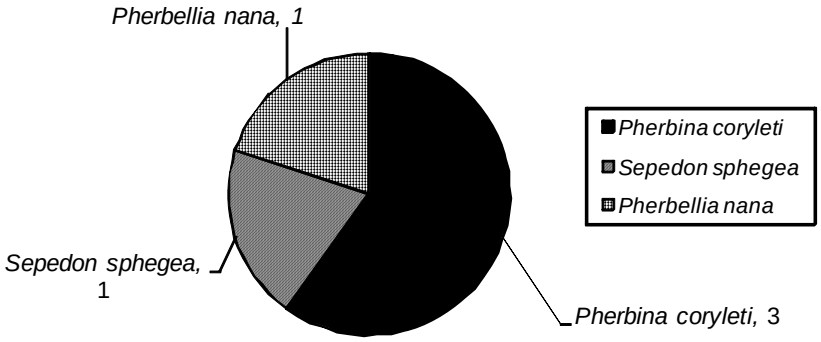


FIGURE 1g. Dry grassland (grazed) community.

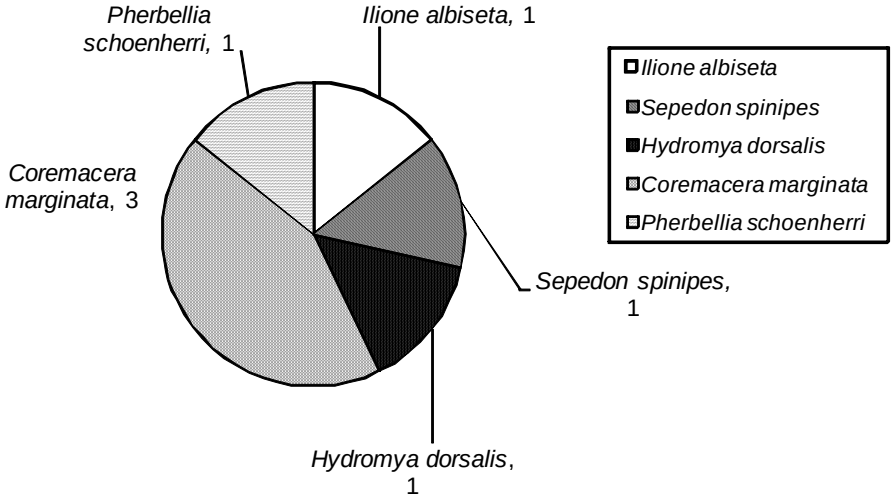


FIGURE 1h. Dry grassland (ungrazed) community.

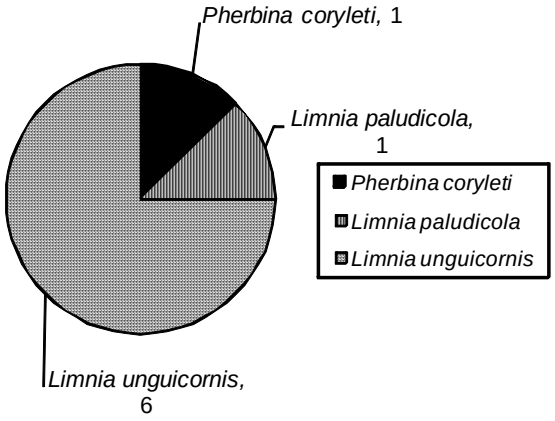


FIGURE 1i. Callow community.

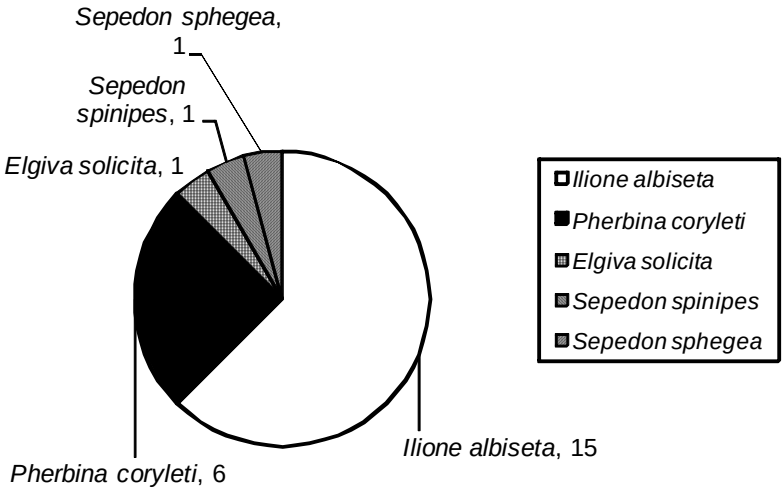


FIGURE 1j. Wet grassland community.

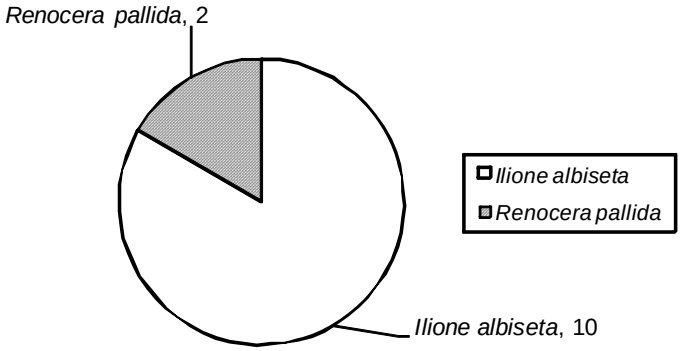


FIGURE 1k. Lake shore community.

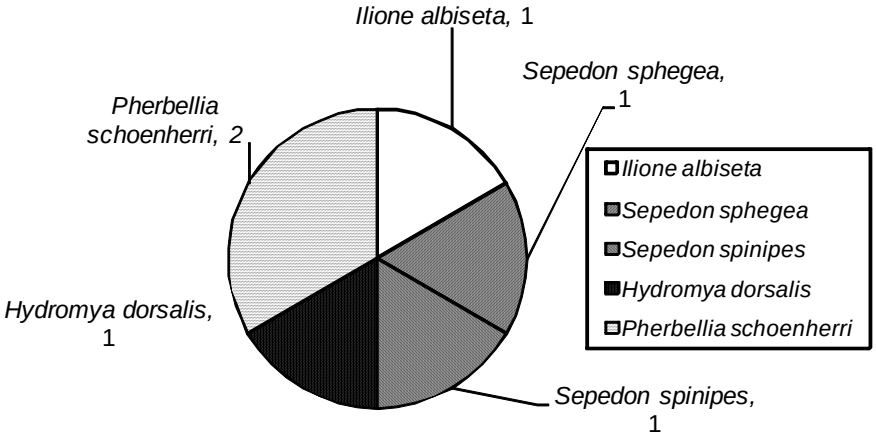


FIGURE 1l. Wet woodland community.

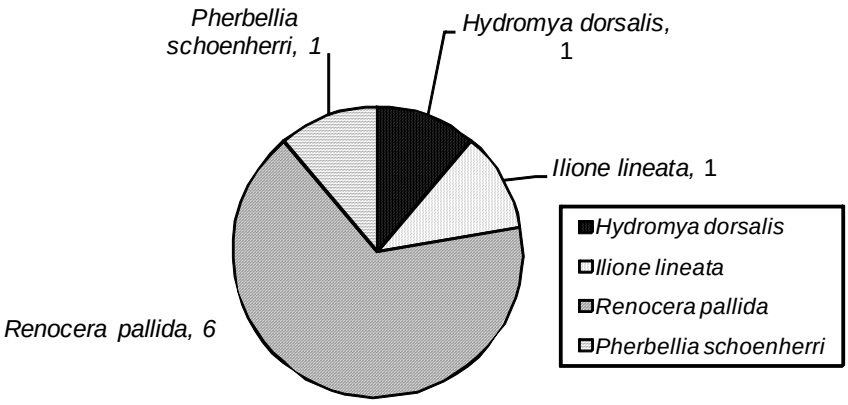
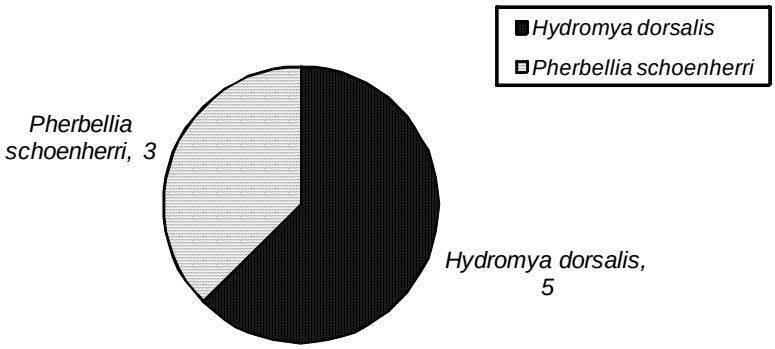


FIGURE 1m. Disused quarry.



	Month											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Colobaea bifasciella	**P**			**P P**	**P**		**A**				**P**	
Pherbellia argyra												
Pherbellia brunnipes							**A**					
Pherbellia cinerella												
Pherbellia dubia					**A**							
Pherbellia n. nana												
Pherbellia s. schoenherri												
Pherbellia ventralis					**A**							
Coremacera marginata									**A**			
Elgiva cucularia												
Elgiva solicita									**A**			
Hydromya dorsalis												
Ilione albiseta	**3**					**2**			**3**		**3**	
Ilione lineata												
Limnia paludicola												
Limnia unguicornis												

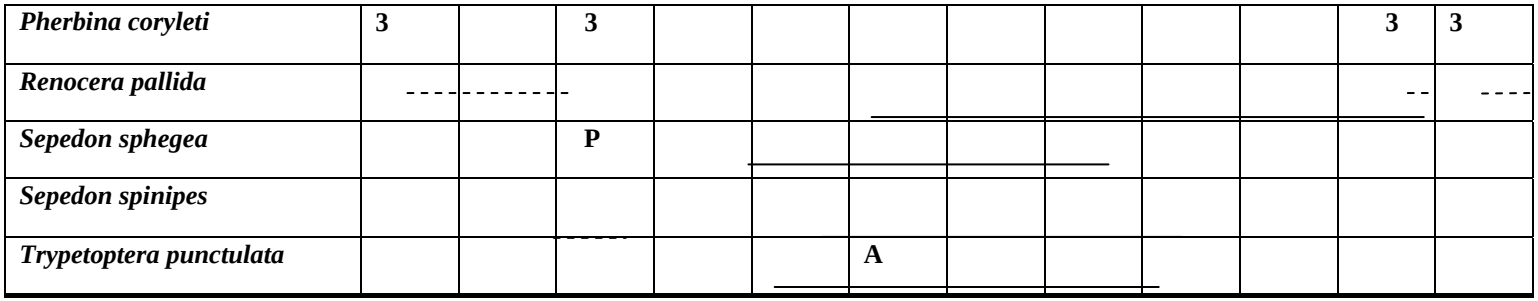


FIGURE 2. Partial phenology plot summarizing the flight period and dates of field-collected larvae and puparia from the present study. "A" = Adult collection; "P" = Puparia collection; 2, 3 =2nd, 3rd instar collection. Solid lines join adult collections and broken lines join immature stage collections.

FIGURE 3. Records generated during this study for *Colobaea bifasciella* in the west of Ireland.

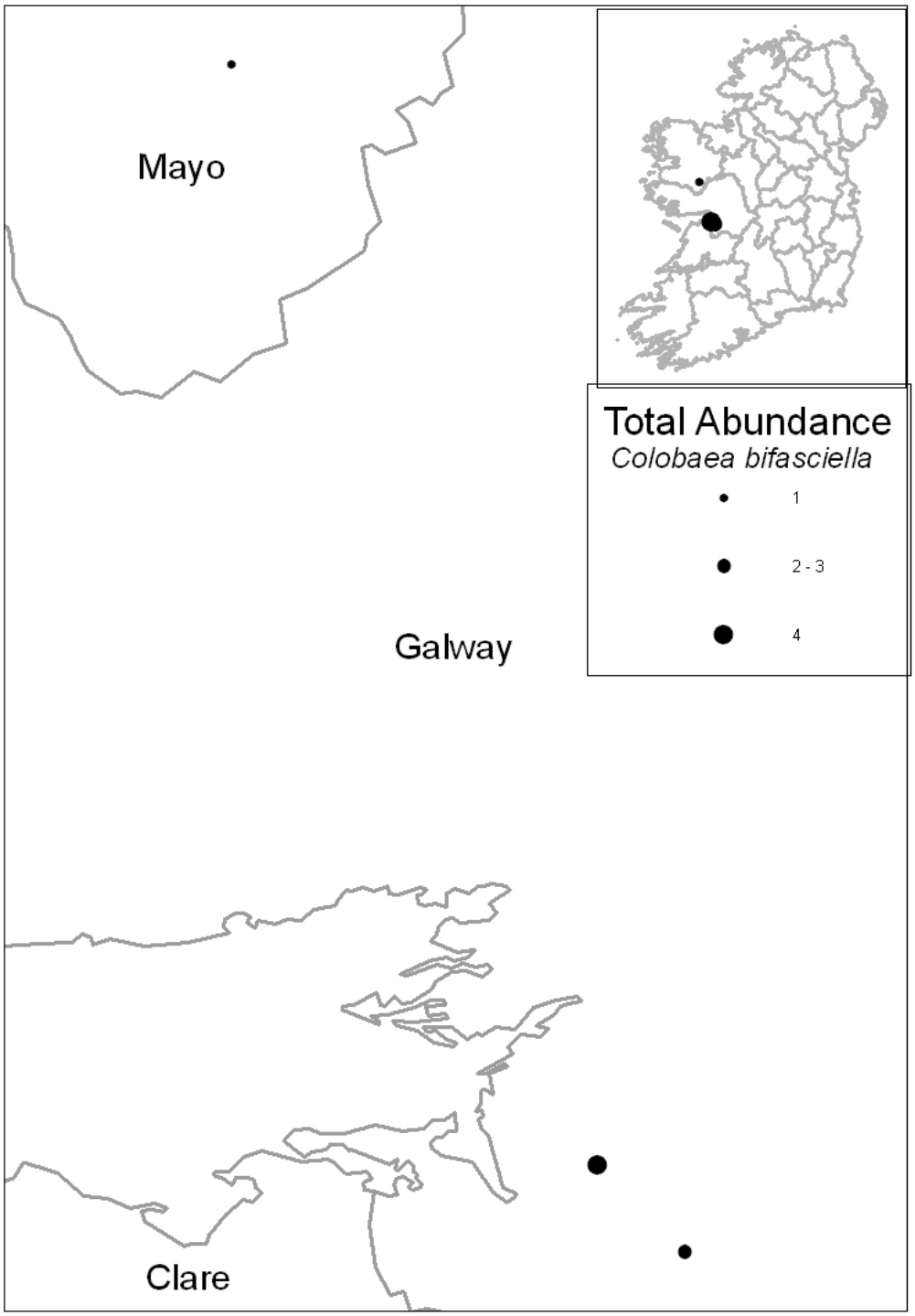


FIGURE 4. Records generated during this study for *Pherbellia argyra* in the west of Ireland.

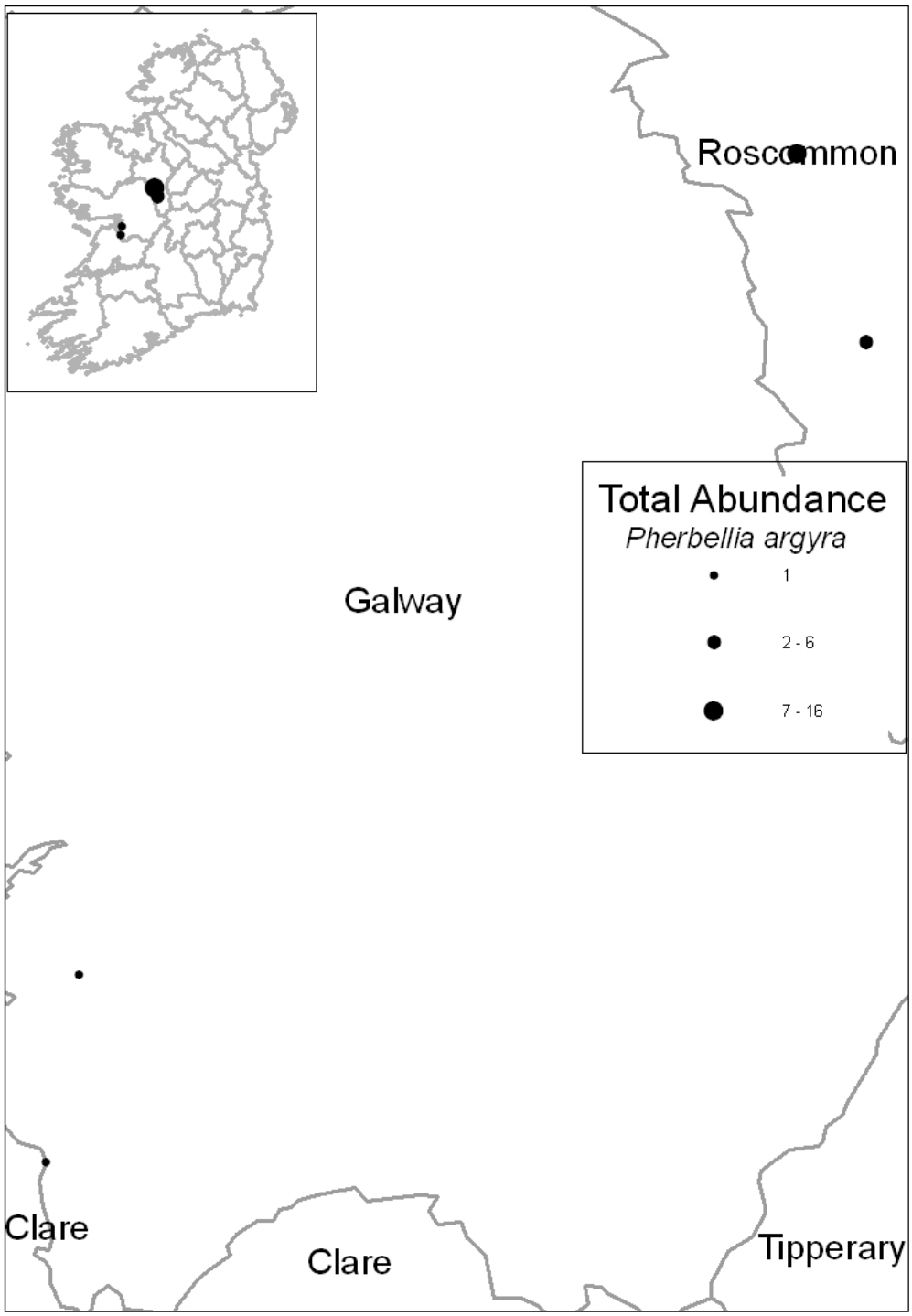


FIGURE 5. Records generated during this studyfor *Pherbellia brunnipes* in the west of Ireland.

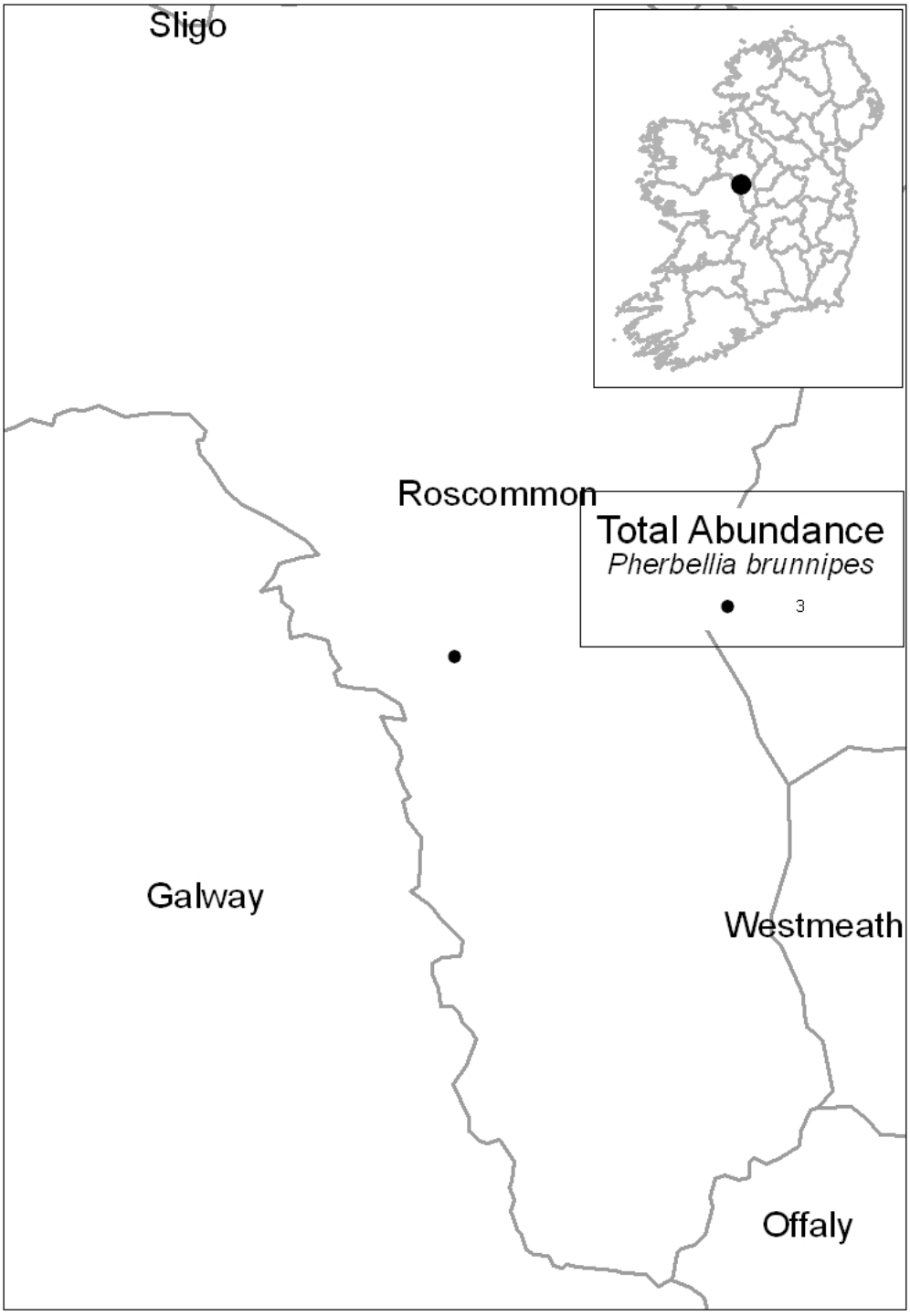


FIGURE 6. Records generated during this study for *Pherbellia cinerella* in the west of Ireland.

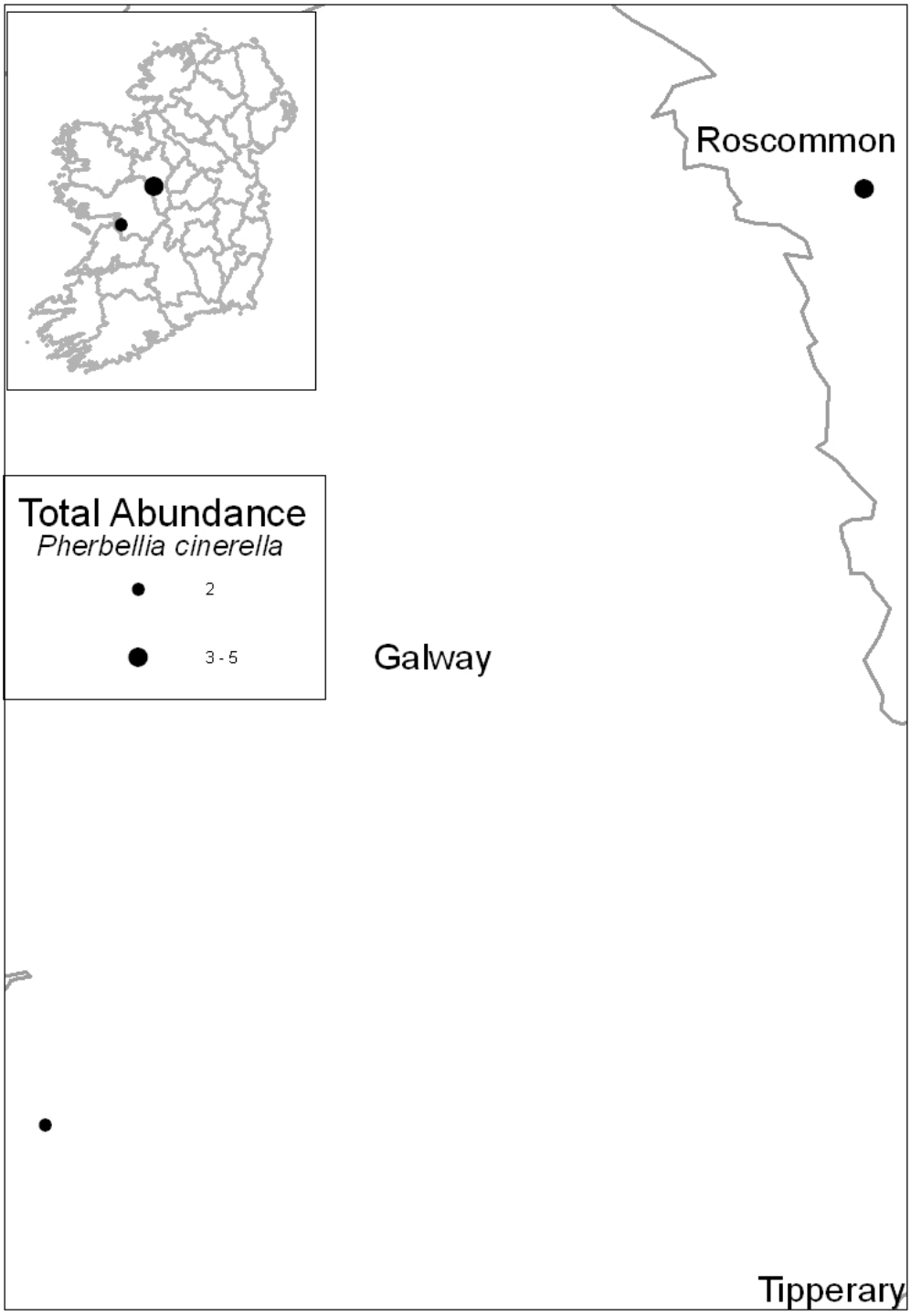


FIGURE 7. Records generated during this study for *Pherbellia dubia* in the west of Ireland.

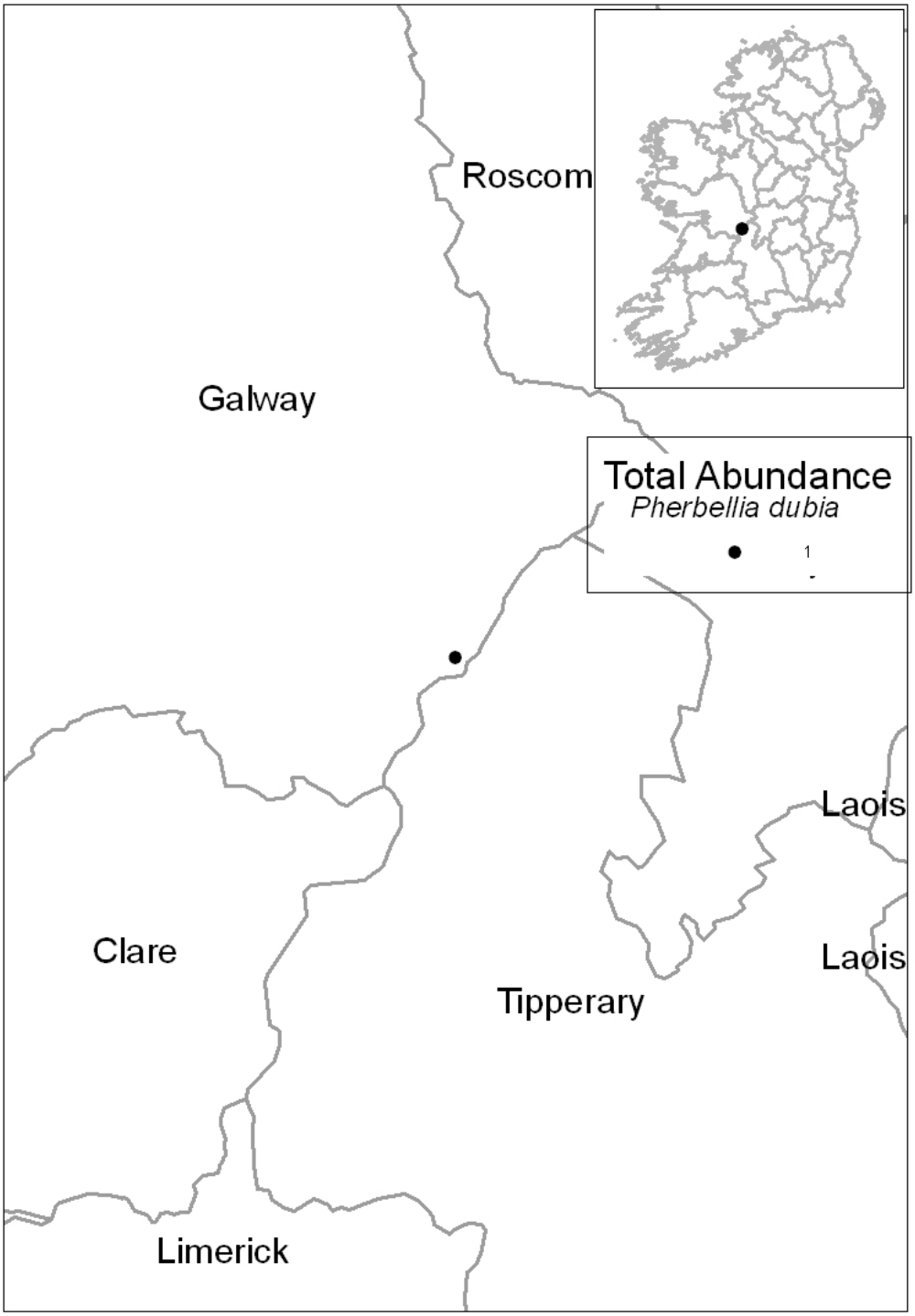


FIGURE 8. Records generated during this study for *Pherbellia nana nana* in the west of Ireland.

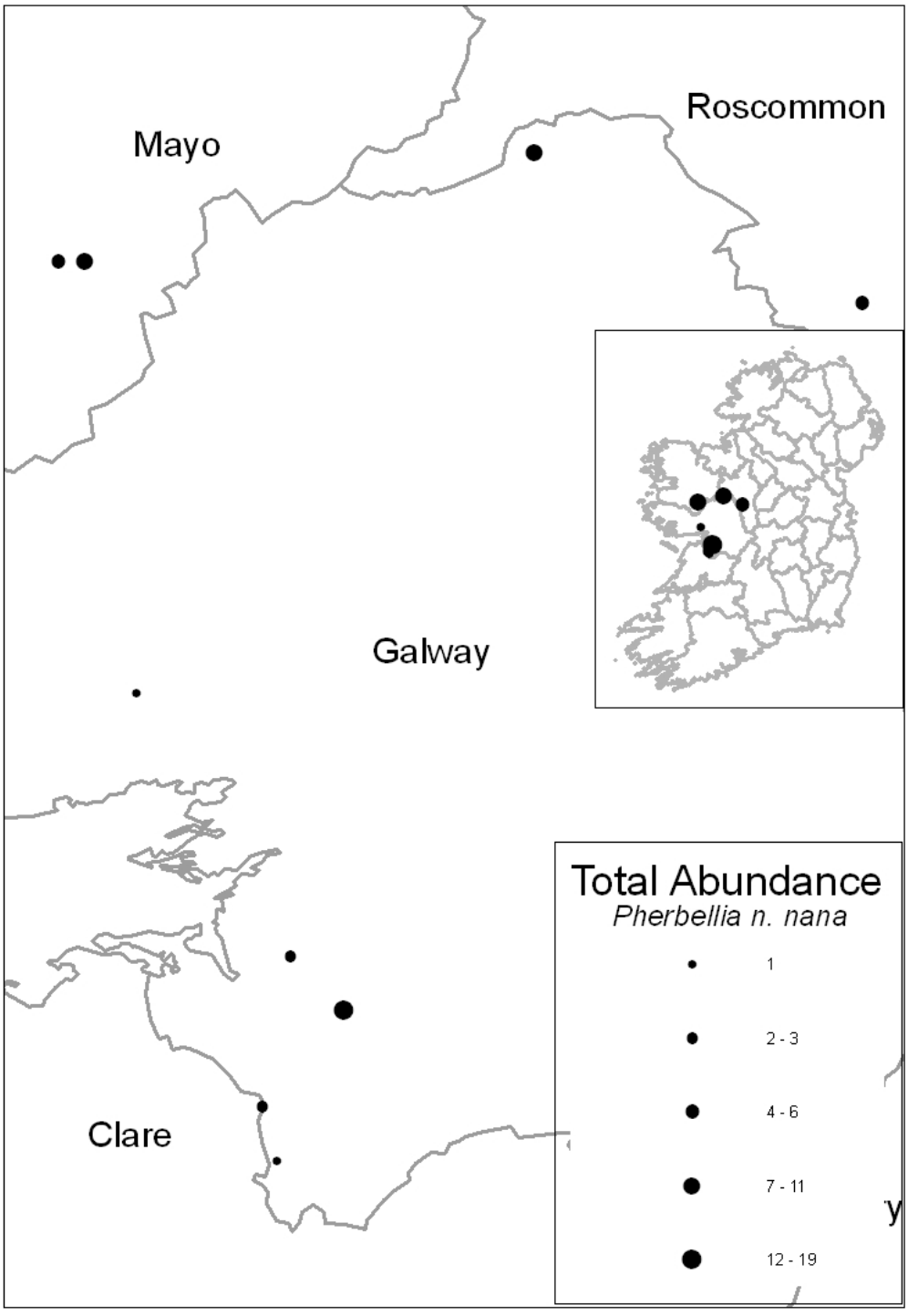


FIGURE 9. Records generated during this study for *Pherbellia schoenherri schoenherri* in the west of Ireland.

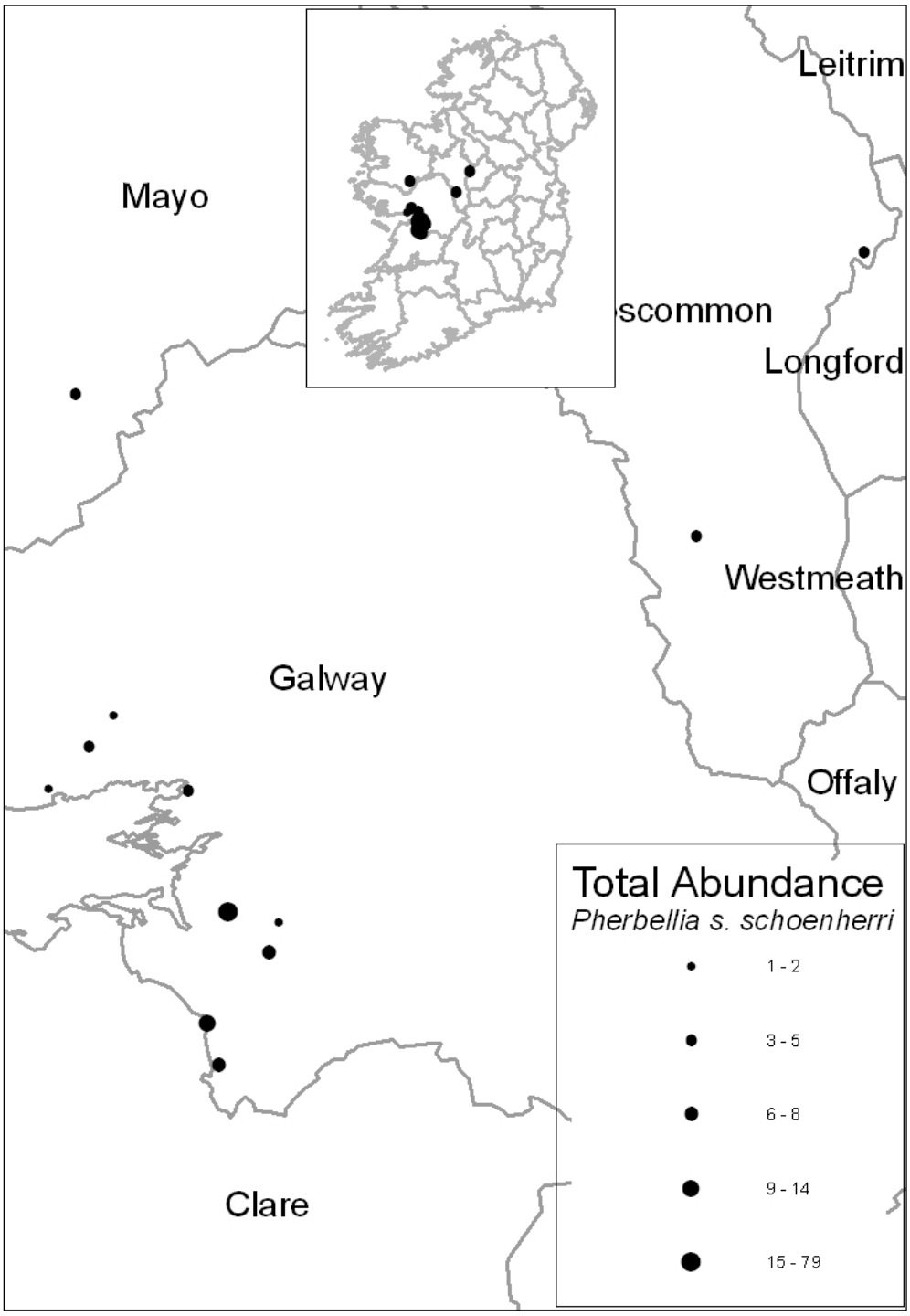


FIGURE 10. Records generated during this study for *Pherbellia ventralis* in the west of Ireland.

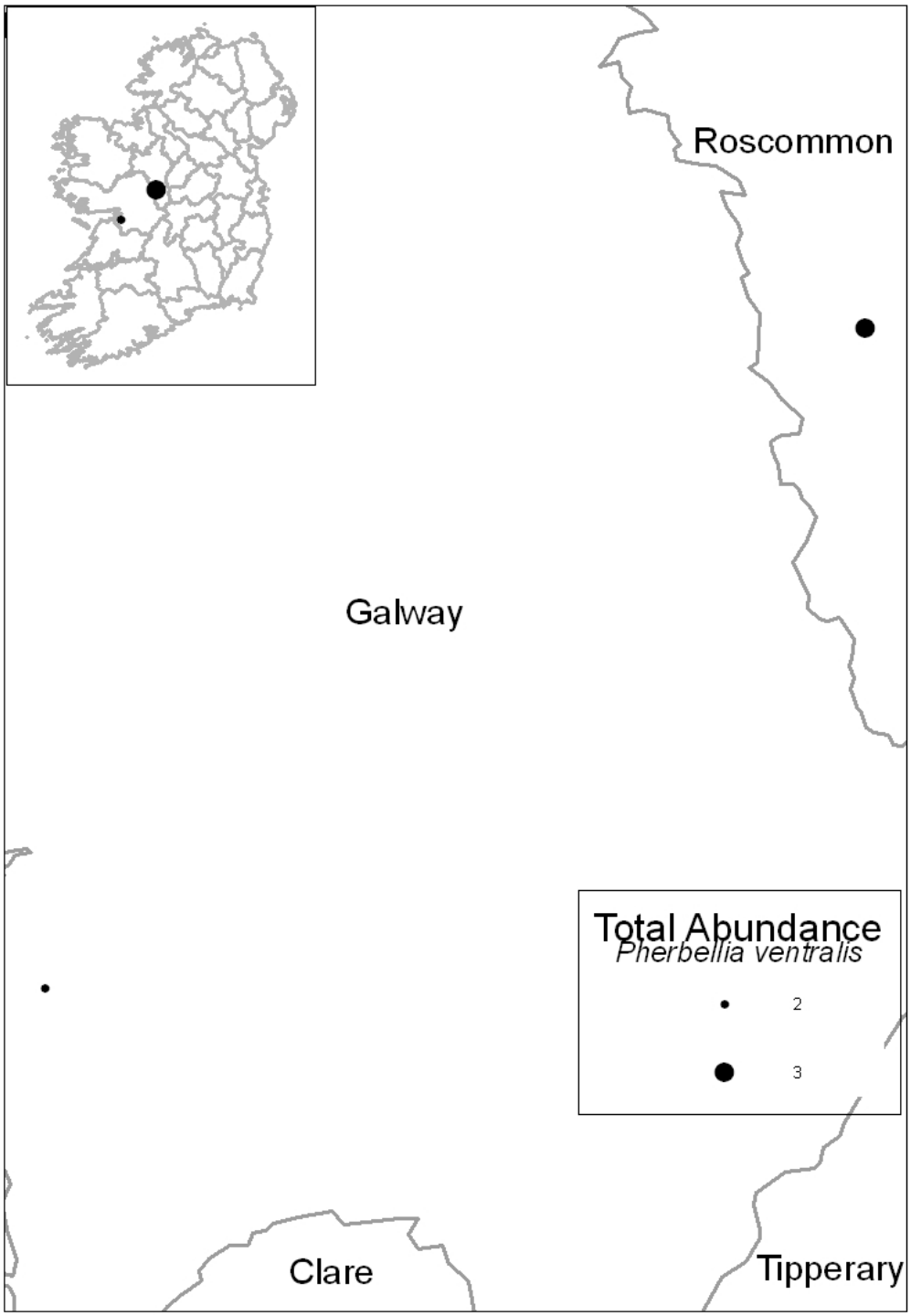


FIGURE 11. Records generated during this study for *Coremacera marginata* in the west of Ireland.

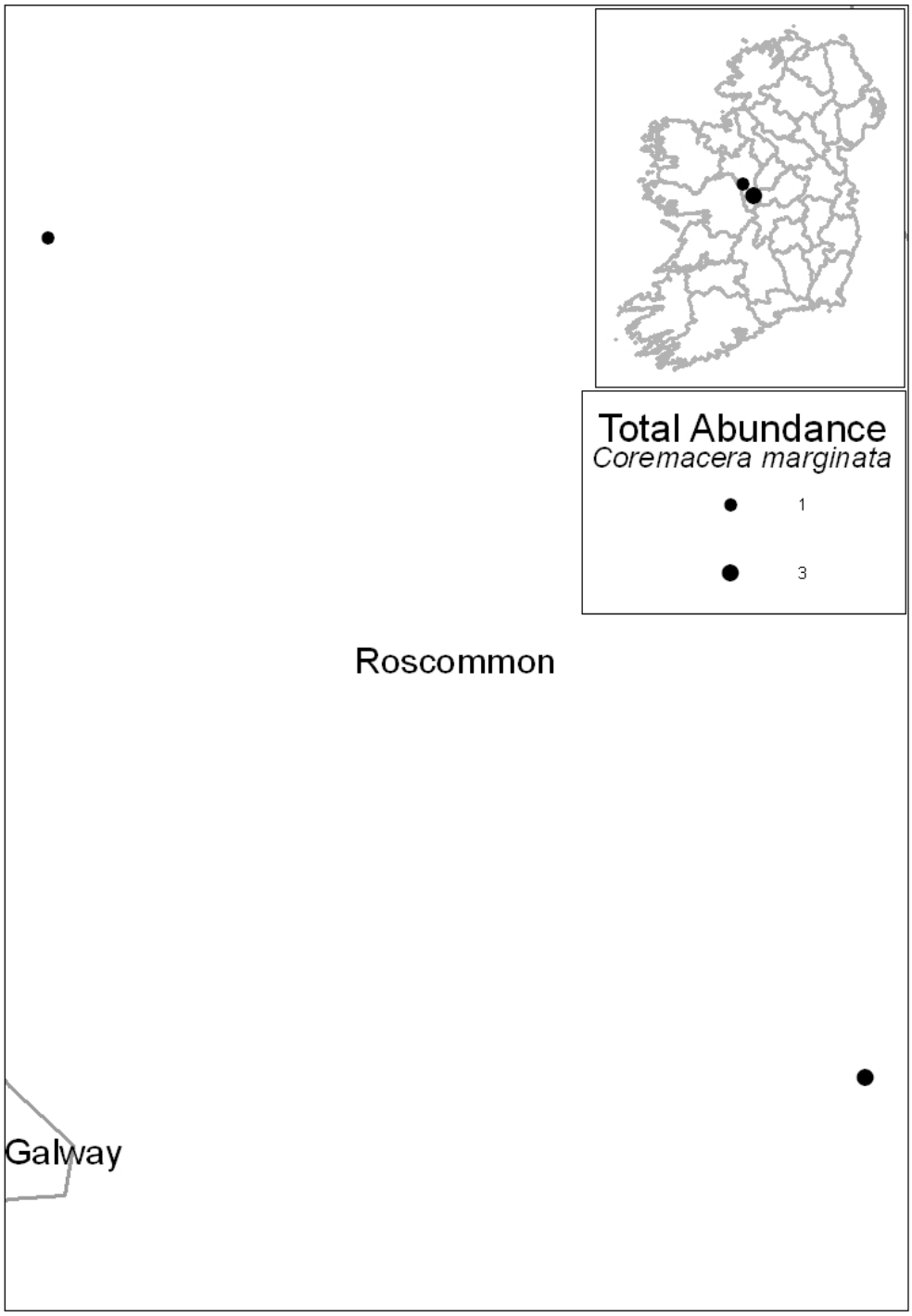


FIGURE 12. Records generated during this study for *Elgiva cucularia* in the west of Ireland.

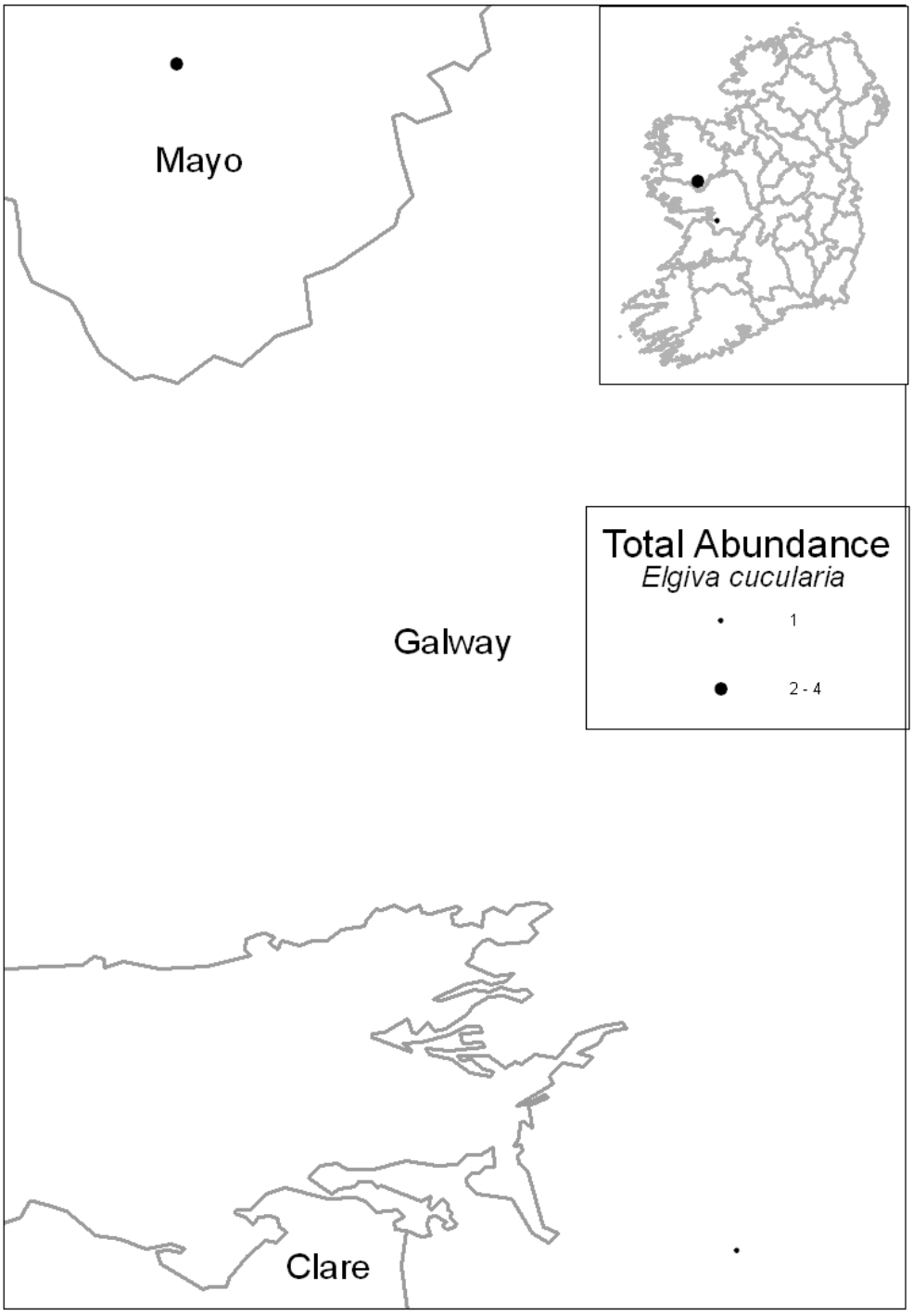


FIGURE 13. Records generated during this study for *Elgiva solicita* in the west of Ireland.

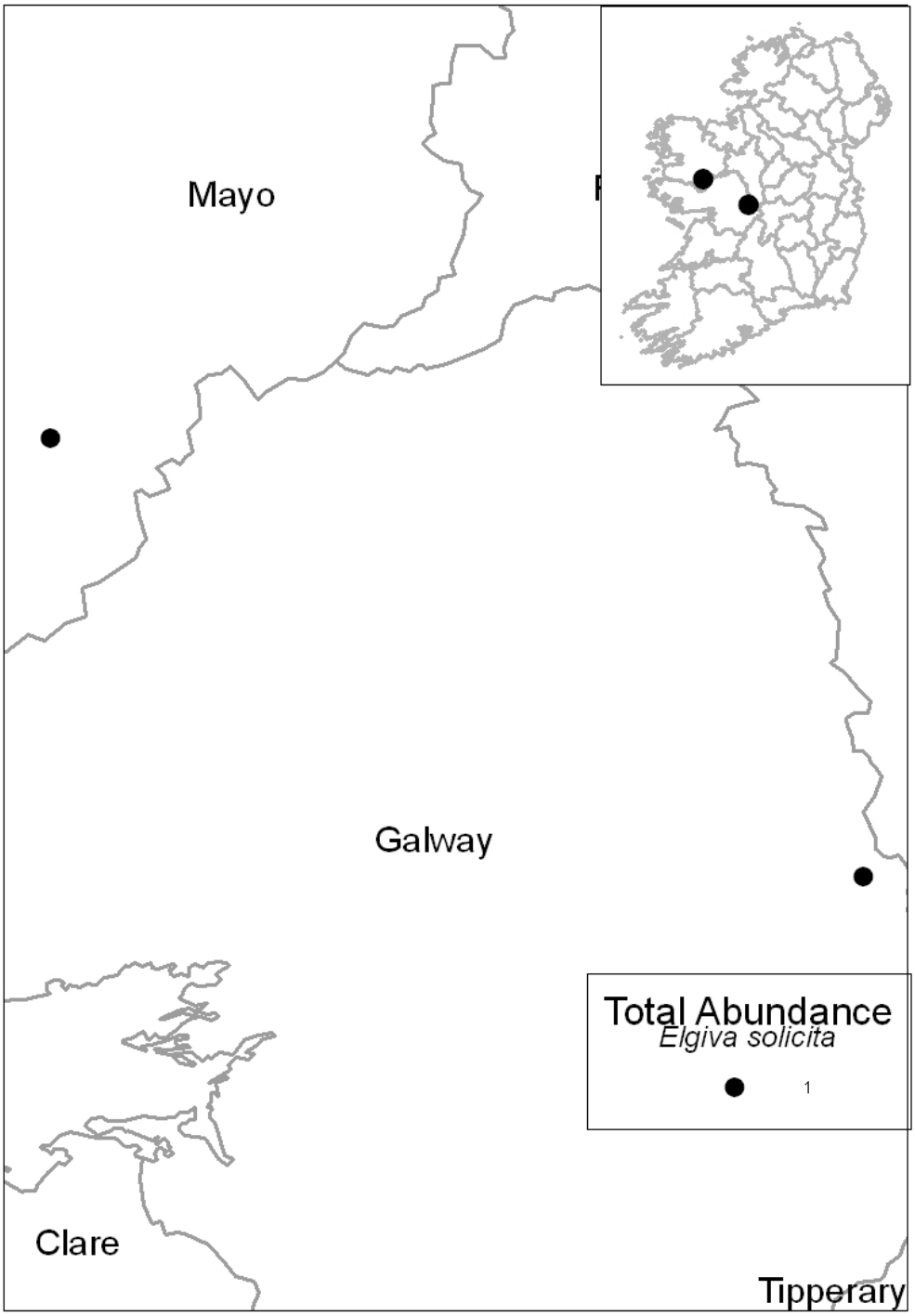


FIGURE 14. Records generated during this study for *Hydromya dorsalis* in the west of Ireland.

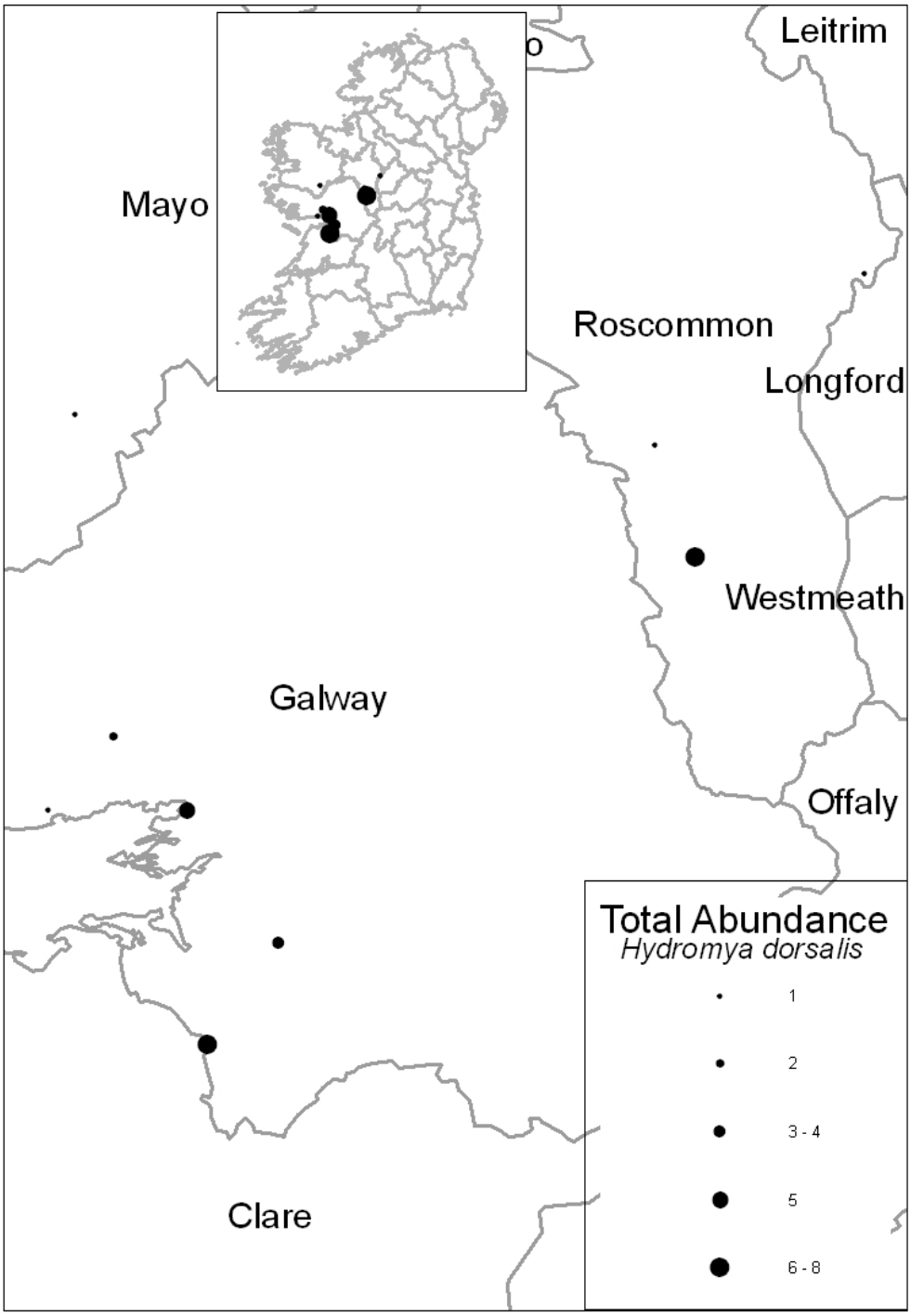


FIGURE 15. Records generated during this study for *Ilione albiseta* in the west of Ireland.

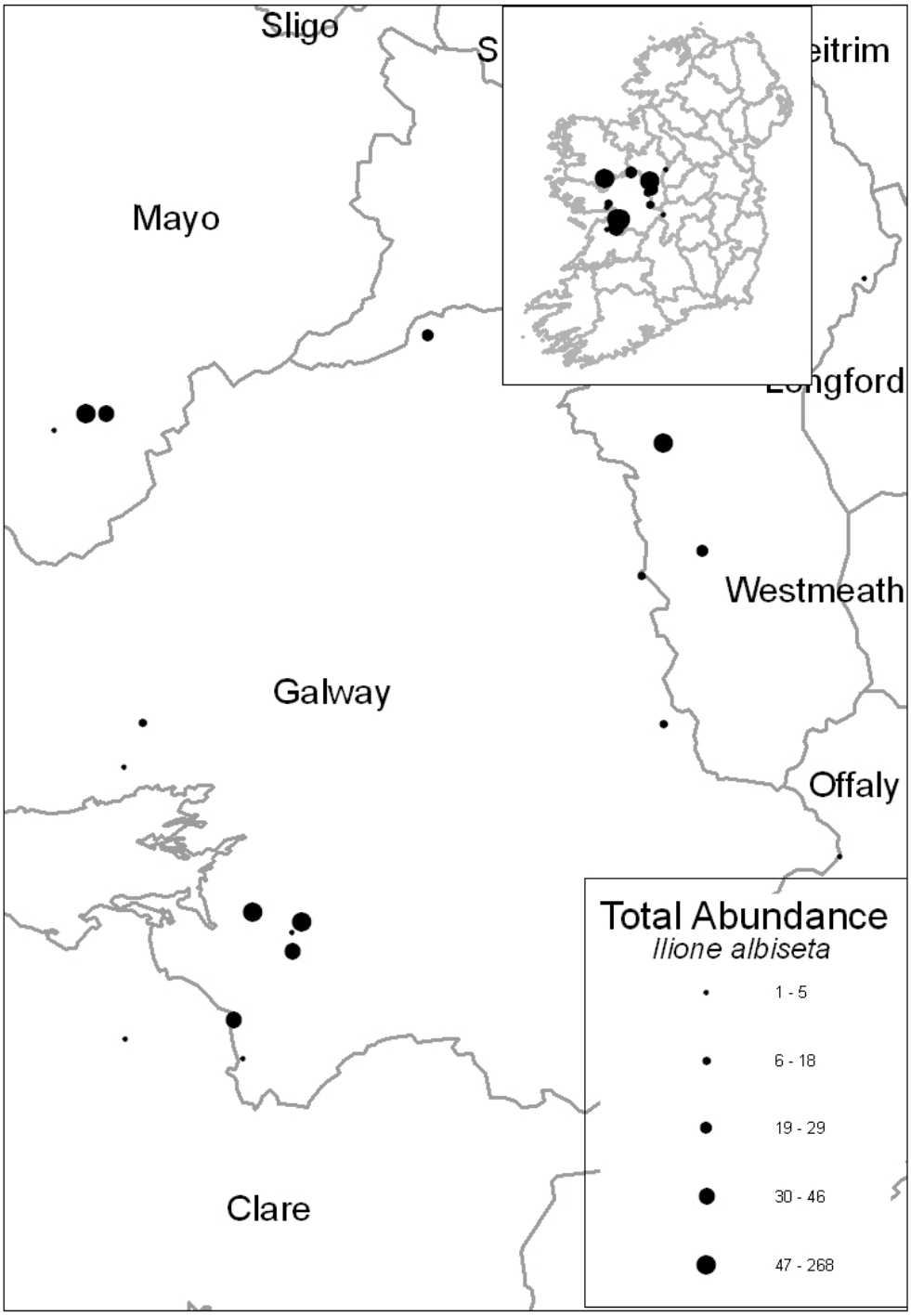


FIGURE 16. Records generated during this study for *Ilione lineata* in the west of Ireland.

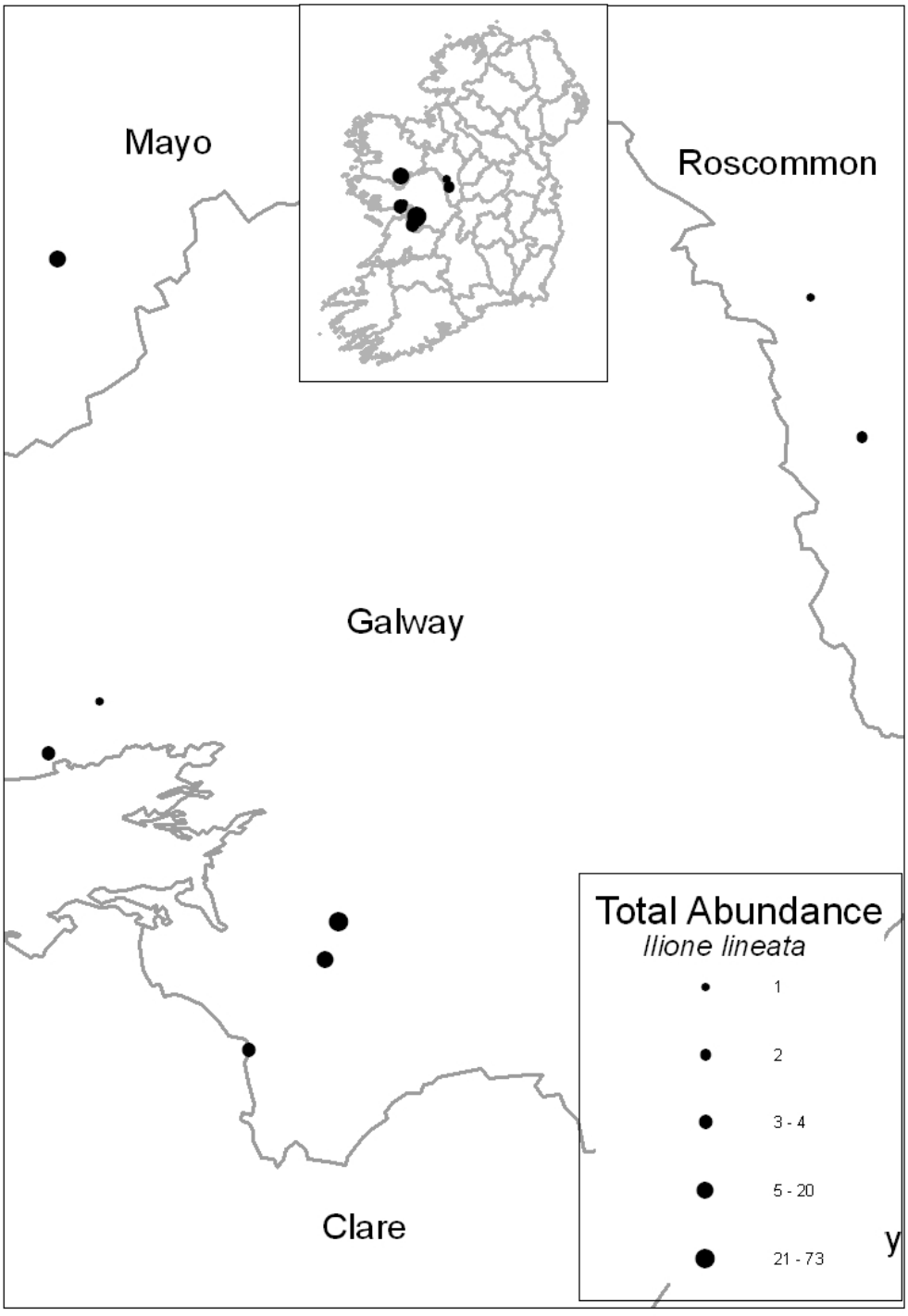


FIGURE 17. Records generated during this study for *Limnia paludicola* in the west of Ireland.

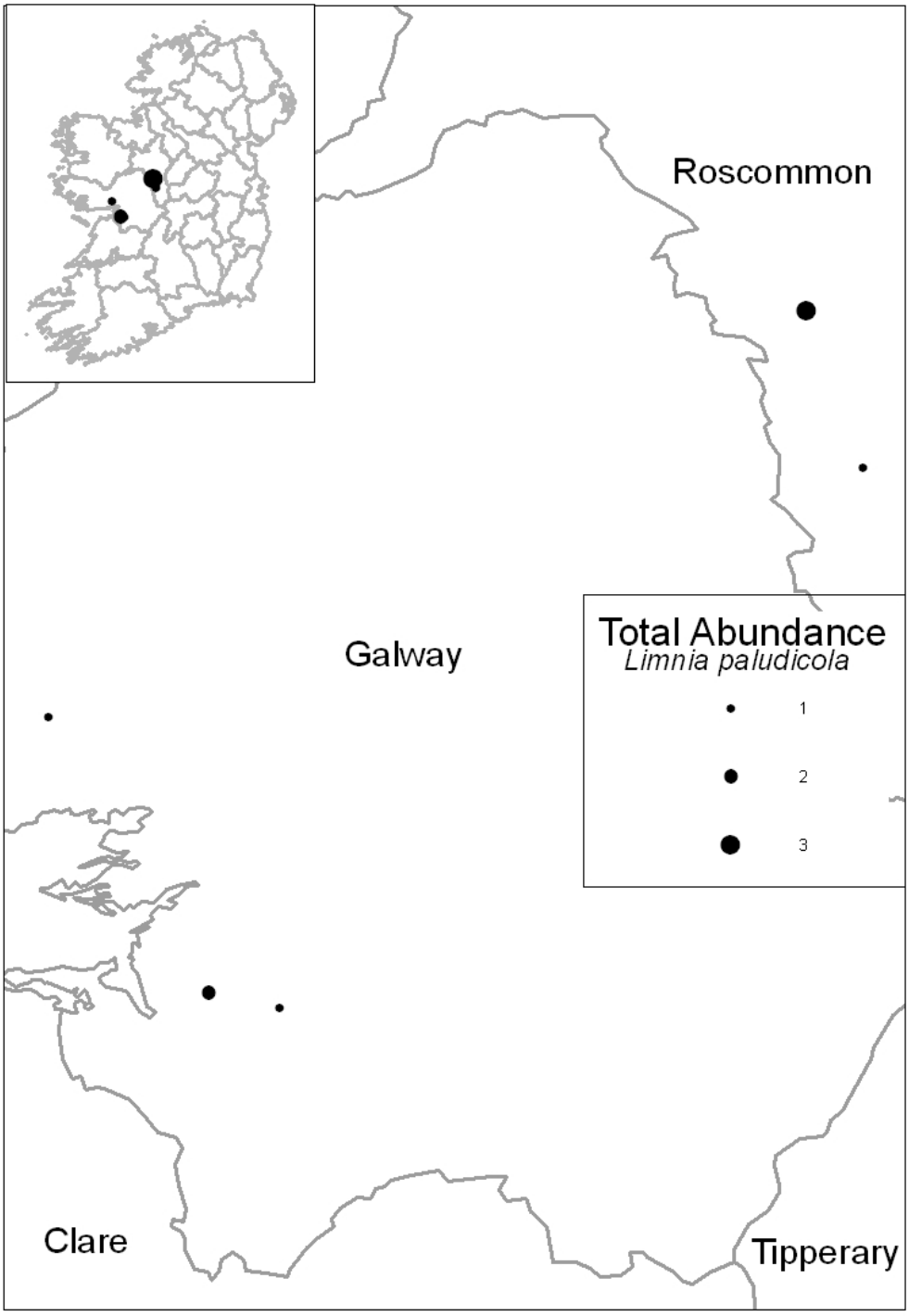


FIGURE 18. Records generated during this study for *Limnia unguicornis* in the west of Ireland.

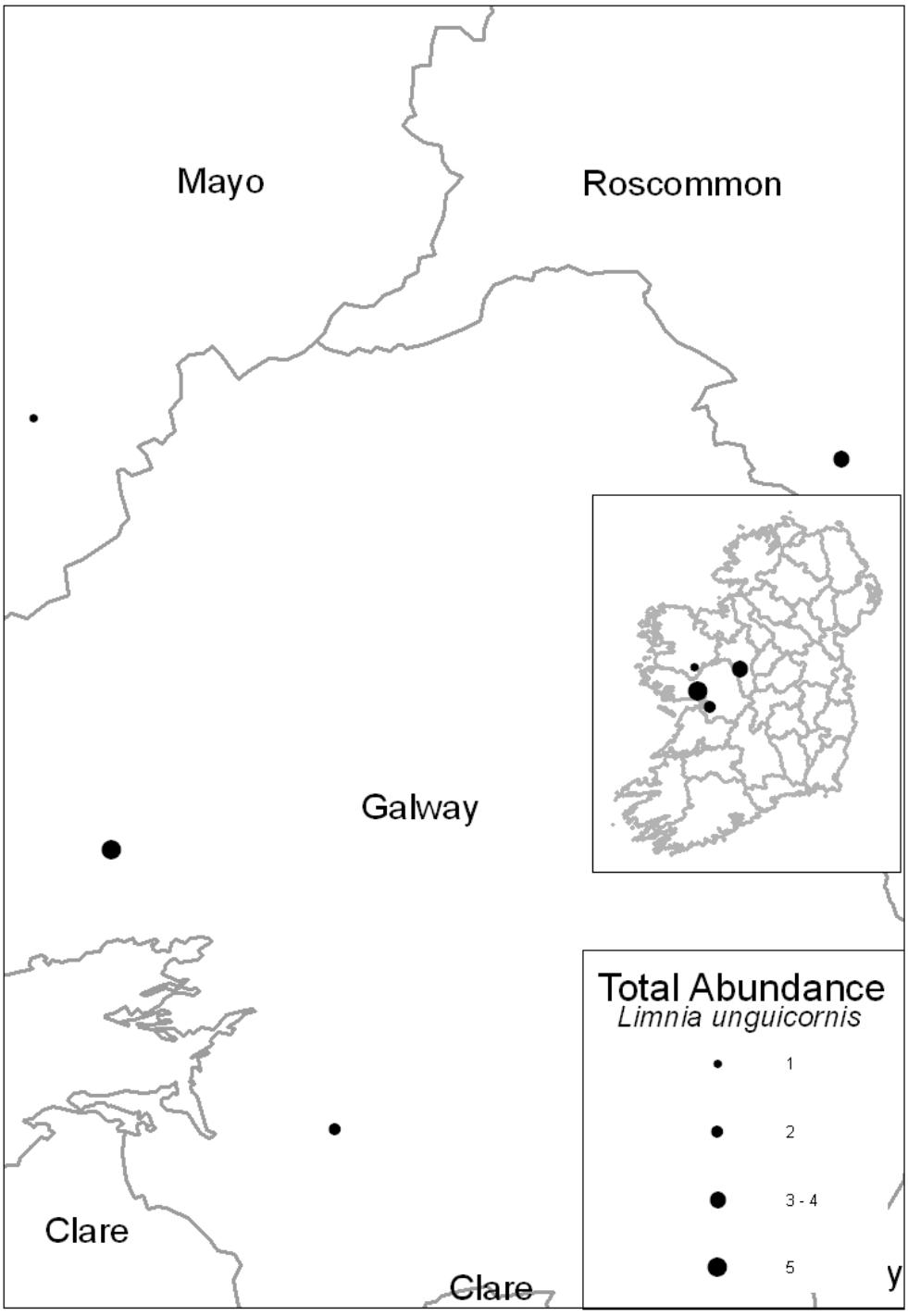


FIGURE 19. Records generated during this study for *Pherbina coryleti* in the west of Ireland.

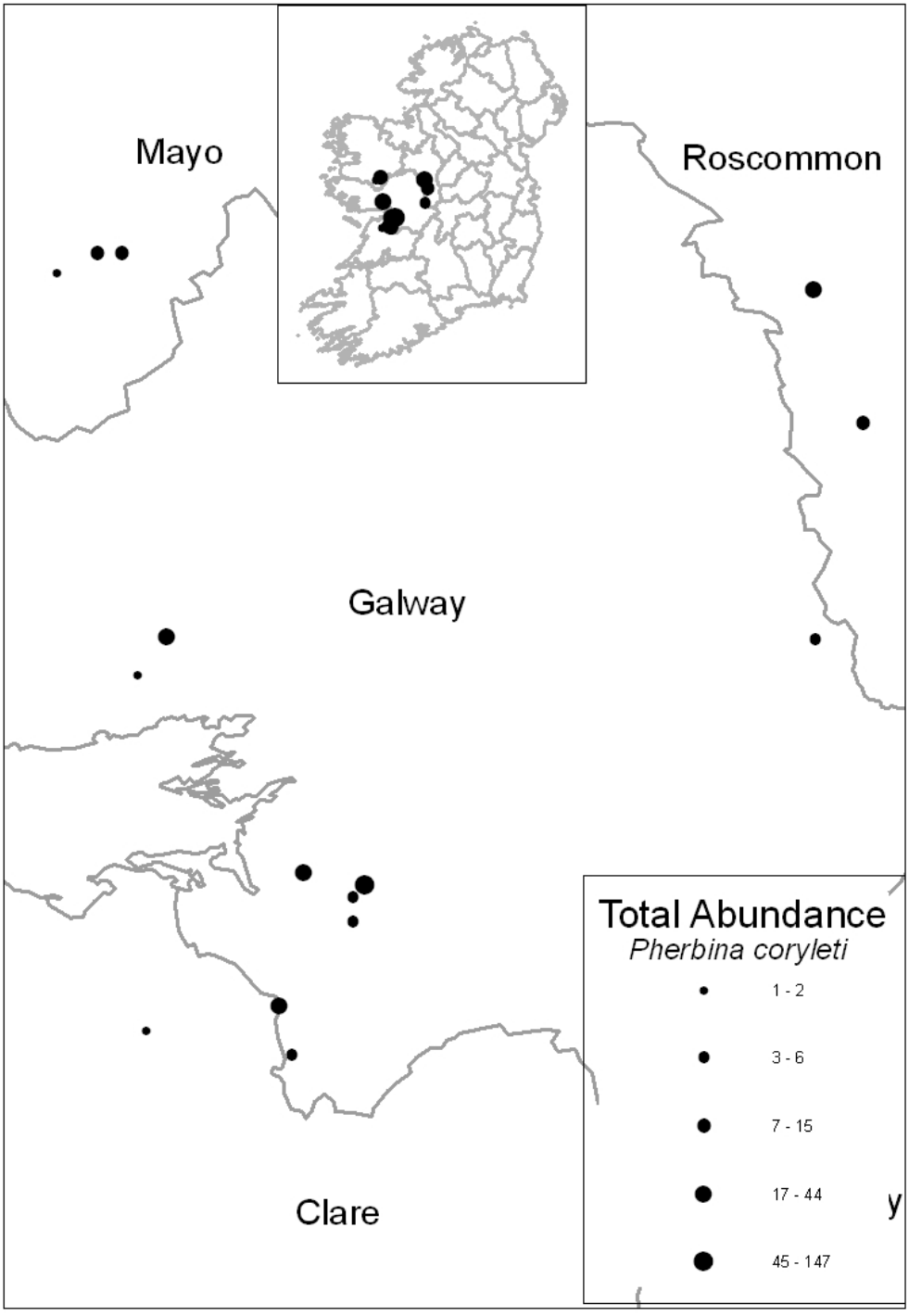


FIGURE 20. Records generated during this study for *Renocera pallida* in the west of Ireland.

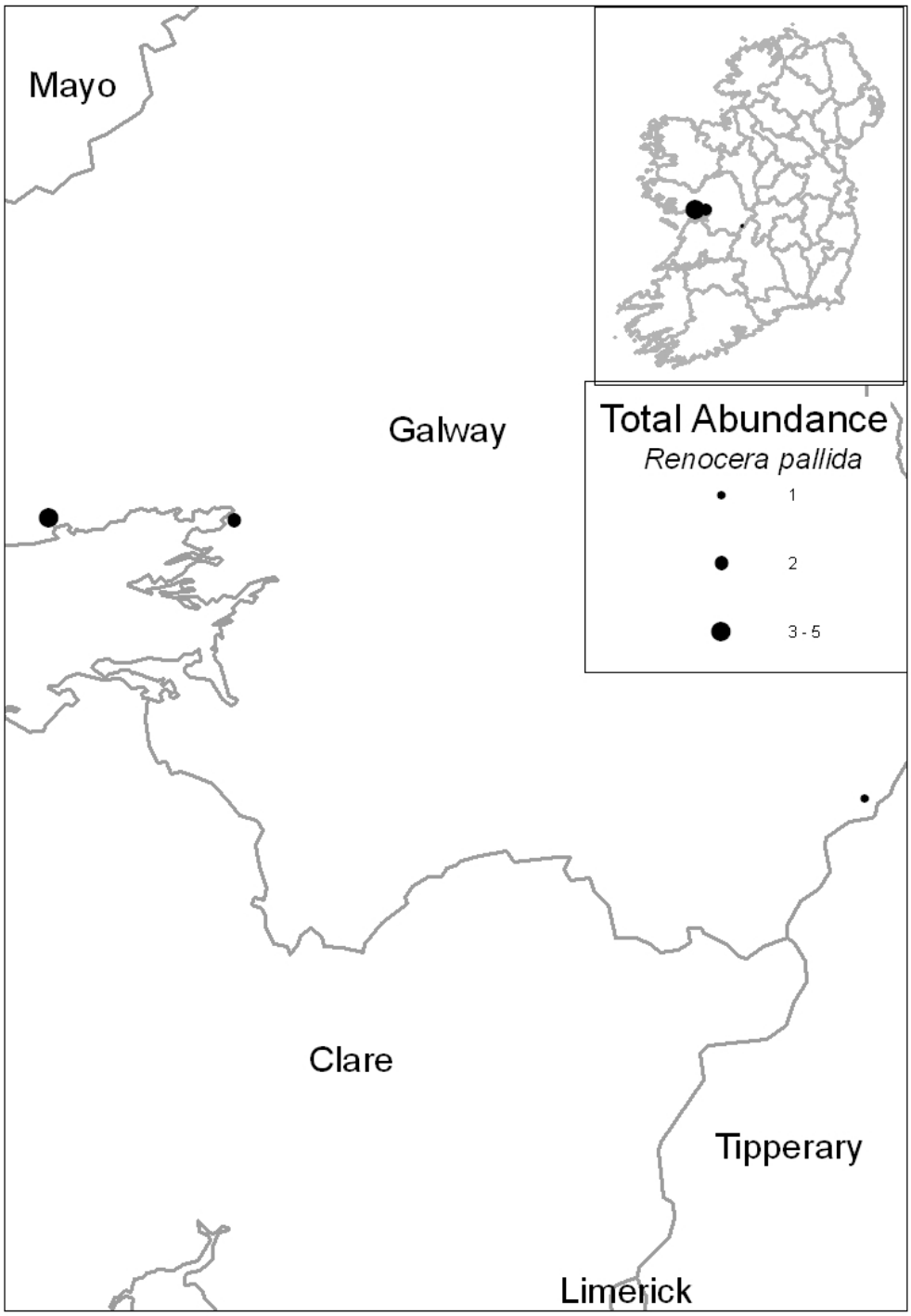


FIGURE 21. Records generated during this study for *Sepedon sphegea* in the west of Ireland.

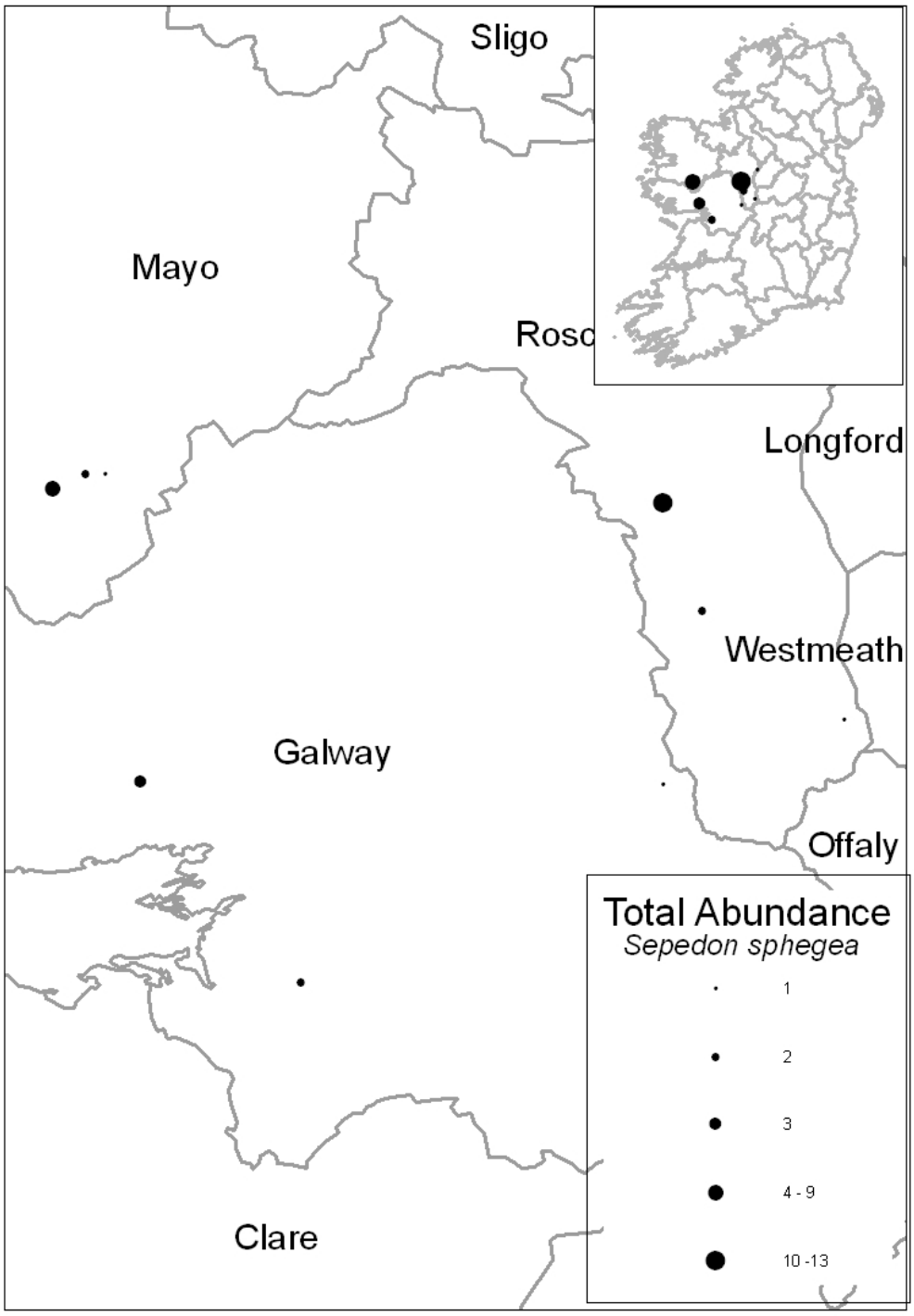


FIGURE 22. Records generated during this study for *Sepedon spinipes* in the west of Ireland.

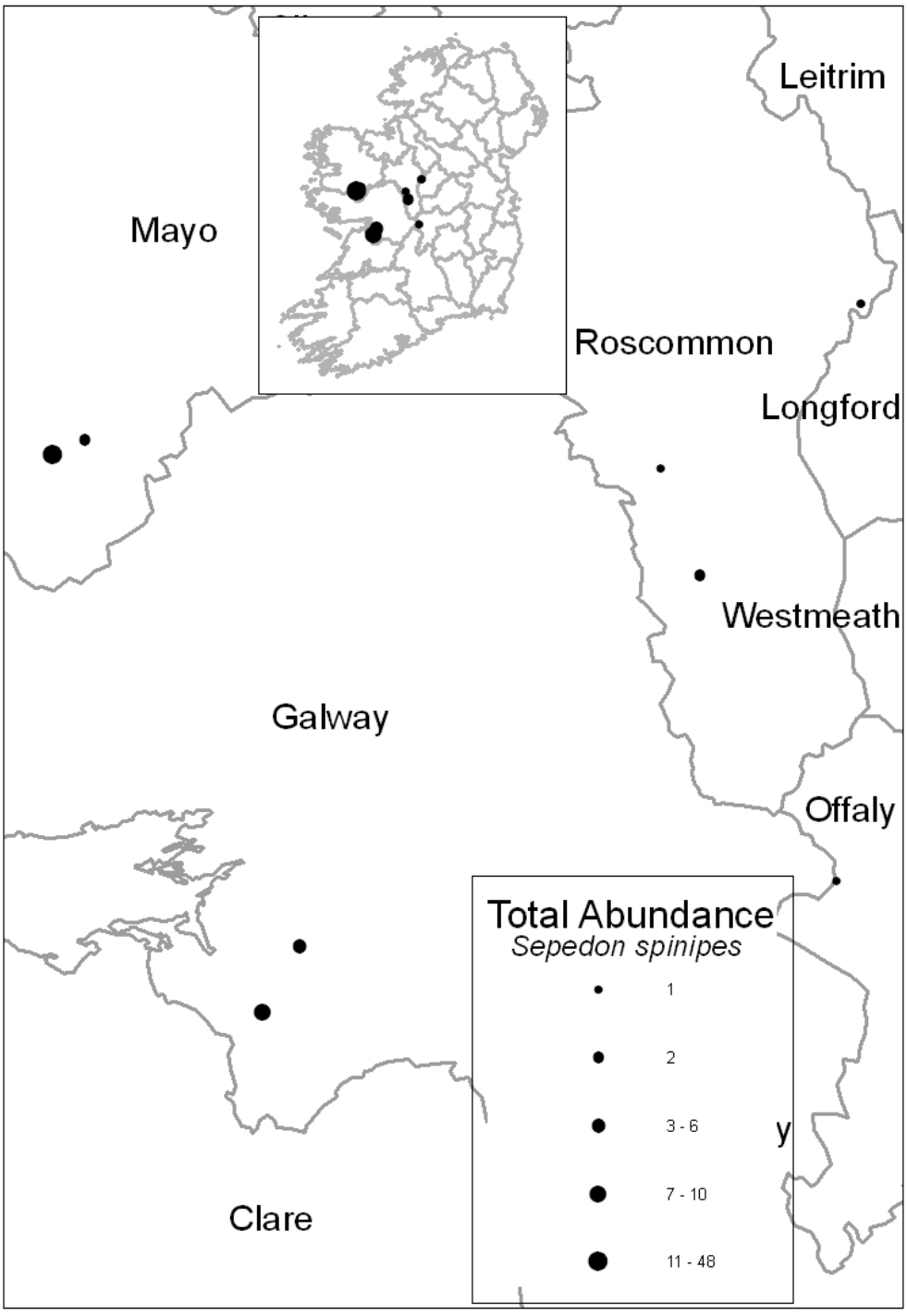


FIGURE 23. Records generated during this study for *Trypetoptera punctulata* in the west of Ireland.

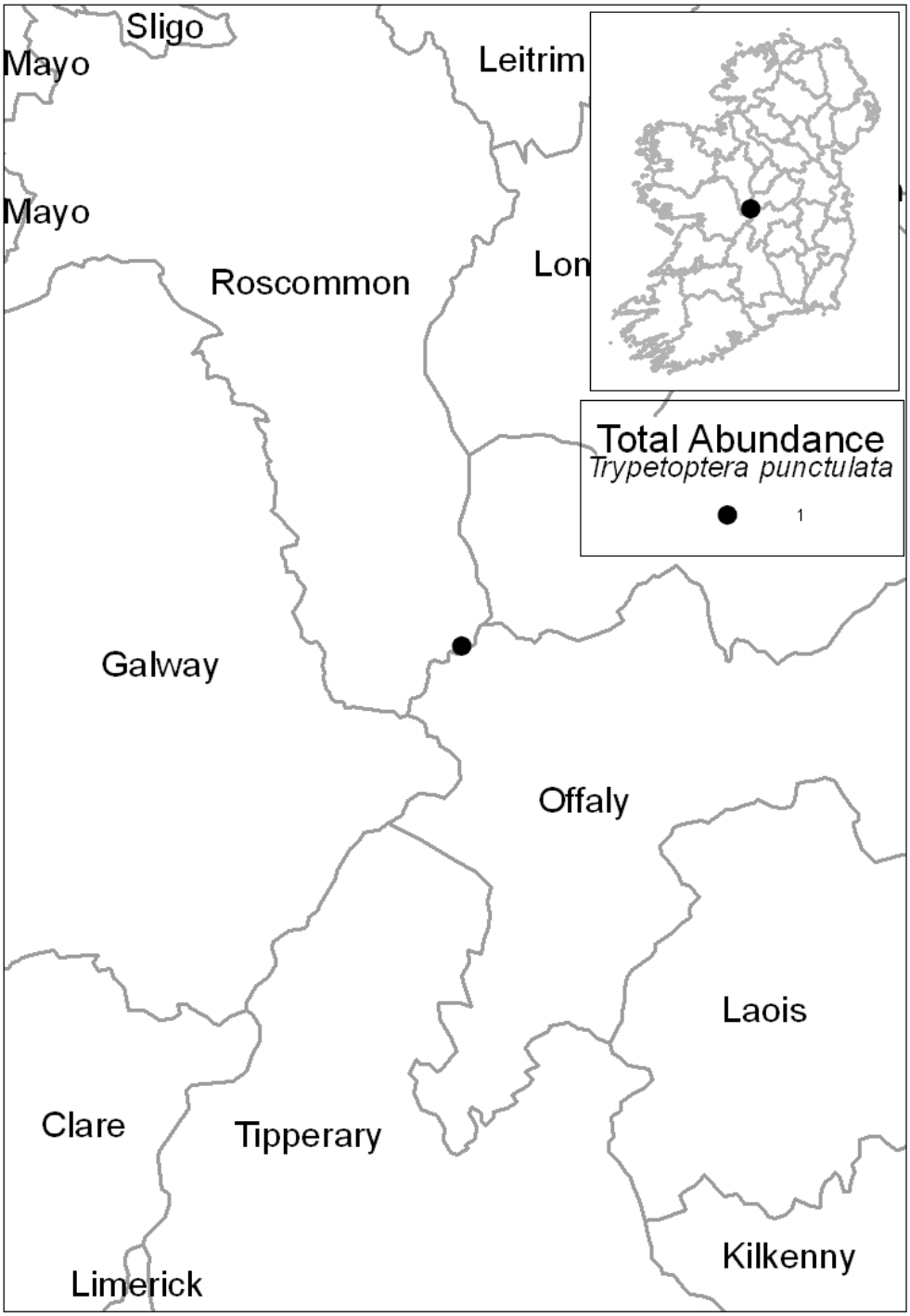


FIGURE 24. Records generated during this study for *Tetanocera arrogans* in the west of Ireland.

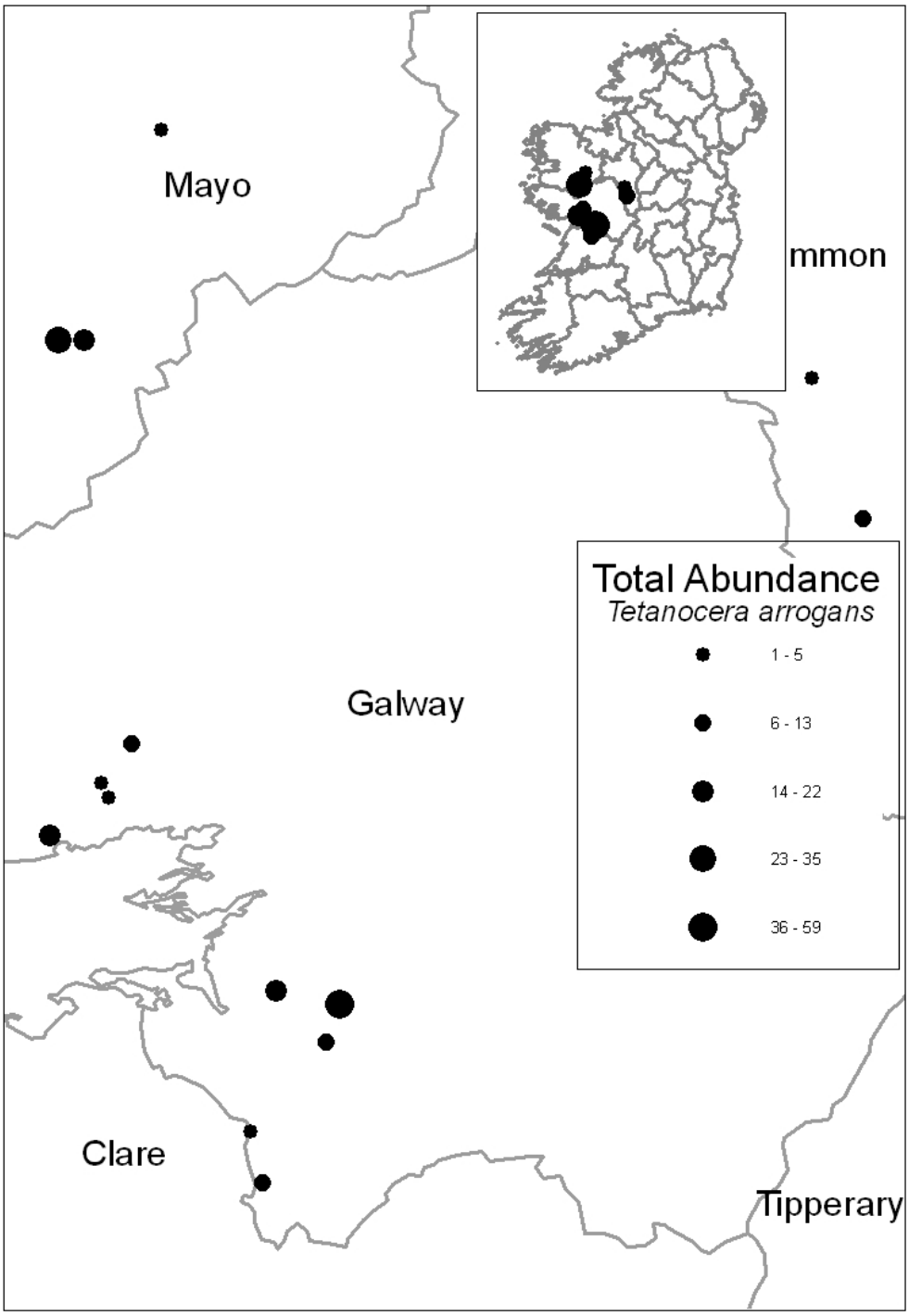


FIGURE 25. Records generated during this study for *Tetanocera elata* in the west of Ireland.

FIGURE 26. Records generated during this study for *Tetanocera ferruginea* in the west of Ireland.

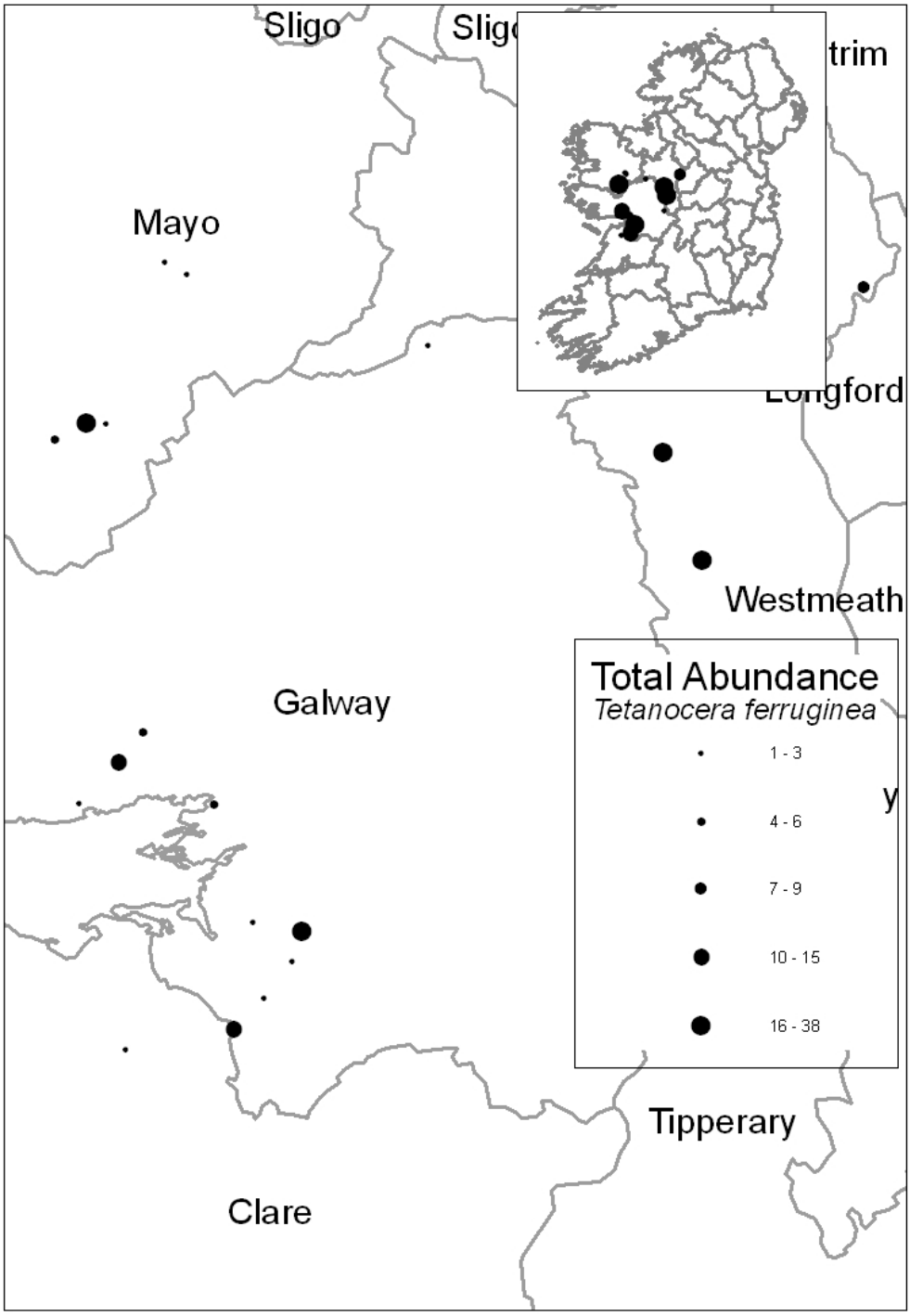


FIGURE 27. Records generated during this study for *Tetanocera freyi* in the west of Ireland.

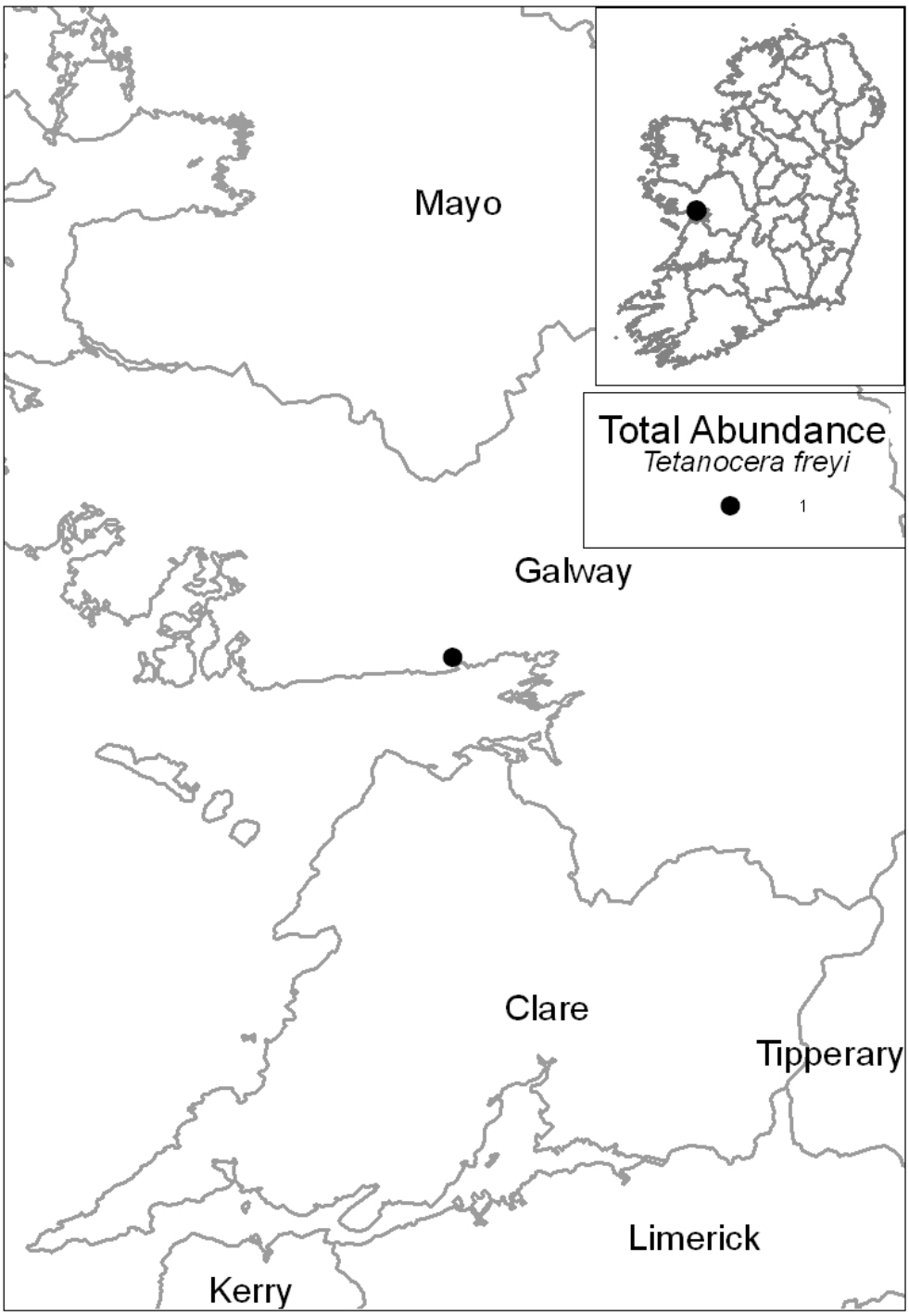


FIGURE 28. Records generated during this study for *Tetanocera fuscinervis* in the west of Ireland.

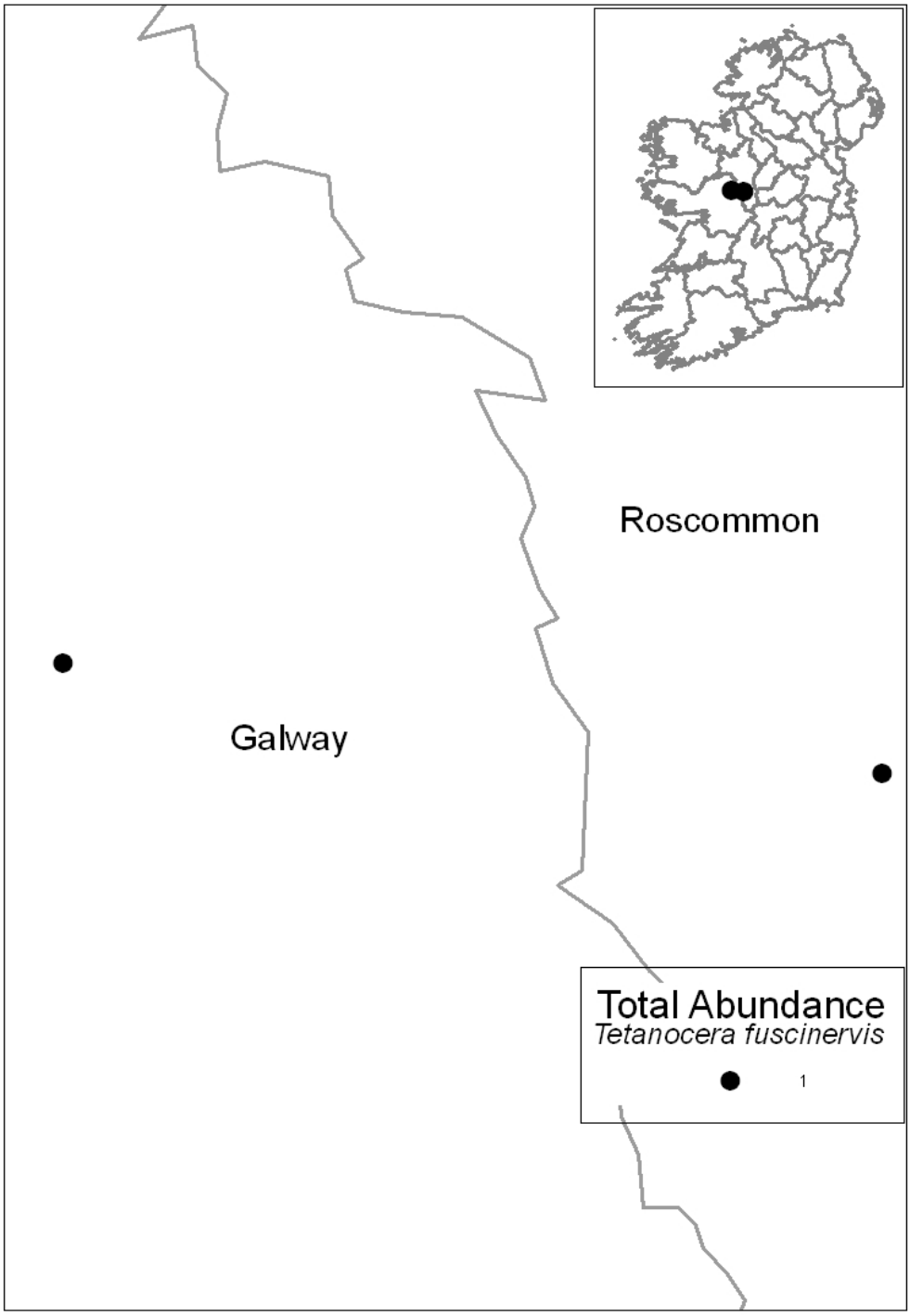


FIGURE 29. Records generated during this study for *Tetanocera hyalipennis* in the west of Ireland.

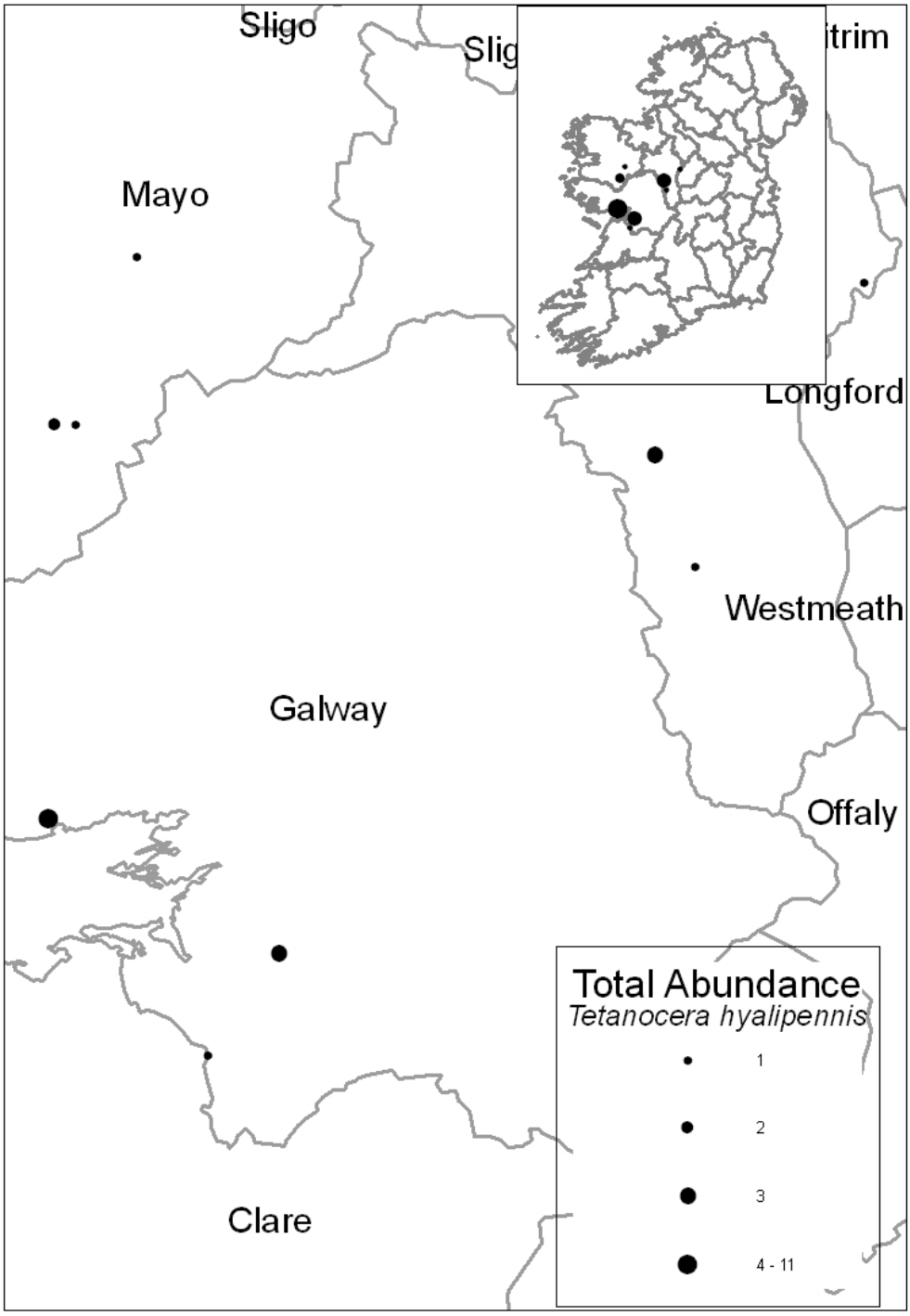


FIGURE 30. Records generated during this study for *Tetanocera robusta* in the west of Ireland.

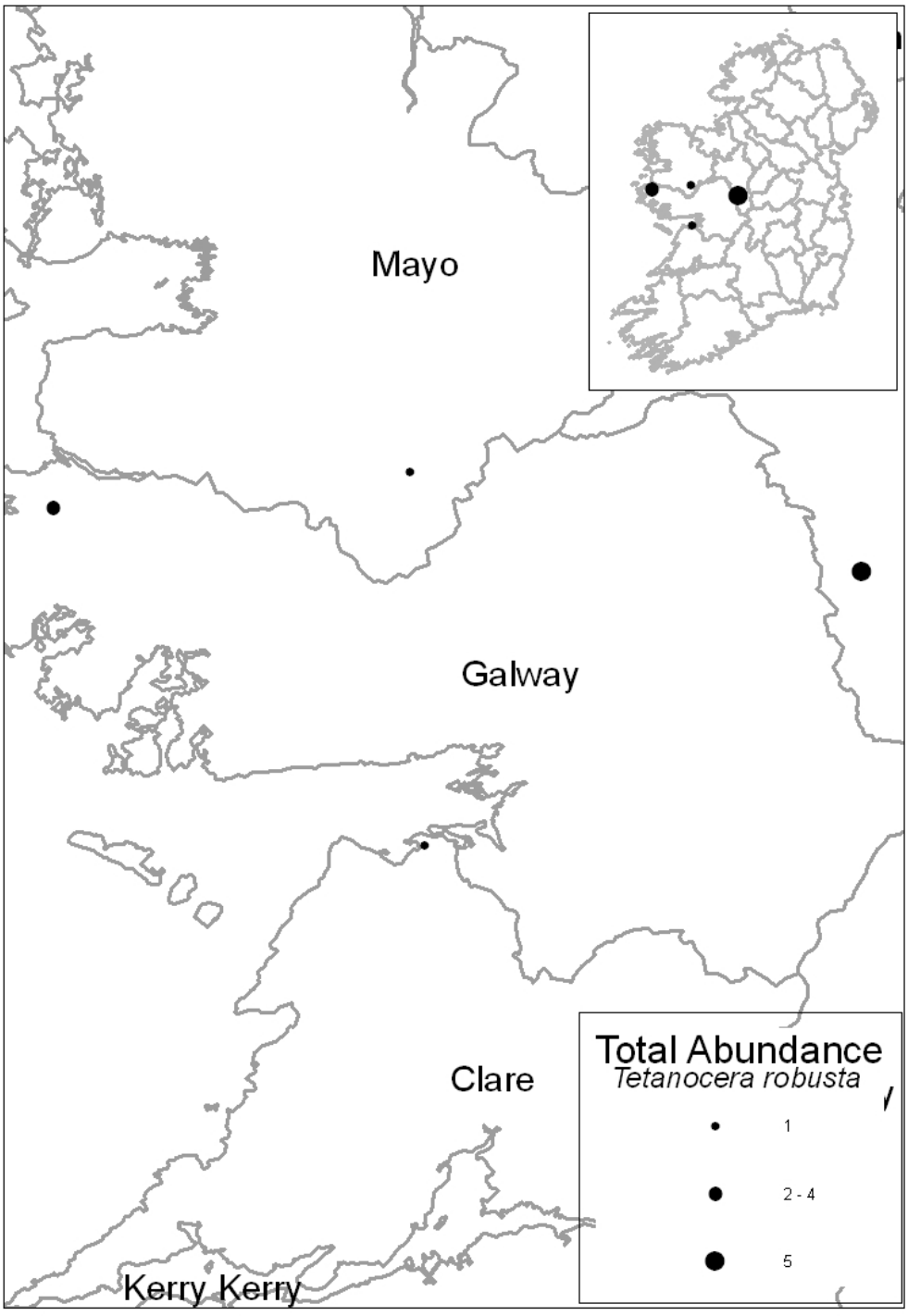
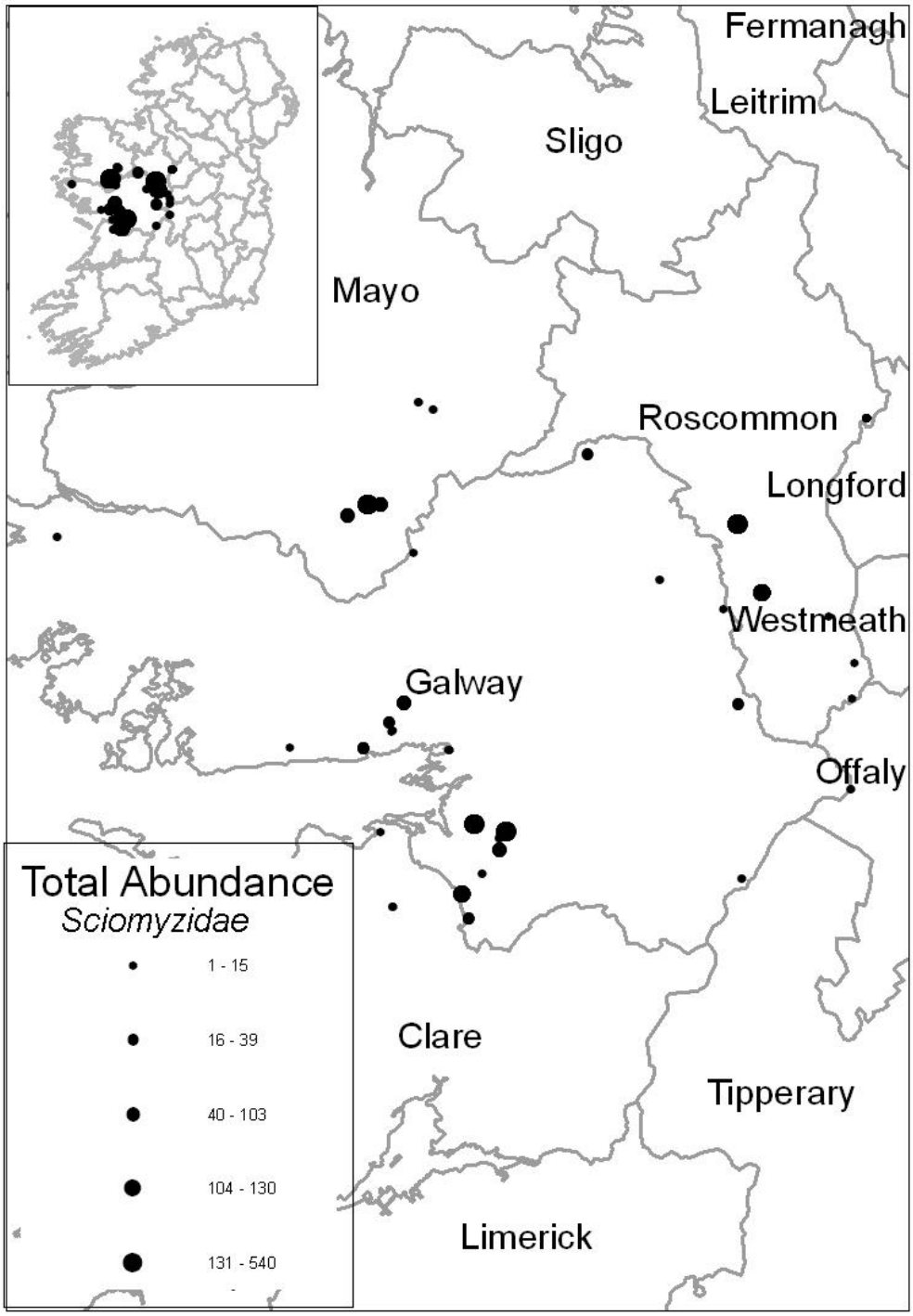


FIGURE 31. Records generated during this study for all sciomyzid species in the west of Ireland.



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