



A Revision of *Perdita* (*Xerophasma*) Timberlake (Hymenoptera: Andrenidae)

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Abstract

Three new species of *Perdita* (*Xerophasma*) endemic to the Mojave Desert are described: *P. celadona* Griswold and Miller and *P. vespertina* Griswold and Miller from eastern Clark County, Nevada, and *P. rhondae* Griswold from Death Valley, California. The subgenus is redescribed to accommodate these new species. New distributional records for *P. bequaertiana* and *P. pallida* and a key to the species of the subgenus are provided. A well supported phylogeny suggests evolution toward nocturnal foraging expressed in increasing ocellar size and a trend toward totally pale integument. The apparent origin and center of diversity for the group is the eastern Mojave Desert.

Key words: Apoidea, Andrenidae, *Perdita*, *Camissonia*, *Oenothera*, Mojave Desert, nocturnal bee, key

Introduction

Perdita, despite its restriction to the Nearctic, is one of the most speciose genera of bees. There are 17 subgenera (Michener 2007), 629 described species and an additional 125 subspecies, some of which are expected to be elevated to species rank upon revision. Numerous species remain undescribed. Diversity in *Perdita* is concentrated in the deserts of North America. For example, the Mojave Desert is home to at least 193 taxa, 19 of them undescribed.

Collecting efforts by USDA-ARS Bee Biology and Systematics Laboratory personnel in the Virgin River drainage of Clark County, Nevada in 1973 yielded specimens of the rarely collected subgenus *Perdita* (*Xerophasma*) Cockerell. Originally described as a monotypic genus (Cockerell 1923), *Xerophasma* was redefined as a subgenus (Timberlake 1953) for two crepuscular *Perdita*, *P. bequaertiana* Cockerell and *P. pallida* Timberlake, distinctive in their large size and pale coloration, and subsequently recognized as a subgenus in the phylogenetic analysis of Danforth (1996). P. H. Timberlake recognized the Virgin River specimens as a new species, but his manuscript name was never published. Study of this material and subsequent collections revealed that not one but two new species are present in the Virgin River drainage of southern Nevada. A third undescribed species was recently discovered in Death Valley National Park, California. Here *Xerophasma* is expanded to include these three smaller, darker new species, new distributional records presented for described species, a key to species provided, and phylogenetic relationships explored.

Methods

A total of 416 specimens of *P.* (*Xerophasma*) including holotypes were studied; institutions are referenced by city and listed in the acknowledgements. Descriptions follow the terminology of Michener (2007). Metasomal terga and sterna are abbreviated T1, T2 ... and S1, S2 ... respectively. All locations were georeferenced using GoogleEarth. Maps were constructed in ArcGIS. For the phylogenetic analysis fifteen characters were used, ten binary and five multistate (see character descriptions below). All species of *P.* (*Xerophasma*) were coded,