Problem Solving Protocol

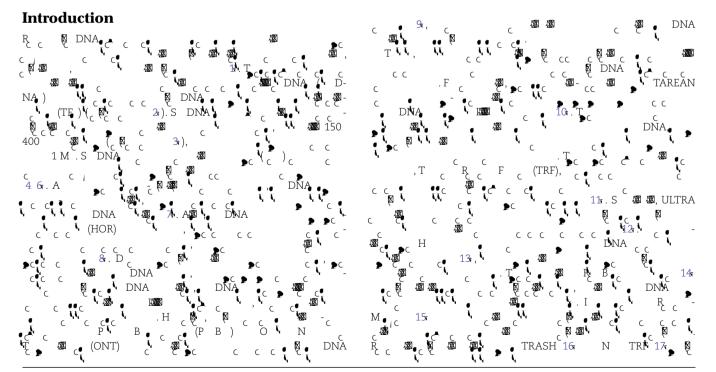
# SatXplor—a comprehensive pipeline for satellite DNA analyses in complex genome assemblies

Marin Volarić, Nevenka Meštrović, Evelin Despot-Slade [D\*



S X 🚳 .

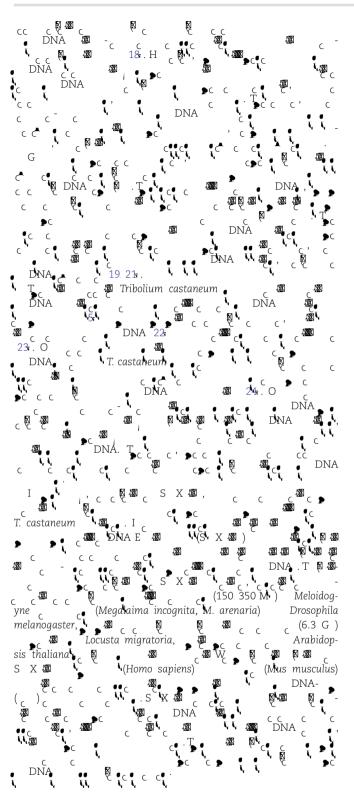
Keywords: SatXplor; pipeline; satellite DNA; genome



Received: August 12, 2024. Revised: October 31, 2024. Accepted: December 4, 2024

© The Author(s) 2024. Published by Oxford University Press.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (https://creativecommons.org/licenses/by-nc/4.0/), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited. For commercial re-use, please contact journals.permissions@oup.com



# Materials and methods Genome and satDNA data

A. thaliana, H. sapiens, and M. musculus DNA

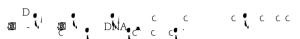
# SatXplor pipeline overview

Detection and extraction of monomers

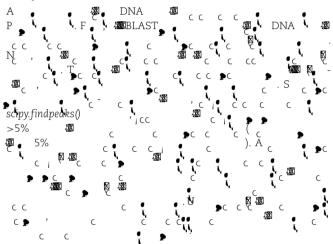


- evalue 10. outfmt 6. max target segs 10000. task blastn.

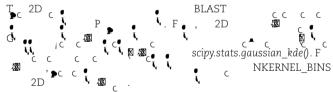
num, threads 2 - dust no - soft, masking false.



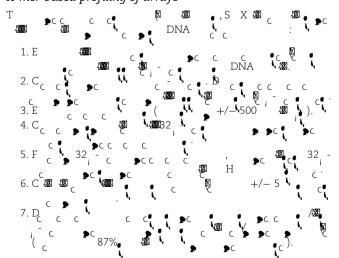
#### Array creation



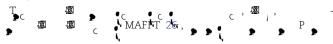
#### Monomer density profiles

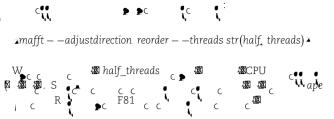


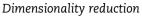
#### K-mer-based profiling of arrays

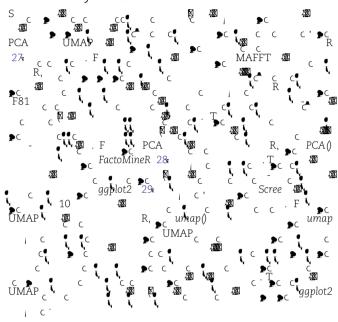


#### Alignment and distance calculations

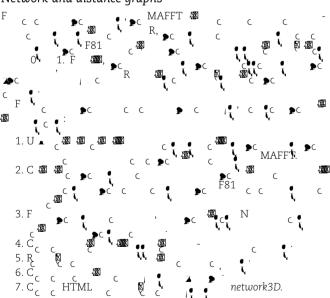




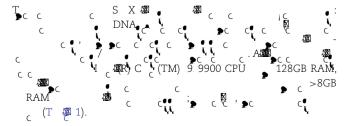


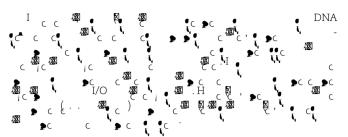


## Network and distance graphs

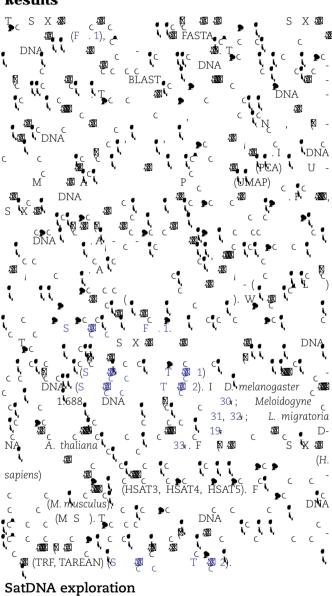


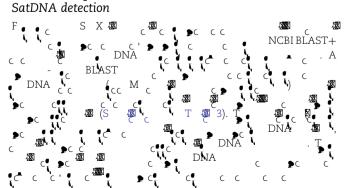
#### **Performance**



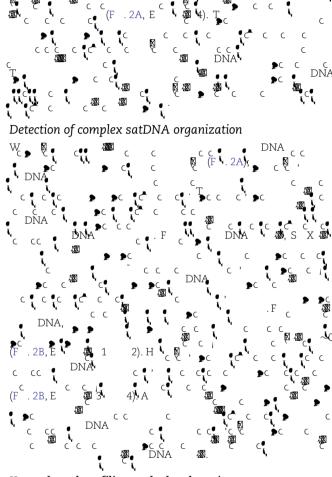


#### **Results**



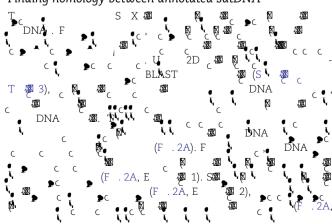


T <b>2</b> 1. E <b>2</b> c, CPU,	• c •c •	c •c c• •c c <sup>®</sup> c	
Genome (size)	Total monomers	Peak memory (GB)	Wall time (seconds)
Arabidopsis thaliana (119 M )	12 107	0.6	230
Drosophila melanogaster (143 M )	426	0.5	120
Meloidogyne incognita (199 M )	10 400	0.8	344
Meloidogyne arenaria (297 M )	83 460	8	626
Tribolium castaneum (225 M )	11 712	1	362
Locusta migratoria (6.2 G )	148 132	25	5238

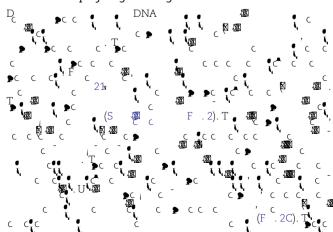


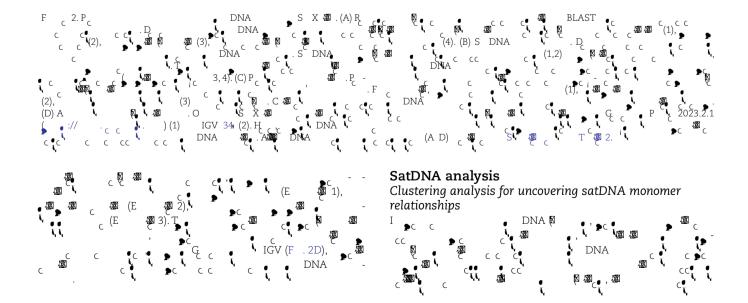


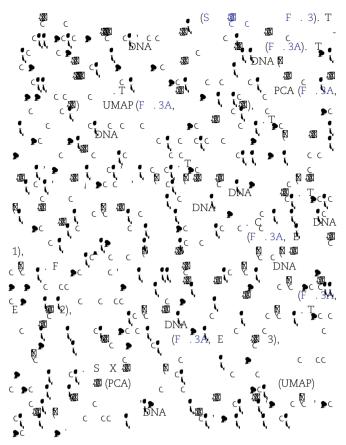
Finding homology between annotated satDNA



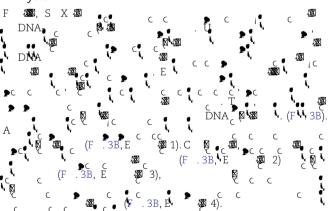
# K-mer-based profiling and edge detection



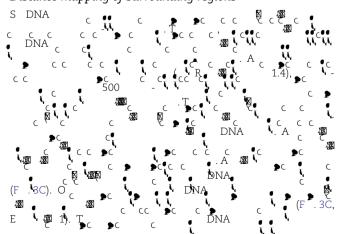


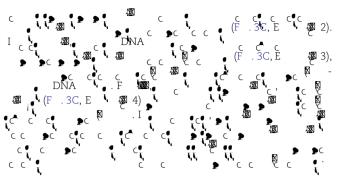


### Unveiling evolutionary trends trough satDNA network analysis

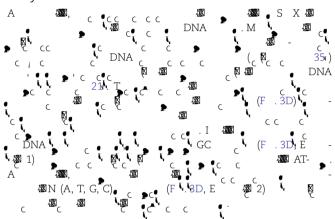


#### Distance mapping of surrounding regions

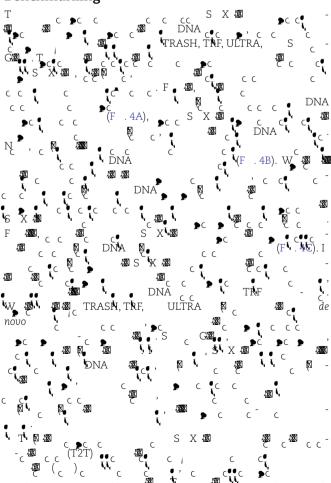


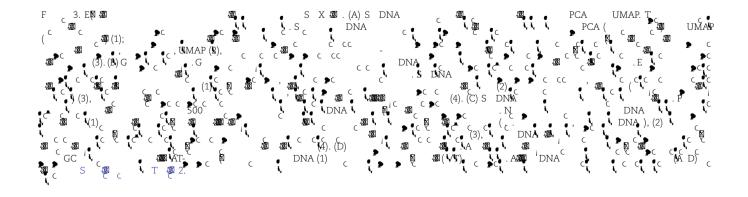


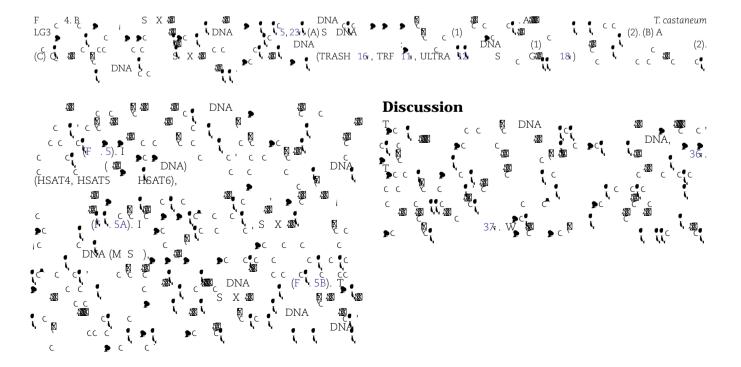
Microhomology detection in flanking regions of satDNA

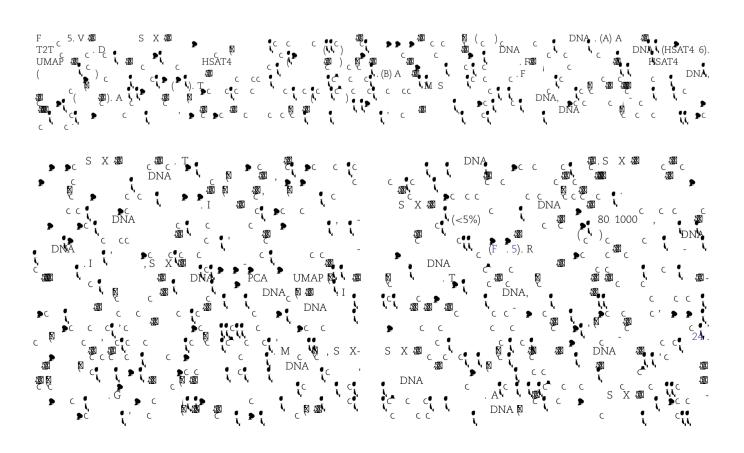


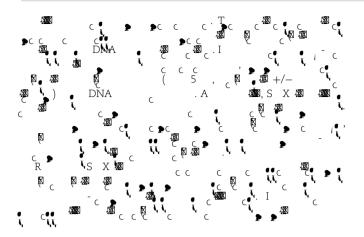
#### Benchmarking











- 10. N N P, R M L, K M, C C Nucleic Acids Res
- 2017;45; 111.

  11. Be G. T C C C C C DNA

  12. ON D, W CC T. ULTRA: A M B T D D

  T R C I : Proc. 2018 ACM Int. Conf. Bioinformatics, Comput. Biol. Heal. Informatics, A C M

  N, US, .37. 46, 2018. :// . /10.1145/3233547.
  3233604.

- 14. B W, K KK, K O. R C Mob DNA 2015; 6:4 9.

  15. S AFA, H & R, G C P. RepeatMasker Open-4.0. 2013. 2015.
- 15. S AFA, 11 7 16. W 16. P, H 16 M, H 17 IR. TRASH:

  16. W 17 P, H 16 M, H 18 C Bioinformatics 2023; C C 39: 308.
- 17. K NI, K N E, D N M. et al. A C N TRF de novo cara DNA cara 2022;**11**:2103.

- 20. V T, MAN R M AN L, N N P. et al. C C DNA C DNA C ... /10.1111/
  ... 14546.

- 23. G T, D M, D S C E. et al. T S - C Genes (Basel) 2023;14:999.
- C, C & G, A V. et al. BLAST+: BMC Bioinformatics 2009;**10**:421.

- 26. K K, M KI. et al. MAFFT: . Nucleic **A**cids Res 2002;**30**:3059. 6**6**.

- 29. W H. ggplot2: Elegant Graphics for Data Analysis. S
- G3 Genes Genomes Genet 2020;10:4129. 46.
- 31. De. -S⊠ c E, M N B, Š S. et al. T c c c c € c **№ 8**/ • 336.

- 35. L, J R, Q T. et al. E

  C C Signal Transduct Target
  Ther 2022;7:342.
- 36. L S, L c M, F<sub>C</sub> D. et al. D C MODO4T © 5.)T MTMMCDP \( \text{MY} \) (.)T MTMM-.0004T \( \text{MS} \)

- 46. M N, M J, P N. et al. TRT : 37: 731. 3. '.'/ '. 'y10.1093/ '. '.' '. '736.
- 47. E C, E R, T M. et al. RepeatOBserver: tandem repeat visualization and centromere detection. R 2023.12.30.573697. :// . /10.1101/2023.12.30.573697.