

Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our [Editorial Policies](#) and the [Editorial Policy Checklist](#).

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed
☐	☒ The exact sample size (<i>n</i>) for each experimental group/condition, given as a discrete number and unit of measurement
☐	☒ A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☐	☒ The statistical test(s) used AND whether they are one- or two-sided <i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i>
☒	☐ A description of all covariates tested
☒	☐ A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☒	☐ A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☒	☐ For null hypothesis testing, the test statistic (e.g. <i>F</i> , <i>t</i> , <i>r</i>) with confidence intervals, effect sizes, degrees of freedom and <i>P</i> value noted <i>Give P values as exact values whenever suitable.</i>
☒	☐ For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐ For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☒	☐ Estimates of effect sizes (e.g. Cohen's <i>d</i> , Pearson's <i>r</i>), indicating how they were calculated

Our web collection on [statistics for biologists](#) contains articles on many of the points above.

Software and code

Policy information about [availability of computer code](#)

Data collection	No software was used for data collection
Data analysis	HiRise assembler by Dovetail Genomics Proximo assembler by Phase Genomics Juicebox ALLPATHS assembly PBjelly from pbsuite v15.8.24 Pilon v1.22 BUSCO v5.0.0 LTR_retriever v2.8.7 Mercury v1.3 bowtie2 v2.5.1 samtools v1.7 RepeatModeler v1.0.11 RepeatMasker v4.1.2 MAKER v3.01-beta AUGUSTUS v3.5.0 HISAT2 v2.1 StringTie v1.3.4 minimap2 v2.12 TEdenovo v2.4 pipeline from the REPET package v2.4

TEannot v2.4
 PASTEC
 BUSCO v4.0.4
 AGAT v0.4.0
 GFFCompare v0.11.2
 BLASTP v2.9.0
 BLASTN v2.9.0
 MCScanX
 VGSC2
 bedtools v2.19.1
 R v4.3.1
 Circos v0.69-9
 SynVisio (synvisio.github.io)
 bedtools v2.29.1
 Bowtie v2.3.4.1
 samtools v1.7
 IGV v2.12.3
 mosdepth v0.3.1
 minimap2 v2.15
 bwa-mem v0.7.17
 samtools v1.8
 GATK v4.1.8.0
 tabix v-0.2.6
 vcf2phylip v-1.5
 IQ-TREE v-2.1.4-beta
 Interactive Tree Of Life tool (<https://itol.embl.de/>)

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our [policy](#)

Sequence data that support the findings of this study have been deposited in GenBank under BioProject accession code PRJNA940147 (<https://www.ncbi.nlm.nih.gov/bioproject/PRJNA940147>), accession numbers SRR23675102 - SRR23675108. Genome assemblies and annotations can be accessed from Dryad (<https://datadryad.org/>) using doi:10.5061/dryad.kwh70rz70 and from CoGe (<https://genomevolution.org/coge/>) using the Genome id60716 for QQ74_V2 and id52047 for C. suecicum V2.

Research involving human participants, their data, or biological material

Policy information about studies with [human participants or human data](#). See also policy information about [sex, gender \(identity/presentation\), and sexual orientation](#) and [race, ethnicity and racism](#).

Reporting on sex and gender	NA
Reporting on race, ethnicity, or other socially relevant groupings	NA
Population characteristics	NA
Recruitment	NA
Ethics oversight	NA

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☒ Life sciences ☐ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

Sample size	NA
Data exclusions	No data were excluded
Replication	NA
Randomization	NA
Blinding	NA

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology and archaeology
☒	☐ Animals and other organisms
☒	☐ Clinical data
☒	☐ Dual use research of concern
☐	☒ Plants

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging