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Characterising Indigenous Chicken (Gallus gallus domesticus) Ecotypes of Tigray, Ethiopia: A Combined Approach Using Ecological Niche Modelling and Phenotypic Distribution Modelling

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Abstract : Livestock must adapt to changing environmental conditions, which can result in either phenotypic plasticity or irreversible phenotypic change. In this study, we combine Ecological Niche Modelling (ENM) and Phenotypic Distribution Modelling (PDM) to provide a comprehensive framework for understanding the ecological and phenotypic characteristics of indigenous chicken (Gallus gallus domesticus) ecotypes. This approach helped us to classify these ecotypes, differentiate their phenotypic traits, and identify associations between environmental variables and adaptive traits. We measured 297 adult indigenous chickens from various agro-ecologies, including 208 females and 89 males. A subset of the 22 measured traits was selected using stepwise selection, resulting in seven traits for each sex. Using ENM, we identified four agro-ecologies potentially harbouring distinct phenotypes of indigenous Tigray chickens. However, PDM classified these chickens into three phenotypical ecotypes. Chickens grouped in ecotype-1 and ecotype-3 exhibited superior adaptive traits compared to those in ecotype-2, with significant variance observed. This high variance suggests a broader range of trait expression within these ecotypes, indicating greater adaptation capacity and potentially more diverse genetic characteristics. Several environmental variables, such as soil clay content, forest cover, and mean temperature of the wettest quarter, were strongly associated with most phenotypic traits. This suggests that these environmental factors play a role in shaping the observed phenotypic variations. By integrating ENM and PDM, this study enhances our understanding of indigenous chickens' ecological and phenotypic diversity. It also provides valuable insights into their conservation and management in response to environmental changes.

Keywords : adaptive traits, agro-ecology, appendage, climate, environment, imagej, morphology, phenotypic variation
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