

Biodiversity of sea buckthorn (*Hippophae rhamnoides* L.) in the Karakorum Mountains of northern Pakistan

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Introduction

Sea buckthorn is a wind pollinated deciduous shrub species in Eurasia, including the Karakorum Mountains region of Pakistan (Gilgit-Baltistan). A striking morphological diversity of berries (Figure 1) in Pakistan with different size and colors - from red to yellow - raises the question: which varieties might be more suitable for different national and international markets and could be used for future domestication and breeding strategies. Unfortunately, the intensive use of this plant as firewood and unsustainable harvesting methods may lead to the loss of genetic diversity.

Study aims

Both morphological and genetic diversity of sea buckthorn were studied to characterize and evaluate the present variability, including the hypothetically ongoing process of domestication. The specific objectives were to:

- 1) compare the dendrometry, fruit traits and genetic diversity patterns among different populations,
- 2) analyze the influence of domestication processes on genetic and morphological traits by comparing wild and supposedly domesticated village stands, and
- 3) evaluate the genetic variation and differentiation in the study area.

Materials & Methods

- **Eight populations** in two regions, Gilgit (Shimshal, Passu, Gulmit) and Baltistan (Thesal, Chandopi, Chutran, Bisil and Arando; Figure 2), were selected.
- **Three hundred** sea buckthorn individuals were sampled and assigned each to **wild** or supposedly **domesticated** (within villages) **stands**.
- **Dendrometry, fruit, leaf and visuals traits** (color of dorsal and ventral leaf parts and fruits using Royal Horticultural Society (RHS) color charts).
- **DNA was extracted** from individual leaf samples and **genotyped for 12 EST-SSR markers**.
- Clustering was done to explore the **genetic differentiation**.

Results

- 22 berry color shades were observed (Figure 3)
- No significant differences in fruit traits between stands, but significant differences among populations were found (Figure 4)
- Three distinct genetic clusters were identified (Figure 5)

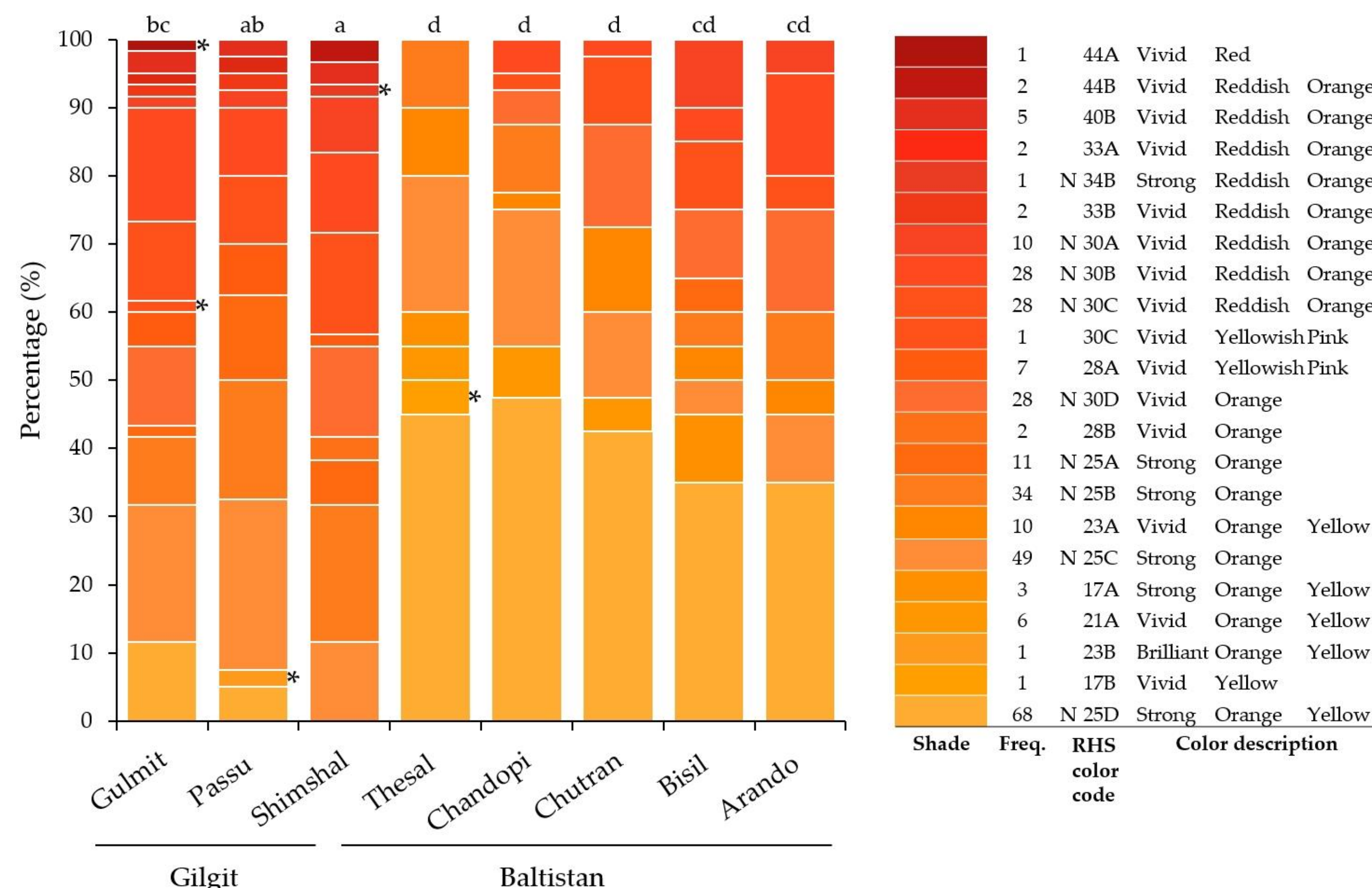


Figure 3. Fruit color shades (Royal Horticultural Society (RHS) colors) observed in the Gilgit and Baltistan regions, northern Pakistan.



Figure 1. Sample of fruits from different sea buckthorn individuals collected in the Gilgit and Baltistan regions, northern Pakistan.

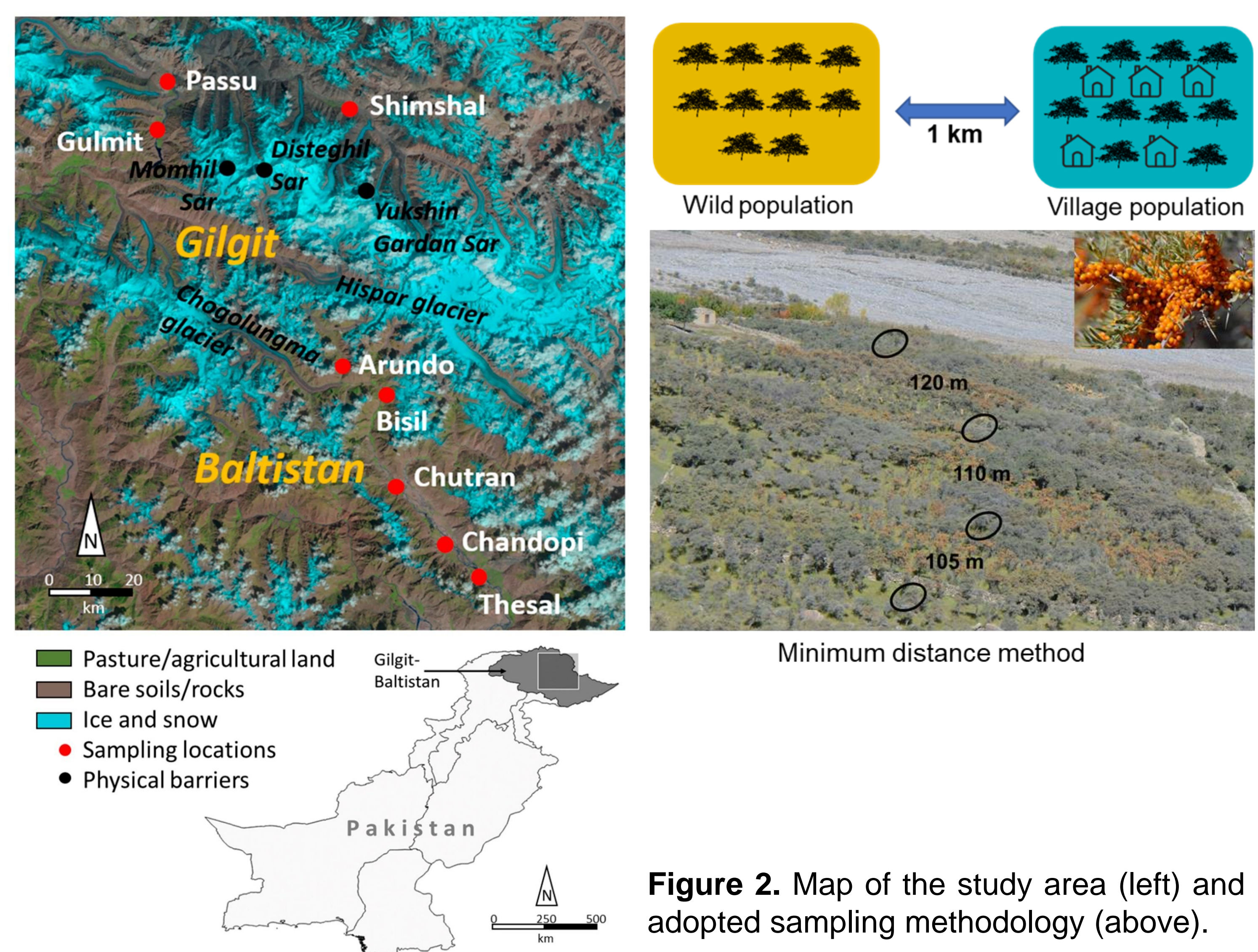


Figure 2. Map of the study area (left) and adopted sampling methodology (above).

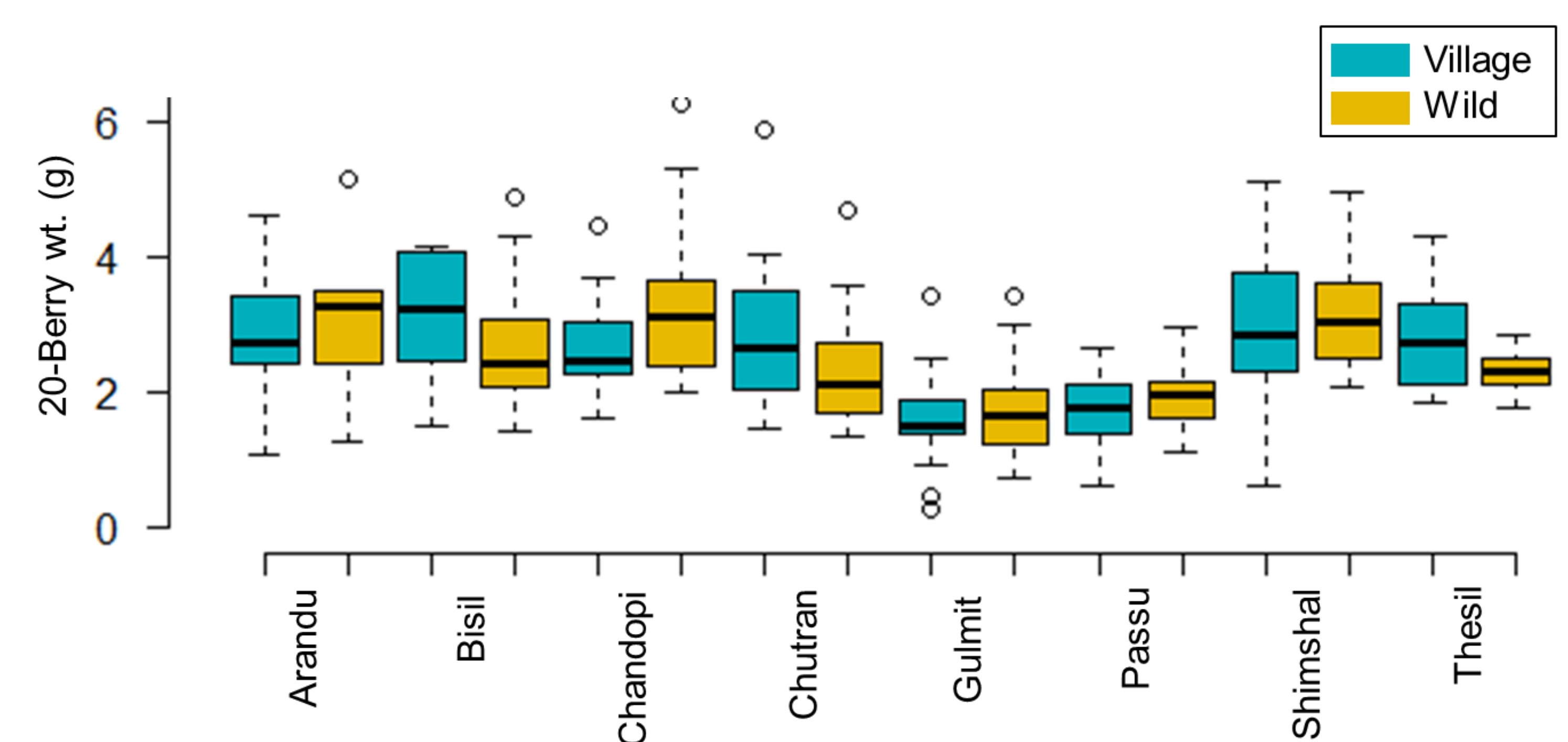


Figure 4. Mean weight of 20 berries of sea buckthorn sampled in the Gilgit and Baltistan regions, northern Pakistan.

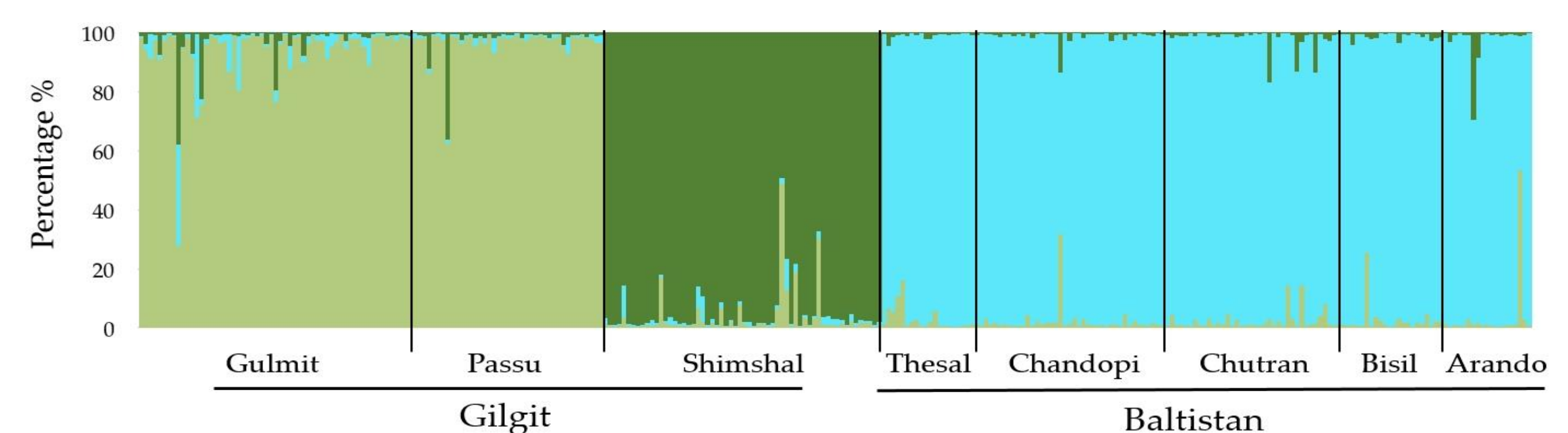


Figure 5. Bayesian inference of the most likely number of clusters (K = 3) of sea buckthorn sampled in the Gilgit and Baltistan regions, northern Pakistan.

Conclusions

- Physical barrier (mountains) can explain genetic clusters.
- No influence of human selection was found.
- Gulmit and Passu, which showed a very low berry weight and represented a different genetic cluster, may be less suitable for berry collection, while larger fruit sizes at Shimshal (distinct cluster) make its stands particularly suitable for collection.