

OP-068 [Bee Biology] Hybridization of honey bees in southwestern Asia

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The honey bee (*Apis mellifera*) is native to Europe, Africa, and southwestern Asia. Within this large range, numerous subspecies and ecotypes have evolved, adapted to local environmental conditions. In some regions, biodiversity is threatened by the mass production of non-native queen bees and migratory beekeeping. In order to protect native subspecies and ecotypes, it is essential to discriminate them from imported bees. Discrimination can be based on wing measurements, but reference datasets are often lacking. The aim of this study is to provide a reference data set for honey bees native to southwestern Asia.

We have collated 17015 fore-wing images of honey bee workers, which represent 1535 colonies from eight countries: Azerbaijan, Cyprus, Georgia, Iran, Iraq, Saudi Arabia, Tajikistan, and Turkey. The wing images were uploaded to a publicly accessible repository. They were measured using 19 landmarks and analyzed using geometric morphometric methods. Wing shape varied significantly across southwestern Asia. Pairwise comparisons revealed that most countries were significantly different from each other. Twelve clusters were identified using Bayesian information criteria and model-based clustering. Seven of the clusters were classified as native and the remaining five clusters were classified as non-native. Six clusters from the Middle East and Central Asia belong to lineage O and one cluster from Saudi Arabia belongs to lineage A.

There is an urgent need to protect the biodiversity of honey bees in southwestern Asia. Protection can be facilitated by the large collection of wing images provided by this study. Native and non-native bees can be effectively discriminated using wing geometric morphometrics. This method is available to both scientists and beekeepers as it doesn't require expensive equipment.

Hybridization of honey bees in southwestern Asia

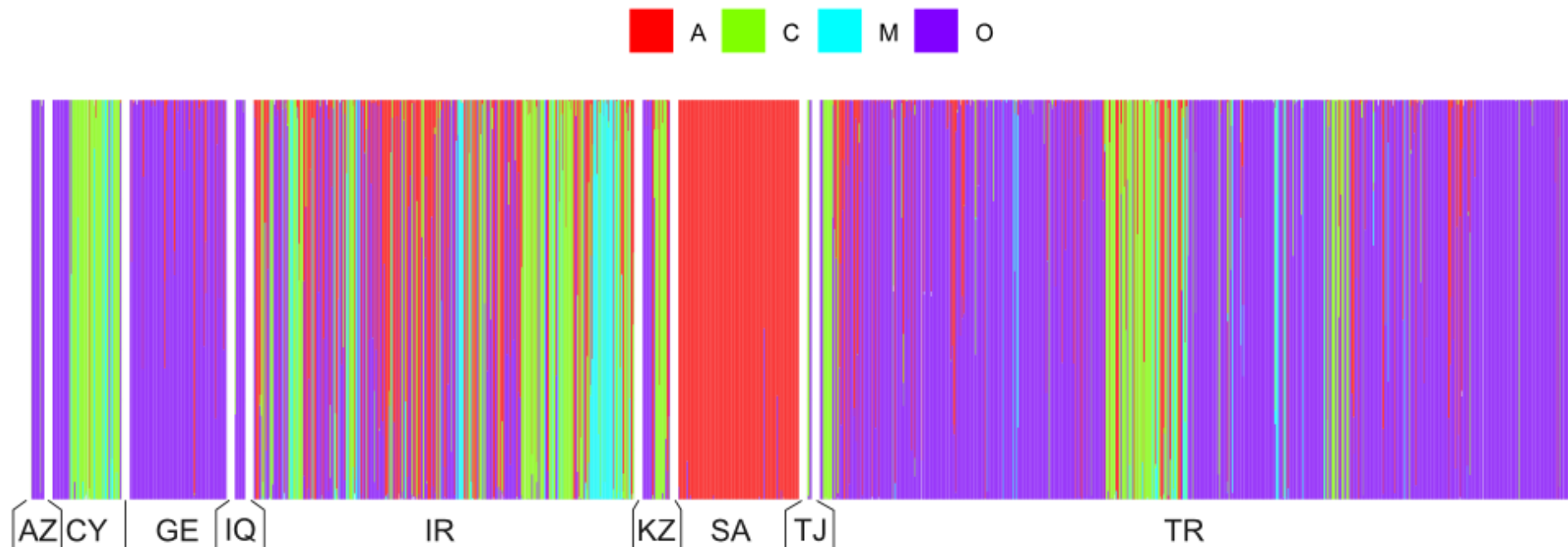
Adam Tofilski, Julita Machlowska - University of Agriculture in Krakow, Poland

Irfan Kandemir - Ankara University, Türkiye

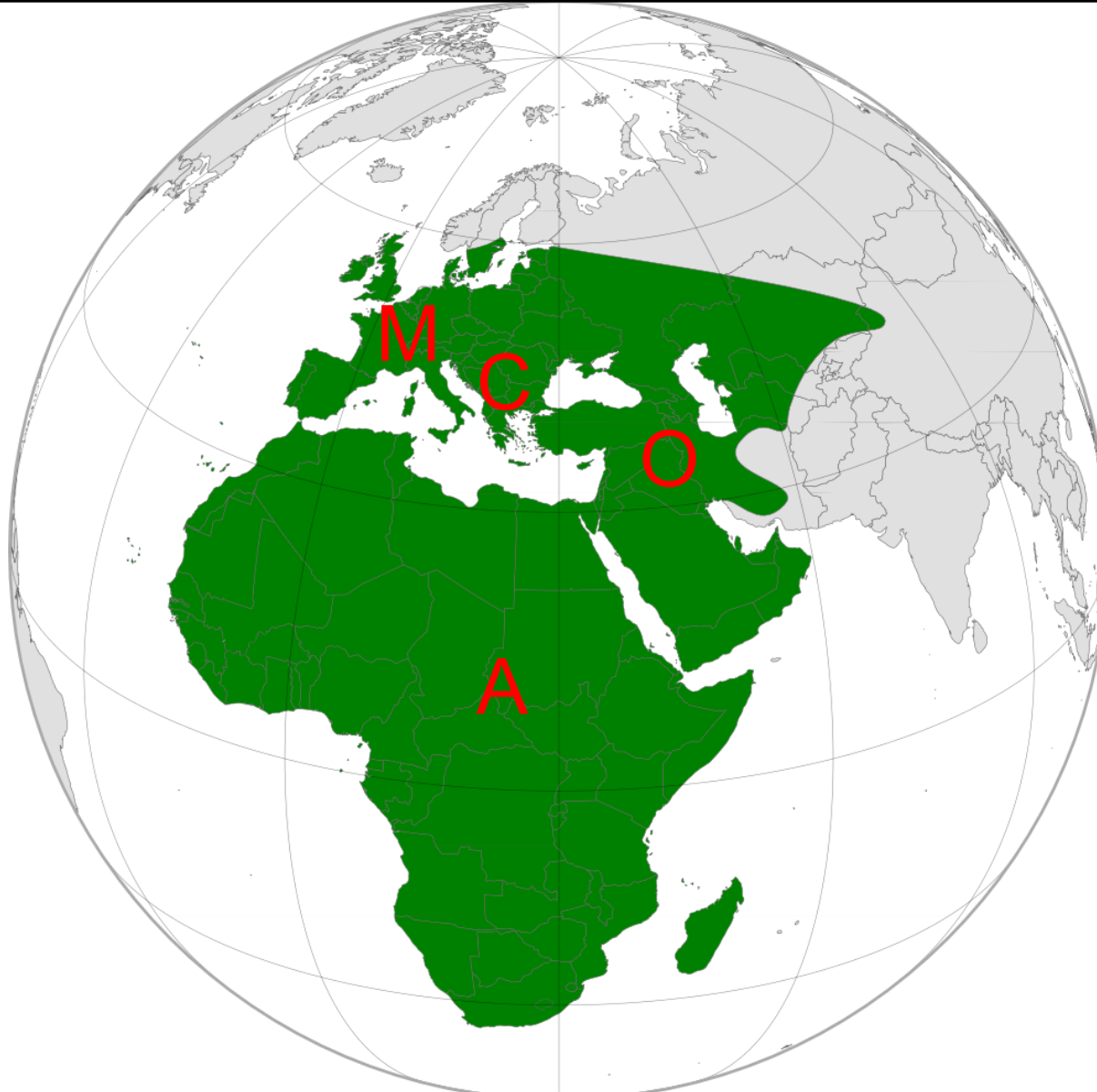
Ayça Özkan Koca - Maltepe University, Türkiye

Vakhtang Kakhniashvili - Georgian Beekeepers Union, Georgia

Yehya Alattal, Ahmad Alghamdi - King Saud University, Saudi Arabia



Natural range of *Apis mellifera*

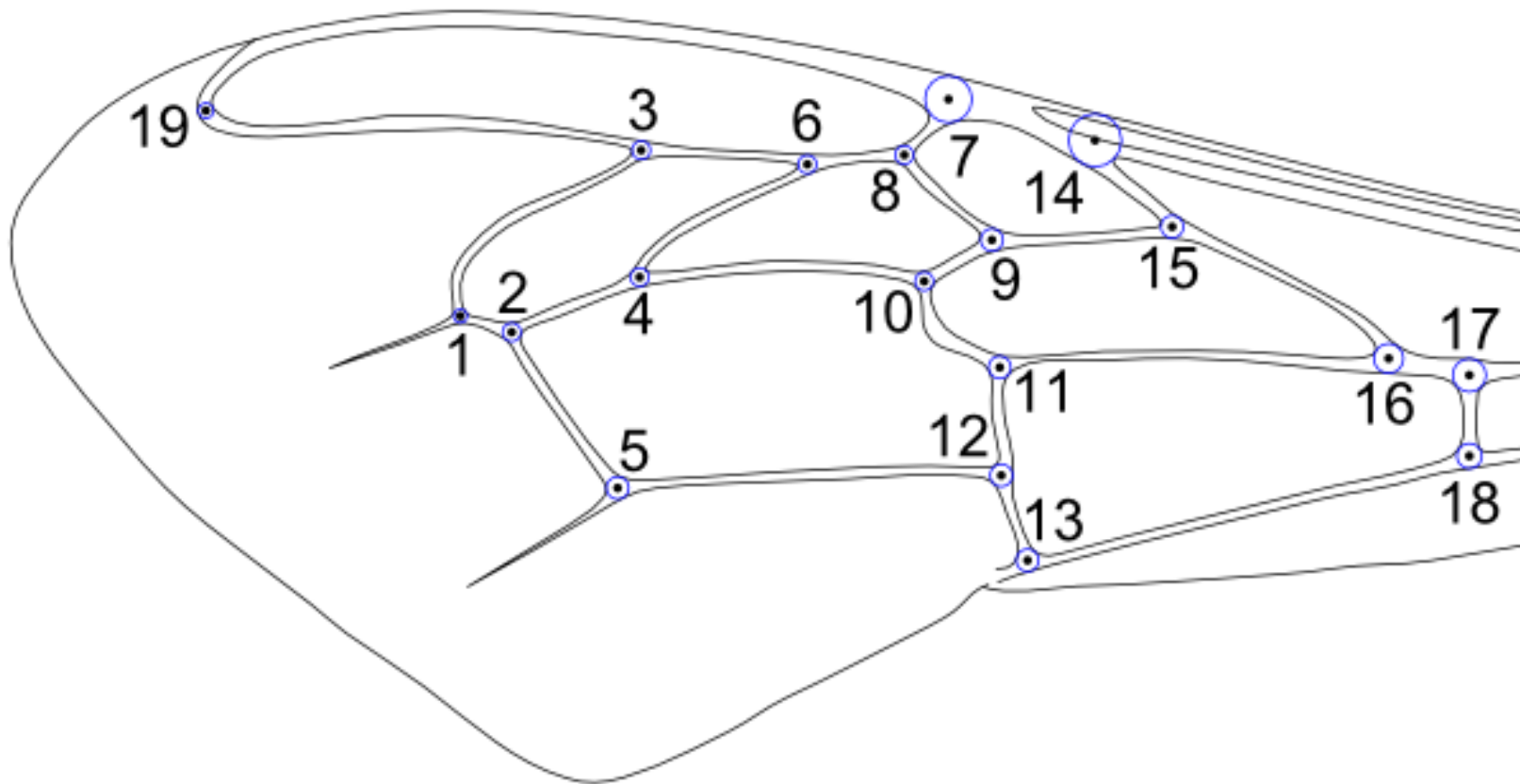


Aim

- Classify the colonies as lineages A, C, M and O.
- Is it feasible to differentiate between honey bees from different countries?
- Provide a reference dataset for identifying regional populations.

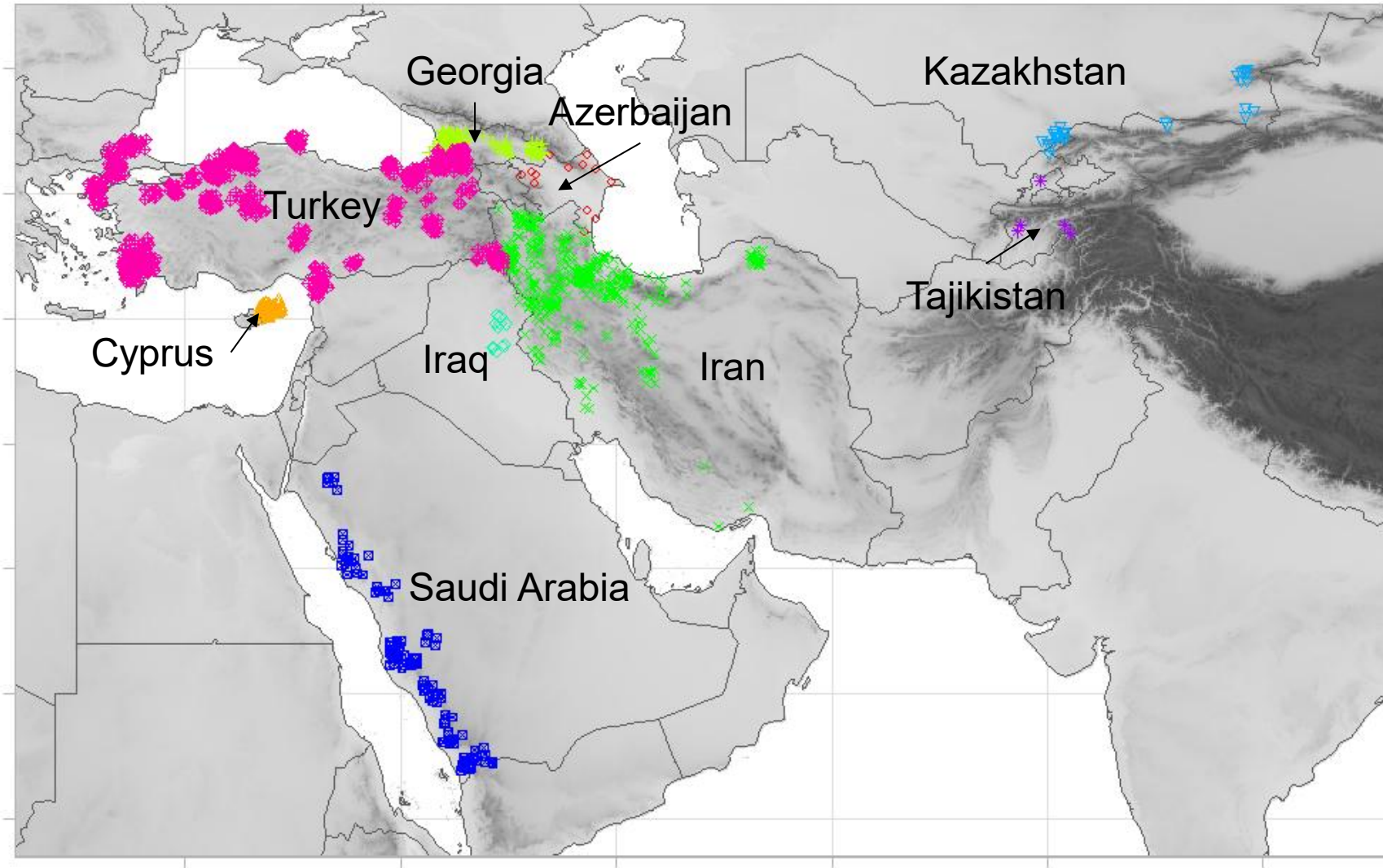
Methods

- geometric morphometrics
- 19 landmarks on forewing

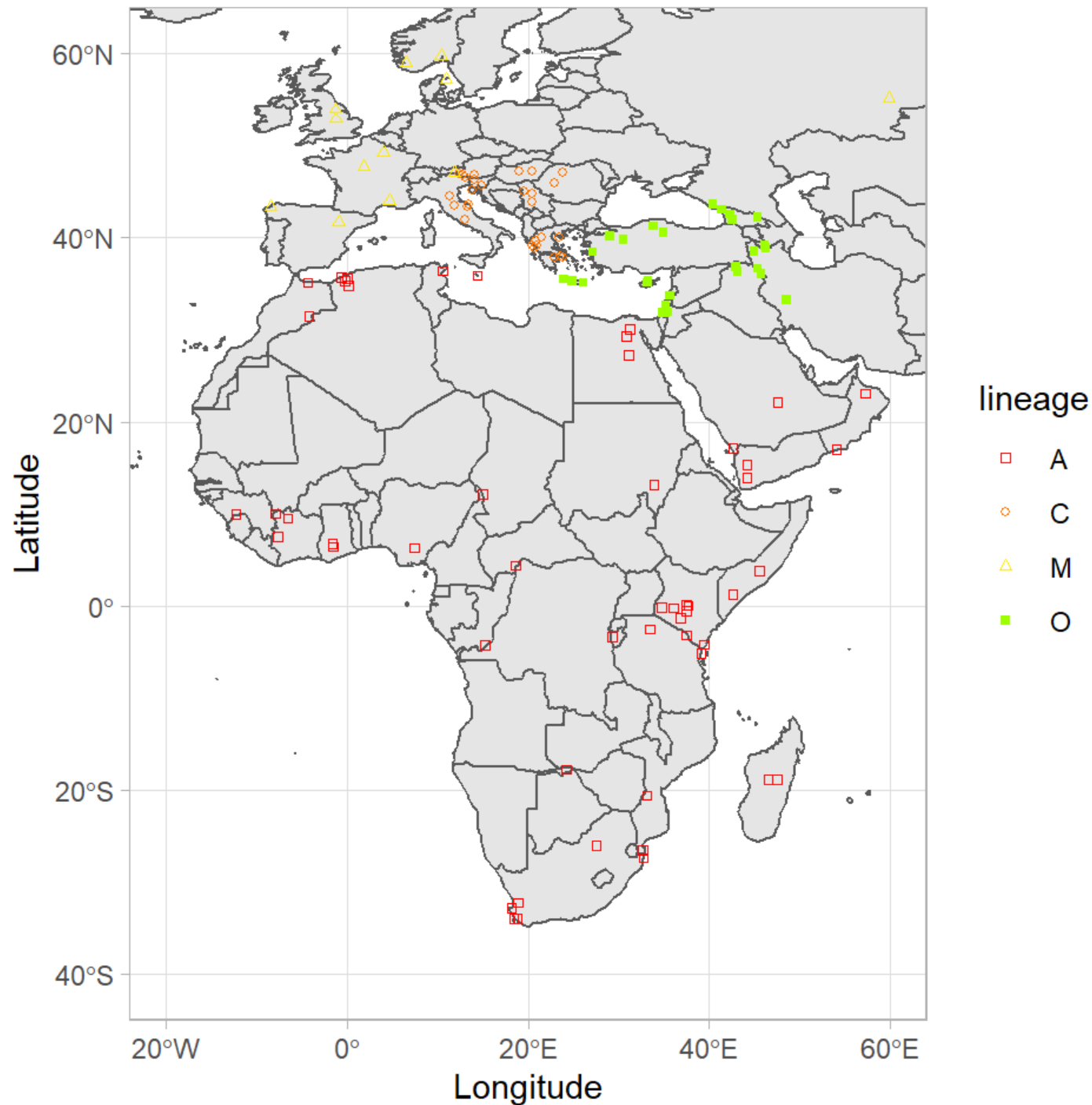


Material 17,457 wings; 1,557 colonies

Azerbaijan
Cyprus
Georgia
Iraq
Iran
Kazakhstan
Saudi Arabia
Tajikistan
Turkey

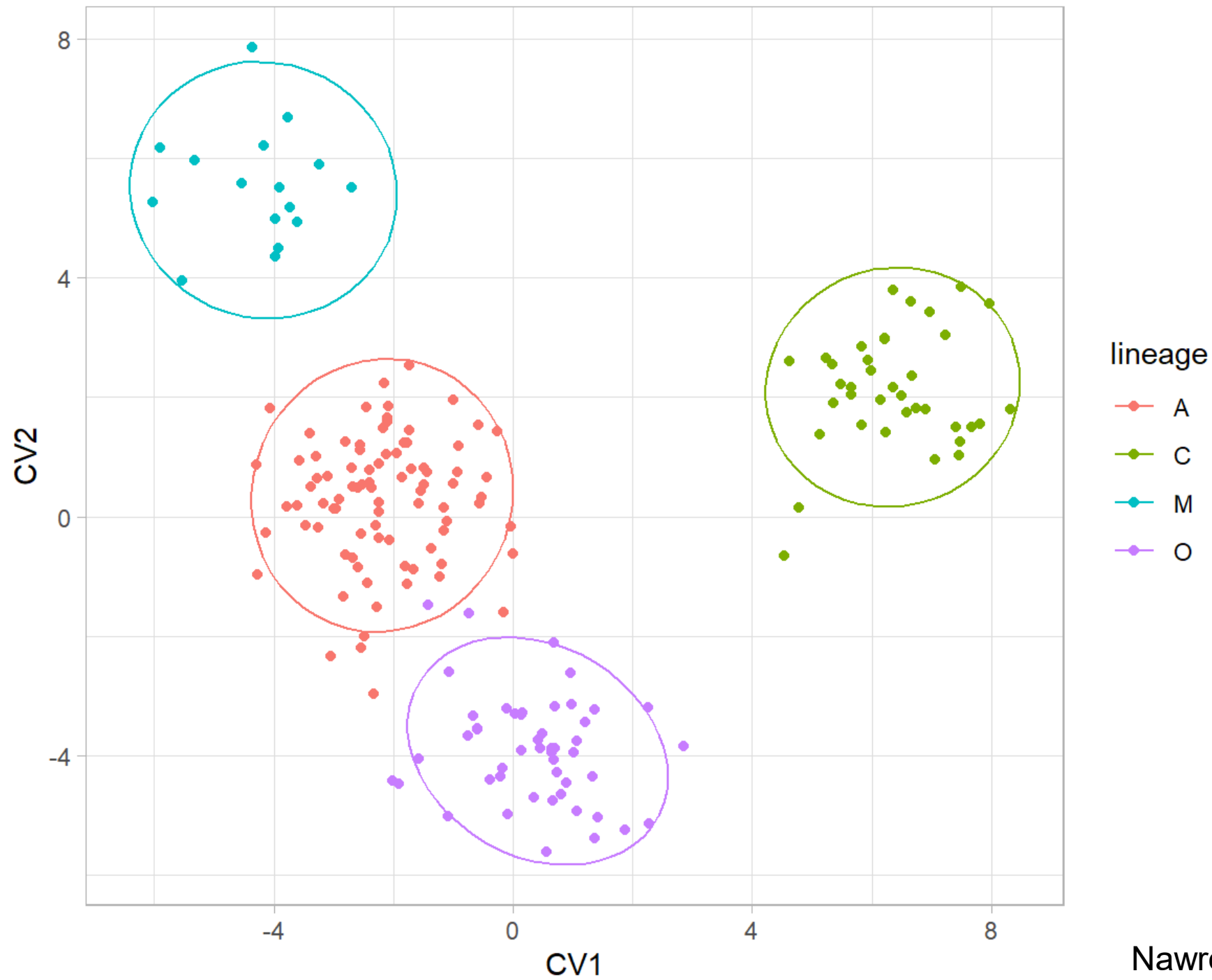


Reference samples from Oberurzel

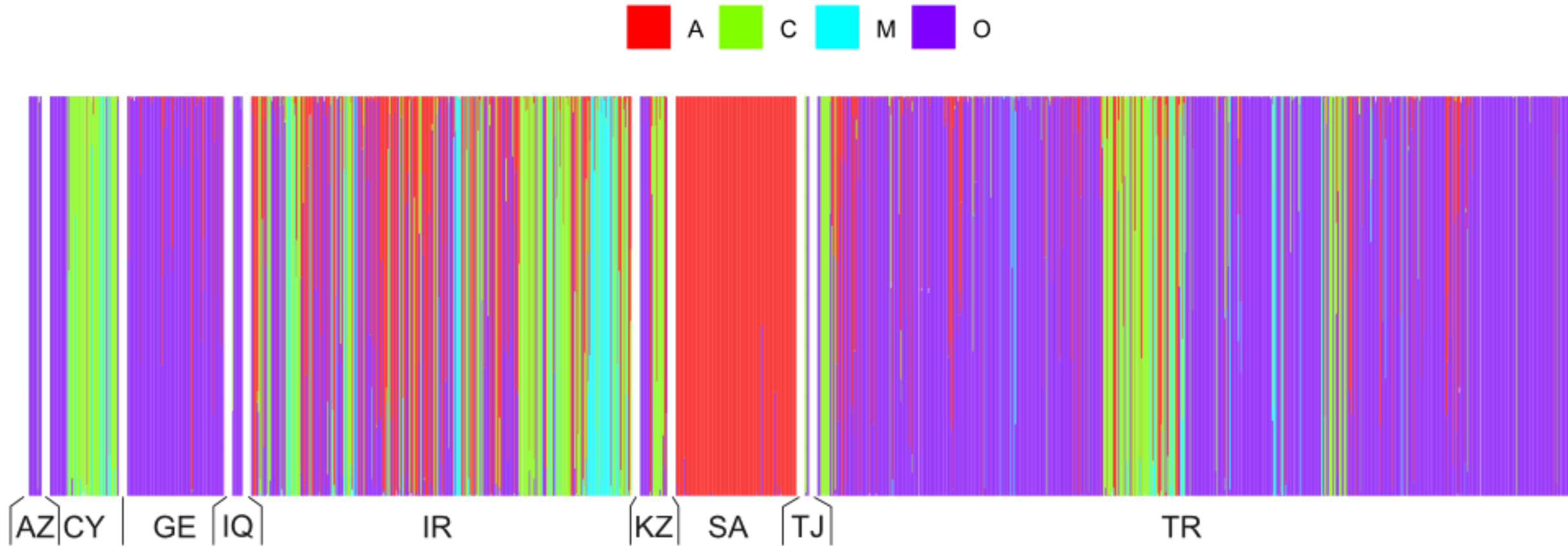


- 1849 workers
- 187 colonies
- 25 subspecies
- 4 lineages

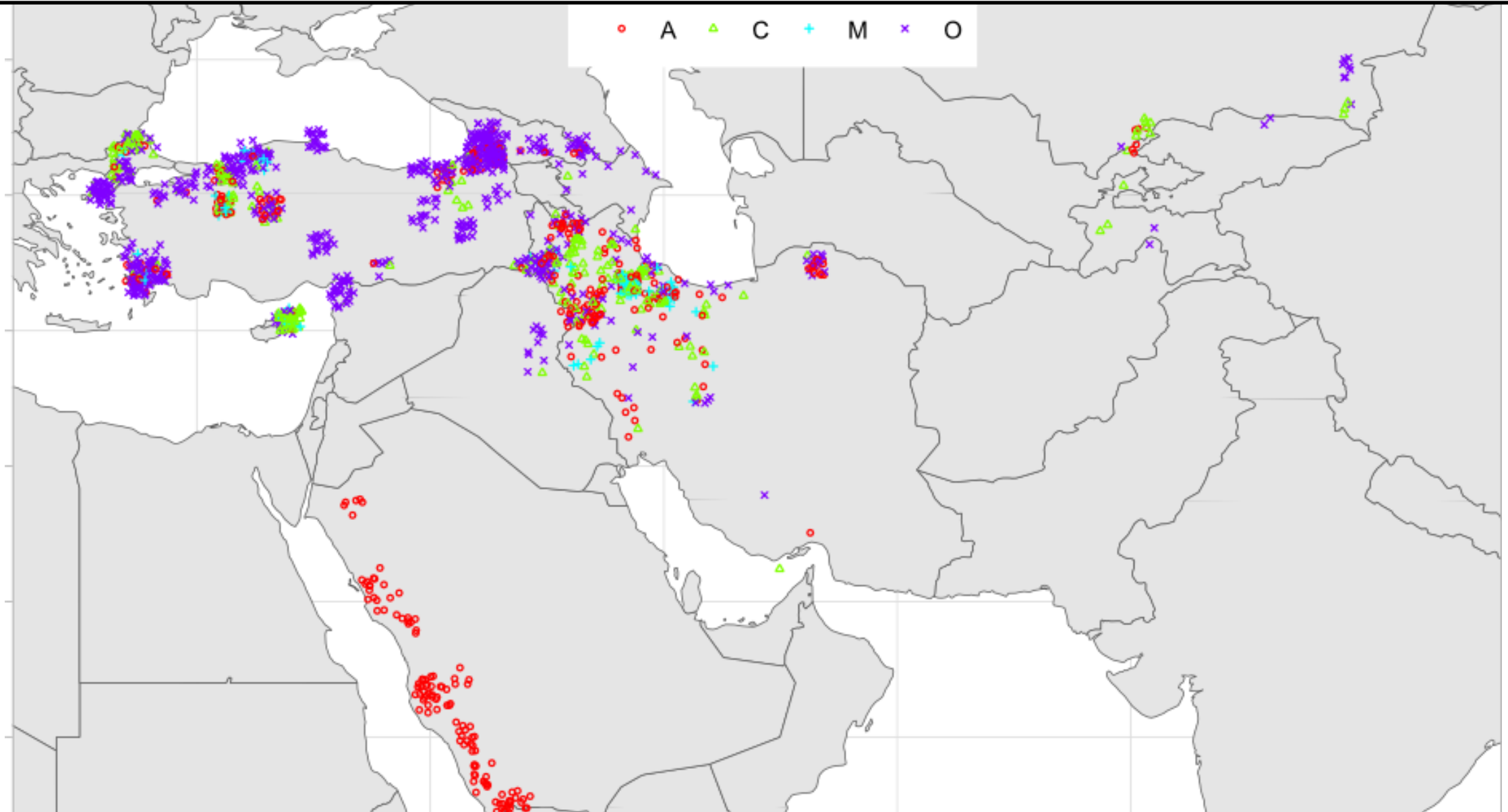
Reference samples from Oberurzel



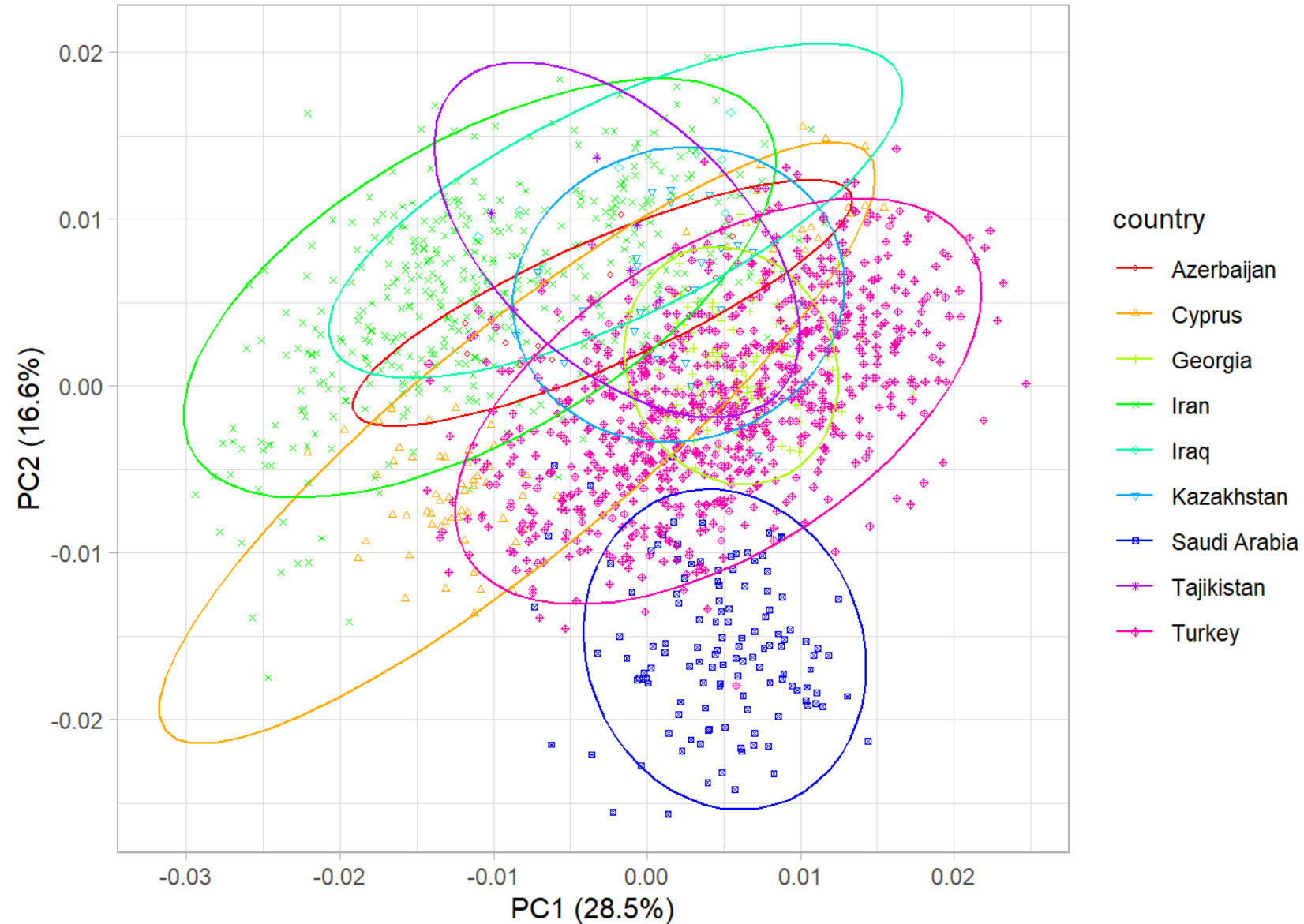
Classification of colonies as evolutionary lineages



Classification of colonies as evolutionary lineages

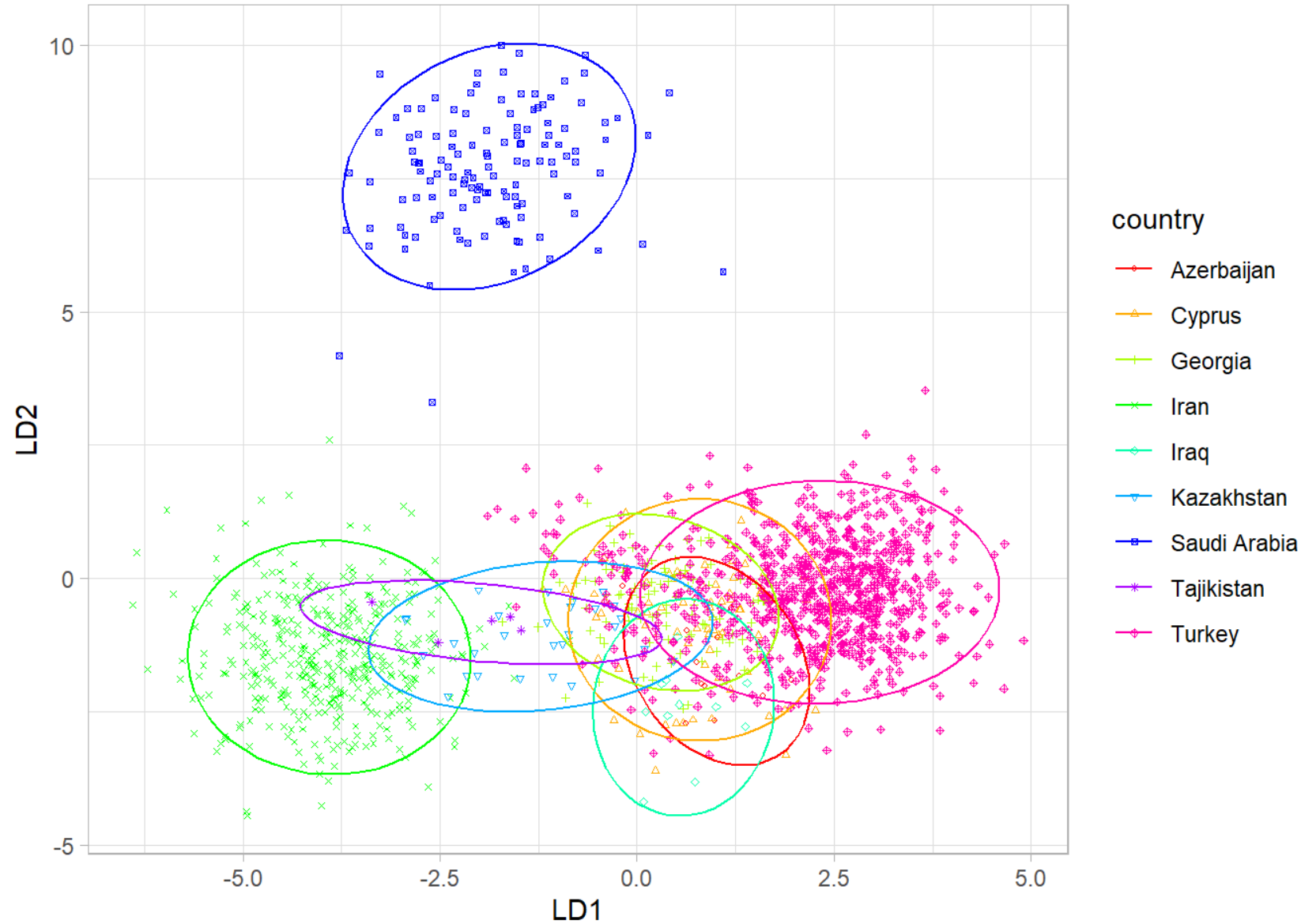


Principal Components Analysis



Linear Discriminant Analysis

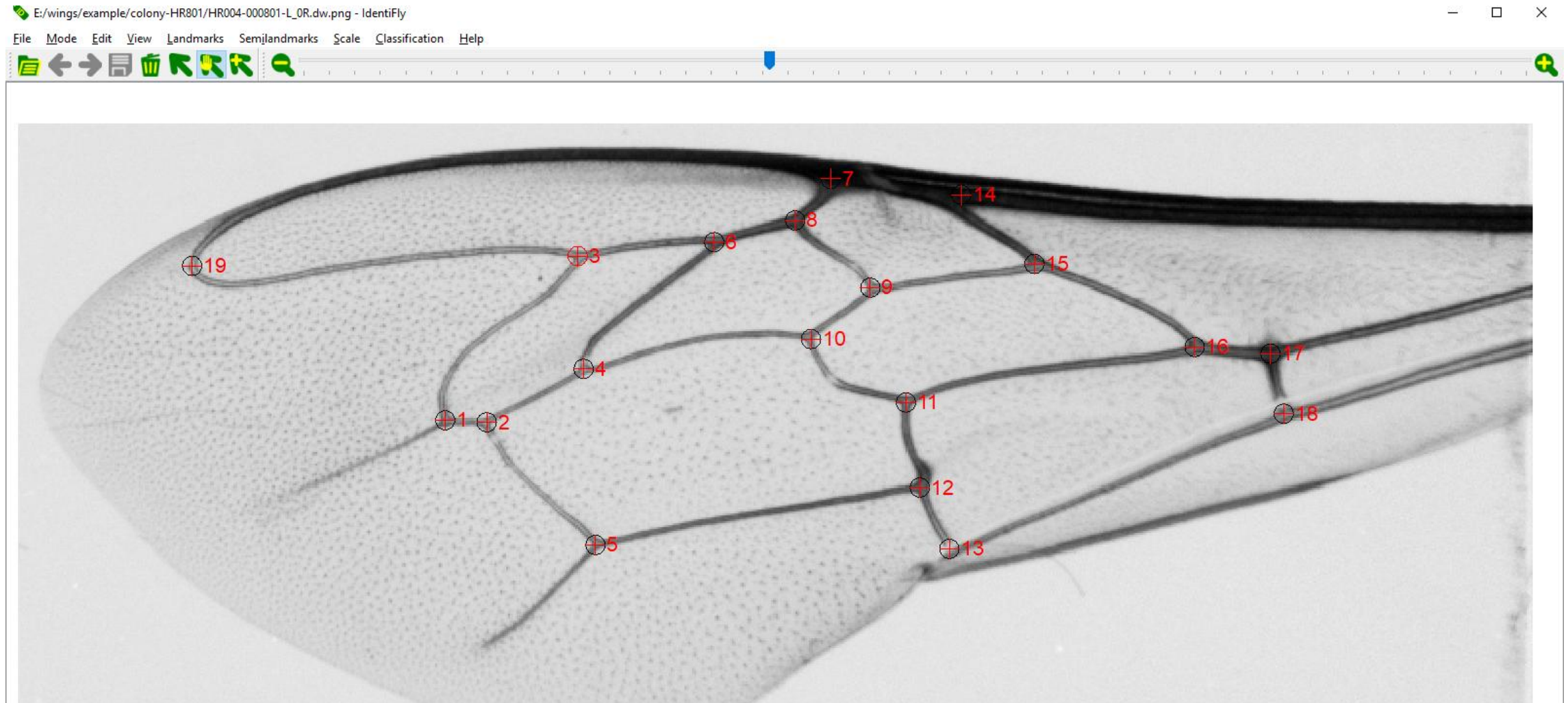
96.7% correctly classified colonies



Conclusions

- There are signs of introgression in the study area.
- Most colonies belong to native lineage.
- The most effective way to protect native bees is to ban imports.
- Wing measurements can be used to verify a colony's country of origin.

IdentiFly software



Freely available from: <http://drawwing.org/identifly>

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Temirbayeva, K., Torekhanov A., Nuralieva U., Sheralieva Z., Tofilski A. 2023. In Search of *Apis mellifera pomonella* in Kazakhstan. Life 13:1860.

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Thank you for your attention

