S3. Significant changes in selection strength found with RELAX

K=selection strength, LR=likelihood ratio, <https://www.datamonkey.org/relax/>

**LR2**: selection relaxation was significant (K = 0.63, LR = 50.72, p = 0.000) as compared to *Alphapapillomavirus*

A screenshot of a graph

Description automatically generated with medium confidence

**Alpha12**: selection intensification was significant (K = 1.21, LR = 40.39, p = 0.000) as compared to *Alphapapillomavirus*

A screenshot of a graph

Description automatically generated with medium confidence

**Alpha12**: selection intensification was significant (K = 1.42, LR = 100.12, p = 0.000) as compared to other mucosal clade close relatives (HR+LR1)

A screenshot of a graph

Description automatically generated with medium confidence