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Abstract

Assessing Fluctuating Asymmetry of *Cucumis sativus* Leaves for Virtual Plant Models †

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Fluctuating asymmetry in plant leaves is a widely used measure in geometric morphometrics. For example, starting from a Procrustes superimposition of a prototype leaf, measurements can be fitted before performing statistical analyses of symmetry. The goal of this study was an adaptation of this concept to improve prototype leaf shapes for virtual plant models based on analysis of fluctuating asymmetry between measurements and model. Several hundred cucumber leaves were digitized in situ with a magnetic field digitizer, where each leaf is represented by 17 unique landmarks. Furthermore, destructive leaf area measurements were performed afterwards. Based on these data, leaves were reconstructed from area and orientation measurements using a simplified shape definition of a virtual plant model. To improve this prototype shape, we conducted point-wise comparisons of fluctuating asymmetry between measurements and model. Robust Bayesian comparison of groups was used to assess statistical differences between leaf halves. Results indicate almost no directional asymmetry in leaves comparing different distances from the prototype, while detecting systematic deviations shared by both halves. This information on leaf symmetry was successfully included in an improved leaf prototype. Further studies will focus on the influence of stress factors on cucumber leaf symmetry.