



DATA NOTE

# The genome sequence of the Dot Moth, *Melanchra persicariae* (Linnaeus, 1761) [version 1; peer review: awaiting peer review]

Douglas Boyes<sup>1+</sup>, Peter W.H. Holland<sup>2</sup>,  
University of Oxford and Wytham Woods Genome Acquisition Lab,  
Darwin Tree of Life Barcoding collective,  
Wellcome Sanger Institute Tree of Life programme,  
Wellcome Sanger Institute Scientific Operations: DNA Pipelines collective,  
Tree of Life Core Informatics collective, Darwin Tree of Life Consortium

<sup>1</sup>UK Centre for Ecology & Hydrology, Wallingford, England, UK

<sup>2</sup>University of Oxford, Oxford, England, UK

+ Deceased author

---

**V1** First published: 27 Apr 2023, 8:190  
<https://doi.org/10.12688/wellcomeopenres.19410.1>  
Latest published: 27 Apr 2023, 8:190  
<https://doi.org/10.12688/wellcomeopenres.19410.1>

---

## Open Peer Review

**Approval Status** AWAITING PEER REVIEW

Any reports and responses or comments on the article can be found at the end of the article.

## Abstract

We present a genome assembly from an individual male *Melanchra persicariae* (the Dot Moth; Arthropoda; Insecta; Lepidoptera; Noctuidae). The genome sequence is 647.9 megabases in span. Most of the assembly is scaffolded into 31 chromosomal pseudomolecules, including the Z sex chromosome. The mitochondrial genome has also been assembled and is 15.4 kilobases in length.

## Keywords

*Melanchra persicariae*, Dot Moth, genome sequence, chromosomal, Lepidoptera



This article is included in the [Tree of Life gateway](#).

**Corresponding author:** Darwin Tree of Life Consortium ([mark.blaxter@sanger.ac.uk](mailto:mark.blaxter@sanger.ac.uk))

**Author roles:** **Boyes D:** Investigation, Resources; **Holland PWH:** Writing – Original Draft Preparation, Writing – Review & Editing;

**Competing interests:** No competing interests were disclosed.

**Grant information:** This work was supported by Wellcome through core funding to the Wellcome Sanger Institute (206194, <https://doi.org/10.35802/206194>) and the Darwin Tree of Life Discretionary Award (218328, <https://doi.org/10.35802/218328>). *The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.*

**Copyright:** © 2023 Boyes D *et al.* This is an open access article distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**How to cite this article:** Boyes D, Holland PWH, University of Oxford and Wytham Woods Genome Acquisition Lab *et al.* **The genome sequence of the Dot Moth, *Melanchnra persicariae* (Linnaeus, 1761) [version 1; peer review: awaiting peer review]** Wellcome Open Research 2023, 8:190 <https://doi.org/10.12688/wellcomeopenres.19410.1>

**First published:** 27 Apr 2023, 8:190 <https://doi.org/10.12688/wellcomeopenres.19410.1>

## Species taxonomy

Eukaryota; Metazoa; Ecdysozoa; Arthropoda; Hexapoda; Insecta; Pterygota; Neoptera; Endopterygota; Lepidoptera; Glossata; Ditrysia; Noctuoidea; Noctuidae; Hadeninae; *Melanchra*; *Melanchra persicariae* (Linnaeus, 1761) (NCBI: txid987979).

## Background

The Dot Moth, *Melanchra persicariae*, is an easily recognised member of the family Noctuidae. The typical form of the moth has almost uniformly blue-black forewings and a bright white reniform stigma (kidney mark), giving the moth its common name. The larva may be green or brown, but always has distinctive markings with three short parallel cream stripes just behind the head and a series of forward-pointing chevron marks on each segment meeting to form triangles when viewed dorsally (Stokoe, 1948). The larvae feed at night and day on a wide variety of herbaceous plants including nettle, dock and bindweeds, or the foliage of deciduous shrubs and trees. The adult moth has a summer flight period, peaking in July in Britain and Ireland (Randle *et al.*, 2019). The larva feeds through the autumn months before overwintering as a pupa.

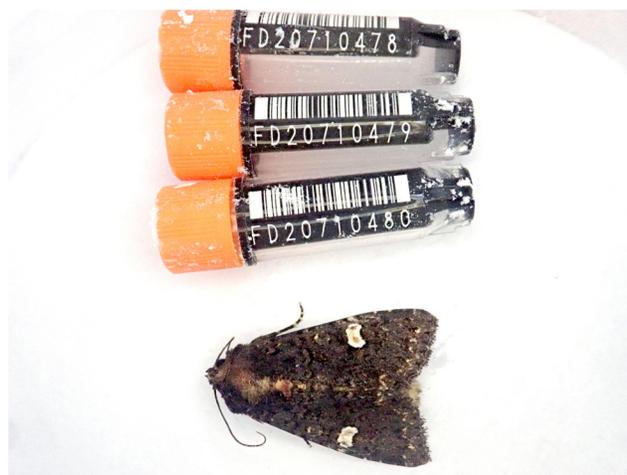
*M. persicariae* can be found in woodland, hedgerows, waste ground and garden habitats, and has been recorded across much of Europe and east across Eurasia to Japan (GBIF Secretariat, 2022). In the UK, the moth can be locally common in parts of southern England and Wales, although it has declined in abundance over the last 50 years (Randle *et al.*, 2019). This moth is scarce in Scotland and is considered ‘very rare’ in Northern Ireland (NBN Atlas Partnership, 2022; Randle *et al.*, 2019; Thompson & Nelson, 2003). The species has a patchy distribution in Ireland, with most records from coastal suburban areas (MothsIreland, 2022).

A genome sequence for *M. persicariae* will facilitate studies into molecular adaptations to polyphagy and contribute to a growing dataset of resources for understanding lepidopteran biology.

## Genome sequence report

The genome was sequenced from one male *Melanchra persicariae* (Figure 1) collected from Wytham Woods, Oxfordshire, UK (latitude 51.77, longitude -1.34). A total of 41-fold coverage in Pacific Biosciences single-molecule HiFi long reads was generated. Primary assembly contigs were scaffolded with chromosome conformation Hi-C data. Manual assembly curation corrected three missing joins or mis-joins and removed one haplotypic duplication, reducing the scaffold count by one.

The final assembly has a total length of 647.9 Mb in 46 sequence scaffolds with a scaffold N50 of 21.5 Mb (Table 1). Most (99.99%) of the assembly sequence was assigned to 31 chromosomal-level scaffolds, representing 30 autosomes and the Z sex chromosome. Chromosome-scale scaffolds confirmed by the Hi-C data are named in order of



**Figure 1.** Photograph of the *Melanchra persicariae* (ilMelPers1) specimen used for genome sequencing.

size (Figure 2–Figure 5; Table 2). While not fully phased, the assembly deposited is of one haplotype. Contigs corresponding to the second haplotype have also been deposited. The mitochondrial genome was also assembled and can be found as a contig within the multifasta file of the genome submission.

The estimated Quality Value (QV) of the final assembly is 68.4 with *k*-mer completeness of 100%, and the assembly has a BUSCO v5.3.2 completeness of 99.1% (single = 98.5%, duplicated = 0.6%), using the lepidoptera\_odb10 reference set ( $n = 5,286$ ).

Metadata for specimens, spectral estimates, sequencing runs, contaminants and pre-curation assembly statistics can be found at <https://links.tol.sanger.ac.uk/species/987979>.

## Methods

### Sample acquisition and nucleic acid extraction

A male *Melanchra persicariae* specimen (individual ilMelPers1, specimen Ox001680) was collected from Wytham Woods, Oxfordshire (biological vice-county: Berkshire), UK (latitude 51.77, longitude -1.34) on 17 July 2021. The specimen was caught using a light trap in woodland habitat by Douglas Boyes (University of Oxford). The specimen was identified by the collector and then snap-frozen on dry ice.

DNA was extracted at the Tree of Life laboratory, Wellcome Sanger Institute (WSI). The ilMelPers1 sample was weighed and dissected on dry ice with head tissue set aside for Hi-C sequencing. Thorax tissue was disrupted using a Nippi Powermasher fitted with a BioMasher pestle. High molecular weight (HMW) DNA was extracted using the Qiagen MagAttract HMW DNA extraction kit. HMW DNA was sheared into an average fragment size of 12–20 kb in a Megaruptor 3 system with speed setting 30. Sheared DNA

**Table 1. Genome data for *Melanchnra persicariae*, iMelPers1.1.**

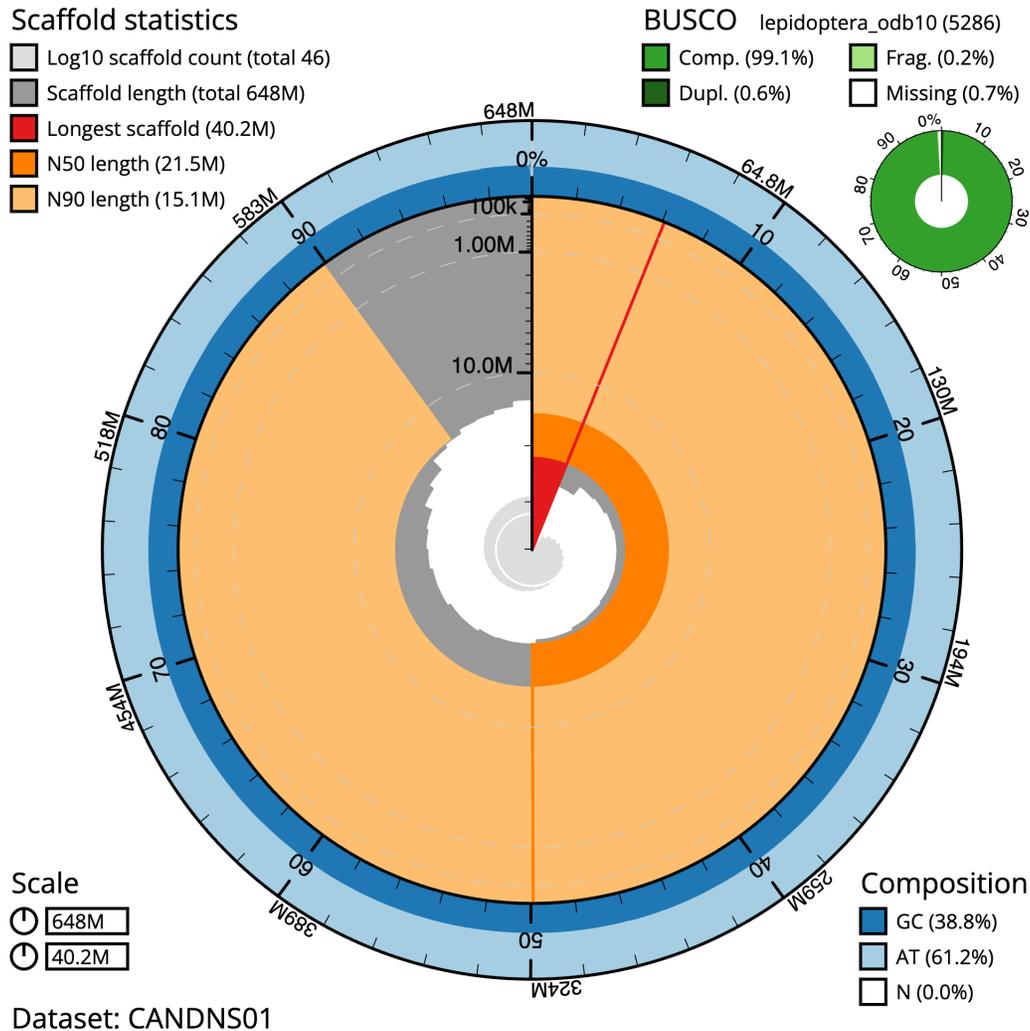
Project accession data		
Assembly identifier	iMelPers1.1	
Species	<i>Melanchnra persicariae</i>	
Specimen	iMelPers1	
NCBI taxonomy ID	987979	
BioProject	PRJEB56410	
BioSample ID	SAMEA10978947	
Isolate information	iMelPers1, male: thorax (genome sequencing); head (Hi-C scaffolding)	
Assembly metrics*		Benchmark
Consensus quality (QV)	68.4	≥ 50
k-mer completeness	100%	≥ 95%
BUSCO**	C:99.1%[S:98.5%,D:0.6%], F:0.2%,M:0.7%,n:5286	C ≥ 95%
Percentage of assembly mapped to chromosomes	99.99%	≥ 95%
Sex chromosomes	Z chromosome	localised homologous pairs
Organelles	Mitochondrial genome assembled.	complete single alleles
Raw data accessions		
PacificBiosciences SEQUEL II	ERR10499391	
Hi-C Illumina	ERR10313055	
Genome assembly		
Assembly accession	GCA_947386135.1	
Accession of alternate haplotype	GCA_947386145.1	
Span (Mb)	647.9	
Number of contigs	108	
Contig N50 length (Mb)	11.6	
Number of scaffolds	46	
Scaffold N50 length (Mb)	21.5	
Longest scaffold (Mb)	40.2	

\* Assembly metric benchmarks are adapted from column VGP-2020 of "Table 1: Proposed standards and metrics for defining genome assembly quality" from (Rhie *et al.*, 2021).

\*\* BUSCO scores based on the lepidoptera\_odb10 BUSCO set using v5.3.2. C = complete [S = single copy, D = duplicated], F = fragmented, M = missing, n = number of orthologues in comparison. A full set of BUSCO scores is available at <https://blobtoolkit.genomehubs.org/view/iMelPers1.1/dataset/CANDNS01/busco>.

was purified by solid-phase reversible immobilisation using AMPure PB beads with a 1.8X ratio of beads to sample to remove the shorter fragments and concentrate the DNA sample. The concentration of the sheared and purified DNA was

assessed using a Nanodrop spectrophotometer and Qubit Fluorometer and Qubit dsDNA High Sensitivity Assay kit. Fragment size distribution was evaluated by running the sample on the FemtoPulse system.



**Figure 2. Genome assembly of *Melanchra persicariae*, ilMelPers1.1: metrics.** The BlobToolKit Snailplot shows N50 metrics and BUSCO gene completeness. The main plot is divided into 1,000 size-ordered bins around the circumference with each bin representing 0.1% of the 647,911,175 bp assembly. The distribution of scaffold lengths is shown in dark grey with the plot radius scaled to the longest scaffold present in the assembly (40,163,345 bp, shown in red). Orange and pale-orange arcs show the N50 and N90 scaffold lengths (21,548,939 and 15,092,271 bp), respectively. The pale grey spiral shows the cumulative scaffold count on a log scale with white scale lines showing successive orders of magnitude. The blue and pale-blue area around the outside of the plot shows the distribution of GC, AT and N percentages in the same bins as the inner plot. A summary of complete, fragmented, duplicated and missing BUSCO genes in the lepidoptera\_odb10 set is shown in the top right. An interactive version of this figure is available at <https://blobtoolkit.genomehubs.org/view/ilMelPers1.1/dataset/CANDNS01/snail>.

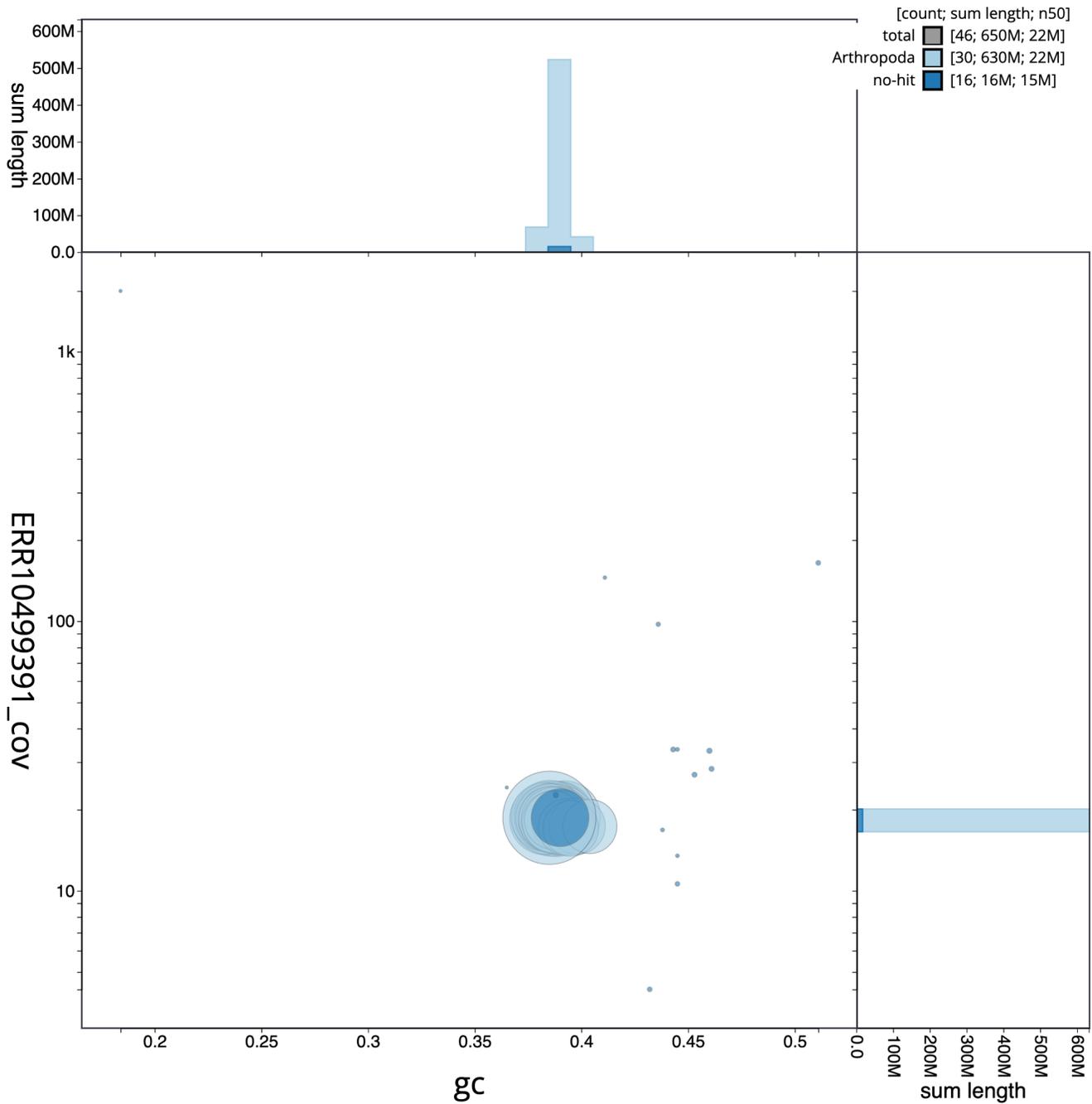
### Sequencing

Pacific Biosciences HiFi circular consensus DNA sequencing libraries were constructed according to the manufacturers' instructions. DNA sequencing was performed by the Scientific Operations core at the WSI on Pacific Biosciences SEQUEL II (HiFi) instrument. Hi-C data were also generated from head tissue of ilMelPers1 using the Arima2 kit and sequenced on the Illumina NovaSeq 6000 instrument.

### Genome assembly, curation and evaluation

Assembly was carried out with Hifiasm (Cheng *et al.*, 2021) and haplotypic duplication was identified and removed with

purge\_dups (Guan *et al.*, 2020). The assembly was then scaffolded with Hi-C data (Rao *et al.*, 2014) using YaHS (Zhou *et al.*, 2023). The assembly was checked for contamination as described previously (Howe *et al.*, 2021). Manual curation was performed using HiGlass (Kerpedjiev *et al.*, 2018) and Pretext (Harry, 2022). The mitochondrial genome was assembled using MitoHiFi (Uliano-Silva *et al.*, 2022), which runs MitoFinder (Allio *et al.*, 2020) or MITOS (Bernt *et al.*, 2013) and uses these annotations to select the final mitochondrial contig and to ensure the general quality of the sequence. To evaluate the assembly, MerquryFK was used to estimate consensus quality (QV) scores and *k*-mer completeness (Rhie *et al.*, 2020). The

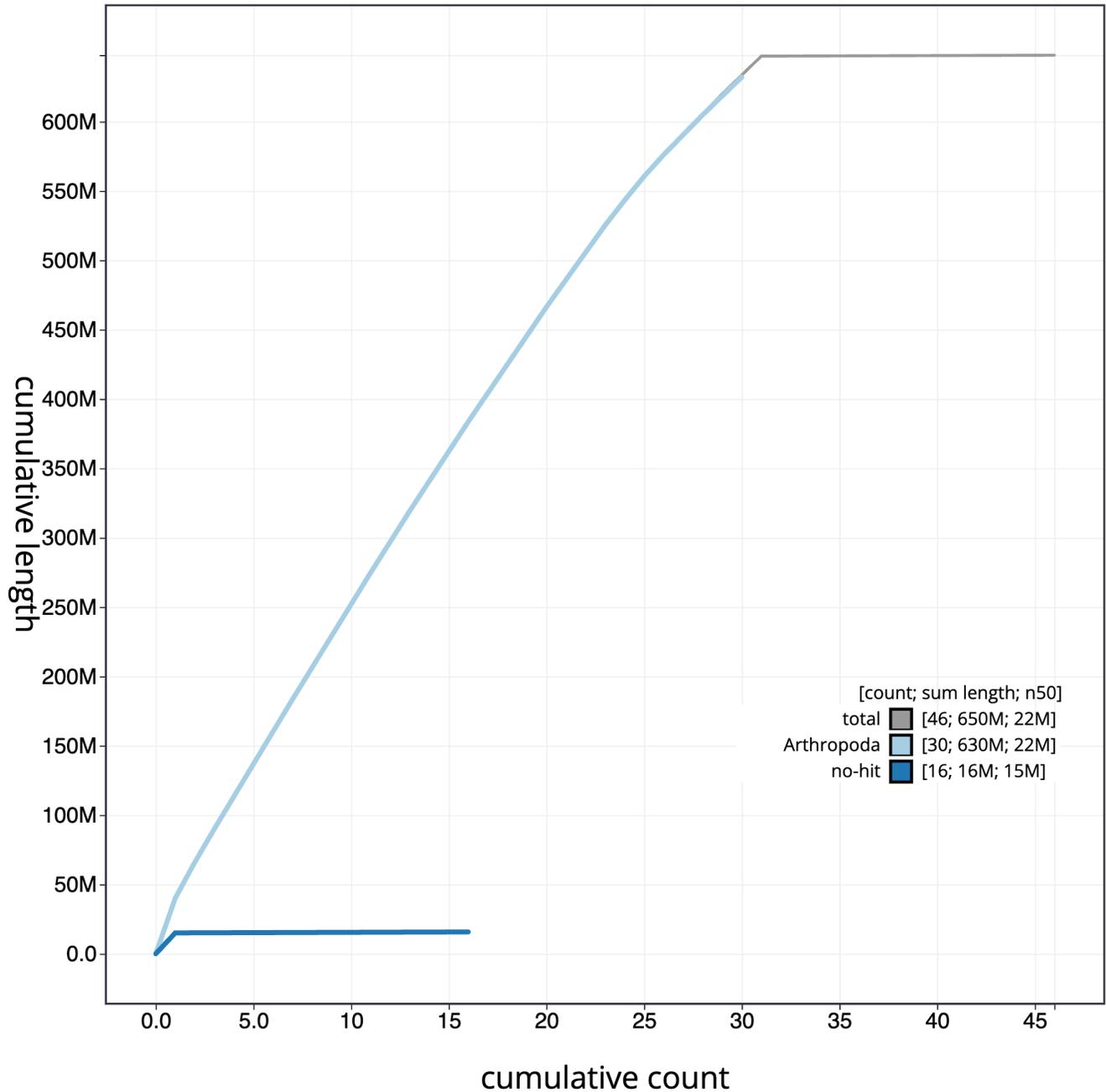


**Figure 3. Genome assembly of *Melanchra persicariae*, iMelPers1.1: BlobToolKit GC-coverage plot.** Scaffolds are coloured by phylum. Circles are sized in proportion to scaffold length. Histograms show the distribution of scaffold length sum along each axis. An interactive version of this figure is available at <https://blobtoolkit.genomehubs.org/view/iMelPers1.1/dataset/CANDNS01/blob>.

genome was analysed within the BlobToolKit environment (Challis *et al.*, 2020) and BUSCO scores (Manni *et al.*, 2021; Simão *et al.*, 2015) were calculated. Table 3 contains a list of software tool versions and sources.

#### Ethics and compliance issues

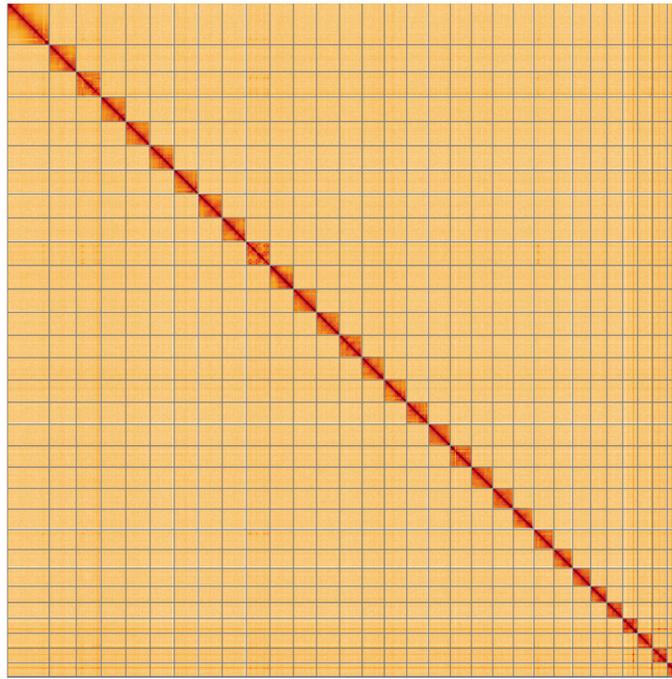
The materials that have contributed to this genome note have been supplied by a Darwin Tree of Life Partner. The submission of materials by a Darwin Tree of Life Partner is



**Figure 4. Genome assembly of *Melanchra persicariae*, ilMelPers1.1: BlobToolKit cumulative sequence plot.** The grey line shows cumulative length for all scaffolds. Coloured lines show cumulative lengths of scaffolds assigned to each phylum using the buscodegenes taxrule. An interactive version of this figure is available at <https://blobtoolkit.genomehubs.org/view/ilMelPers1.1/dataset/CANDNS01/cumulative>.

subject to the [Darwin Tree of Life Project Sampling Code of Practice](#). By agreeing with and signing up to the Sampling Code of Practice, the Darwin Tree of Life Partner agrees they will meet the legal and ethical requirements and standards

set out within this document in respect of all samples acquired for, and supplied to, the Darwin Tree of Life Project. All efforts are undertaken to minimise the suffering of animals used for sequencing. Each transfer of samples is further undertaken



**Figure 5. Genome assembly of *Melanchra persicariae*, iIMelPers1.1: Hi-C contact map of the iIMelPers1.1 assembly, visualised using HiGlass.** Chromosomes are shown in order of size from left to right and top to bottom. An interactive version of this figure may be viewed at [https://genome-note-higlass.tol.sanger.ac.uk/l/?d=DpyT6iq2Rr2JBQ2hDL\\_f8g](https://genome-note-higlass.tol.sanger.ac.uk/l/?d=DpyT6iq2Rr2JBQ2hDL_f8g).

**Table 2. Chromosomal pseudomolecules in the genome assembly of *Melanchra persicariae*, iIMelPers1.**

INSDC accession	Chromosome	Size (Mb)	GC%
OX376644.1	1	25.93	38.8
OX376645.1	2	24.03	39.2
OX376646.1	3	23.74	38.9
OX376647.1	4	23.35	38.6
OX376648.1	5	23.16	38.3
OX376649.1	6	23.12	38.7
OX376650.1	7	23	38.4
OX376651.1	8	22.96	38.5
OX376652.1	9	22.74	38.7
OX376653.1	10	22.63	38.8
OX376654.1	11	22.25	39
OX376655.1	12	22.22	38.5
OX376656.1	13	21.55	38.3
OX376657.1	14	21.51	38.6
OX376658.1	15	21.36	38.7

INSDC accession	Chromosome	Size (Mb)	GC%
OX376659.1	16	20.95	38.5
OX376660.1	17	20.92	38.9
OX376661.1	18	20.42	39
OX376662.1	19	20.39	38.8
OX376663.1	20	19.92	38.6
OX376664.1	21	19.63	38.6
OX376665.1	22	19.32	38.7
OX376666.1	23	18.04	38.7
OX376667.1	24	17.27	39.1
OX376668.1	25	15.54	38.7
OX376669.1	26	15.09	38.9
OX376670.1	27	14.49	39.3
OX376671.1	28	14.35	39.8
OX376672.1	29	13.95	39.5
OX376673.1	30	13.23	40.4
OX376643.1	Z	40.16	38.5
OX376674.1	MT	0.02	18.7

**Table 3. Software tools: versions and sources.**

Software tool	Version	Source
BlobToolKit	4.0.7	<a href="https://github.com/blobtoolkit/blobtoolkit">https://github.com/blobtoolkit/blobtoolkit</a>
BUSCO	5.3.2	<a href="https://gitlab.com/ezlab/busco">https://gitlab.com/ezlab/busco</a>
Hifiasm	0.16.1-r375	<a href="https://github.com/chhyllp123/hifiasm">https://github.com/chhyllp123/hifiasm</a>
HiGlass	1.11.6	<a href="https://github.com/higlass/higlass">https://github.com/higlass/higlass</a>
Mercury	MercuryFK	<a href="https://github.com/thegenemyers/MERQURY.FK">https://github.com/thegenemyers/MERQURY.FK</a>
MitoHiFi	2	<a href="https://github.com/marcelauliano/MitoHiFi">https://github.com/marcelauliano/MitoHiFi</a>
PretextView	0.2	<a href="https://github.com/wtsi-hpag/PretextView">https://github.com/wtsi-hpag/PretextView</a>
purge_dups	1.2.3	<a href="https://github.com/dfguan/purge_dups">https://github.com/dfguan/purge_dups</a>
YaHS	yahs-1.1.91eebc2	<a href="https://github.com/c-zhou/yahs">https://github.com/c-zhou/yahs</a>

according to a Research Collaboration Agreement or Material Transfer Agreement entered into by the Darwin Tree of Life Partner, Genome Research Limited (operating as the Wellcome Sanger Institute), and in some circumstances other Darwin Tree of Life collaborators.

### Data availability

European Nucleotide Archive: *Melanchra persicariae* (dot moth). Accession number [PRJEB56410](https://identifiers.org/ena.embl/PRJEB56410); <https://identifiers.org/ena.embl/PRJEB56410>. (Wellcome Sanger Institute, 2022)

The genome sequence is released openly for reuse. The *Melanchra persicariae* genome sequencing initiative is part of the Darwin Tree of Life (DTOL) project. All raw sequence data and the assembly have been deposited in INSDC databases. The genome will be annotated using available RNA-Seq data and presented through the [Ensembl](#) pipeline at the European Bioinformatics Institute. Raw data and assembly accession identifiers are reported in [Table 1](#).

### Author information

Members of the University of Oxford and Wytham Woods Genome Acquisition Lab are listed here: <https://doi.org/10.5281/zenodo.4789928>.

Members of the Darwin Tree of Life Barcoding collective are listed here: <https://doi.org/10.5281/zenodo.4893703>.

Members of the Wellcome Sanger Institute Tree of Life programme are listed here: <https://doi.org/10.5281/zenodo.4783585>.

Members of Wellcome Sanger Institute Scientific Operations: DNA Pipelines collective are listed here: <https://doi.org/10.5281/zenodo.4790455>.

Members of the Tree of Life Core Informatics collective are listed here: <https://doi.org/10.5281/zenodo.5013541>.

Members of the Darwin Tree of Life Consortium are listed here: <https://doi.org/10.5281/zenodo.4783558>.

### References

- Allio R, Schomaker-Bastos A, Romiguier J, et al.: **MitoFinder: Efficient automated large-scale extraction of mitogenomic data in target enrichment phylogenomics.** *Mol Ecol Resour.* 2020; **20**(4): 892–905. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Bernt M, Donath A, Jühling F, et al.: **MITOS: Improved *de novo* metazoan mitochondrial genome annotation.** *Mol Phylogenet Evol.* 2013; **69**(2): 313–9. [PubMed Abstract](#) | [Publisher Full Text](#)
- Challis R, Richards E, Rajan J, et al.: **BlobToolKit - interactive quality assessment of genome assemblies.** *G3 (Bethesda).* 2020; **10**(4): 1361–1374. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Cheng H, Concepcion GT, Feng X, et al.: **Haplotype-resolved *de novo* assembly using phased assembly graphs with hifiasm.** *Nat Methods.* 2021; **18**(2): 170–175. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- GBIF Secretariat: ***Melanchra persicariae* Linnaeus, 1761.** GBIF Backbone Taxonomy. 2022; (Accessed: 19 December 2022). [Reference Source](#)
- Guan D, McCarthy SA, Wood J, et al.: **Identifying and removing haplotypic duplication in primary genome assemblies.** *Bioinformatics.* 2020; **36**(9): 2896–2898. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Harry E: **PretextView (Paired REad TEXTure Viewer): A desktop application for viewing pretext contact maps.** 2022; (Accessed: 19 October 2022). [Reference Source](#)

Howe K, Chow W, Collins J, *et al.*: **Significantly improving the quality of genome assemblies through curation.** *GigaScience*. Oxford University Press, 2021; **10**(1): g1aa153.

[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

Kerpedjiev P, Abdennur N, Lekschas F, *et al.*: **HiGlass: Web-based visual exploration and analysis of genome interaction maps.** *Genome Biol.* 2018; **19**(1): 125.

[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

Manni M, Berkeley MR, Seppely M, *et al.*: **BUSCO Update: Novel and Streamlined Workflows along with Broader and Deeper Phylogenetic Coverage for Scoring of Eukaryotic, Prokaryotic, and Viral Genomes.** *Mol Biol Evol.* 2021; **38**(10): 4647–4654.

[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

MothsIreland: **Dot Moth (*Melanchra persicariae*), MothsIreland, Mapping Ireland's Moths.** 2022; (Accessed: 19 December 2022).

[Reference Source](#)

NBN Atlas Partnership: ***Melanchra persicariae* (Linnaeus, 1761) Dot Moth.**

NBN Atlas, 2022; (Accessed: 19 December 2022).

[Reference Source](#)

Randle Z, Evans-Hill LJ, Parsons MS, *et al.*: **Atlas of Britain & Ireland's Larger Moths.** Newbury: NatureBureau, 2019.

[Reference Source](#)

Rao SSP, Huntley MH, Durand NC, *et al.*: **A 3D map of the human genome at kilobase resolution reveals principles of chromatin looping.** *Cell.* 2014; **159**(7): 1665–1680.

[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

Rhie A, Walenz BP, Koren S, *et al.*: **Mercury: Reference-free quality,**

**completeness, and phasing assessment for genome assemblies.** *Genome Biol.* 2020; **21**(1): 245.

[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

Rhie A, McCarthy SA, Fedrigo O, *et al.*: **Towards complete and error-free genome assemblies of all vertebrate species.** *Nature.* 2021; **592**(7856): 737–746.

[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

Simão FA, Waterhouse RM, Ioannidis P, *et al.*: **BUSCO: assessing genome assembly and annotation completeness with single-copy orthologs.** *Bioinformatics.* 2015; **31**(19): 3210–3212.

[PubMed Abstract](#) | [Publisher Full Text](#)

Stokoe WJ: **The Caterpillars of British Moths. Series 1.** London and New York: Warne and Co, 1948.

[Reference Source](#)

Thompson RS, Nelson B: ***Melanchra persicariae* (Linnaeus, 1761).** In: *The Butterflies and Moths of Northern Ireland.* National Museums Northern Ireland. 2003.

[Reference Source](#)

Uliano-Silva M, Ferreira JGRN, Krashennnikova K, *et al.*: **MitoHiFi: a python pipeline for mitochondrial genome assembly from PacBio High Fidelity reads.** *bioRxiv.* [Preprint], 2022.

[Publisher Full Text](#)

Wellcome Sanger Institute: **The genome sequence of the Dot Moth, *Melanchra persicariae* (Linnaeus, 1761).** European Nucleotide Archive. [dataset], accession number PRJEB56410, 2022.

Zhou C, McCarthy SA, Durbin R: **YaHS: yet another Hi-C scaffolding tool.** *Bioinformatics.* Edited by C. Alkan, 2023; **39**(1): btac808.

[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)