

Effects of climatic drivers on traits divergence of *Juglans regia* L. population in Northern Pakistan

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Juglans regia L., is a nutritious fruit producing tree commonly found in the temperate zone and the northern hemisphere. Habitats of this species vary from wasteland, ridges to farm boundaries and forests. As this species grows extensively in northern Pakistan, particularly in three districts namely Dir lower, Dir upper and Swat districts, hence the Walnut population of these three northern districts has been explored in 44 sites for detecting the range of morphological divergence in their leaves and nuts. Climatic data was collected by a device “Professional Wireless Weather Centre” as well as from “Federal Department of Metrology Government of Pakistan”. Walnut morphology was characterized through simple ruler and Vernier callipers, correlating climatic drivers with Walnut morphology. Our findings revealed that the shoot length (height) of Walnut in both districts of Dir vary from 33 to 67.2 feet, whereas the height of this species in district Swat varies from 35.37 to 61.3 feet. Similarly in both districts of Dir (lower & upper districts) the leaf length varies from 10.31 to 12.12cm and its width varies from 5.33 to 6.38cm, however, in district Swat the length of leaf varies from 10.12 to 12.23cm and its width varies from 5.24 to 6.47cm. Considering the nuts, in both the districts of Dir, the length of nuts, their width, thickness and weight varies from 31.13±0.21, 27.12±0.32, 25.0±0.24mm, 8.11±0.24gm to 43.23±0.11, 37.91±0.82, 36.92±0.84mm and 9.95±0.21gm respectively, whereas in district Swat these values for these parameters vary from 30.45±0.12, 26.22±0.22, 26.11±0.1mm, 8.18±0.9gm to 44.22±0.41, 36.24±0.14, 33.24±0.33mm and 9.91±0.87gm respectively. Plant height was maximum in low altitudinal areas of 778 meters above the sea level (e.g., in Rangila and Balo Rabat areas), while it was minimum at high altitude areas of 2804 meters (above the sea level e.g., in Malam Jaba and Laram areas). The height of plants, leaves length, nuts length and weight have significant variation to their environment ($P < 0.05$). The study reveals the effect of climatic and edaphic drivers (temperature, precipitation, soil temperature, altitude etc.) on the morphological variation of *Juglans regia* L., and to know their proper growth and development growing in the forest ecosystems of north western Pakistan in the Hindu Kush Himalayan junction.

Keywords: Leaf width; Nutritious; Climatic; Population; Conservation; Forest ecosystem