

Principal components analysis of morphological variation of the *Ptelea trifoliata* species complex.

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Ptelea trifoliata, commonly known as wafer ash, is a small tree in the Rutaceae family with alternate leaves, trifoliate leaflets, yellow to white flowers and winged fruit. The species is endemic across North America and has highly variable morphological characteristics. Bailey revised previous treatments of *Ptelea* based on morphological characters of specimens collected across the United States and Mexico (Bailey 1962). The current taxonomic treatment of *Ptelea trifoliata* includes five subspecies and ten varieties of great morphological variation. *Ptelea trifoliata* contains alkaloids which vary in type and distribution within subspecies and may be useful medicinally. Alkaloids extracted from the leaves of *Ptelea trifoliata* subspecies *pallida* variety *confinis* indicate that subspecies may vary chemically and may have different medicinal properties. To properly access *Ptelea trifoliata* for medicinal uses, it is beneficial to determine if the current taxa can be supported by a principal components analysis of morphological characters. A multivariate analysis of morphological variation was performed to determine differences between subspecies and varieties of *Ptelea trifoliata*. Characters of 361 herbarium specimens from the entire geographic range and taxa were measured to determine if the current subspecies and varieties should be recognized. Each specimen was assigned a subspecies and variety according to Bailey's revision. Potentially distinct local variants were coded by geography. Morphological data were analyzed with principal components analysis (PCA) to determine if these morphological characteristics differentiate taxa. Results were evaluated and compared with Bailey's revision. Quantitative characters were selected for analysis based on characters from Bailey's revision and observations from herbarium specimens. Measurements and character observations were taken from the largest leaf and largest mature fruit of each specimen. Qualitative characters of pubescence, leaf margin, fruit wing base, bark color and the presence of teratological fruit were also observed. Data were collected with a Nikon SMZ-1B stereoscope, a one-millimeter plastic ruler and a plastic protractor. Principal components analysis of the data collected was performed using PC-ORD 4.20 to evaluate the contributions of characters to the variation among taxonomic units. PCA showed subspecies *pallida* as somewhat distinct. Subspecies *pallida* is the only subspecies with orange or white instead of green or brown twigs. No other subspecies were distinct in PCA. Varieties of subspecies *pallida* were not distinct in the PCA. Variety *confinis* was never glabrous and absent from Arizona, while variety *lutescens* was found primarily in Arizona and always glabrous. Specimens of subspecies *coahuilensis* from Coahuila vary somewhat from specimens collected in other Mexican states. Type specimens of subspecies *coahuilensis* varieties *pumila* and *coahuilensis* do not coincide with any group or geographic location. PCA of subspecies *polyadenia* and *angustifolia* overlap extensively, and qualitative characters show similarities and overlapping range. PCA of subspecies *angustifolia* showed no distinction between varieties. PCA of subspecies *trifoliata* showed no distinction between varieties. Findings support the recognition of subspecies *pallida*. It appeared somewhat distinct from the other subspecies in the PCA and is qualitatively distinct in twig color. Subspecies *pallida* also differs from other subspecies by containing the alkaloid marmesinin. No findings support the separation of other subspecies or varieties of *Ptelea trifoliata*. Specimens of subspecies *coahuilensis* from Coahuila differ from other specimens of the subspecies and do not fit Bailey's description of either variety *coahuilensis* or variety *pumila*. No distinctions between varieties of subspecies *pallida* were found. Variety *lutescens* and variety *confinis* have some geographic differences. Subspecies *polyadenia* and *angustifolia* are indistinct from the findings. Varieties of subspecies *trifoliata* are distinguished only by pubescence and habitat. Quantitative and qualitative characters in addition to chemical data support the recognition of subspecies *pallida*. Other subspecies and varieties were not shown to be distinct.