Pollination Ecology
Final Report for Biennium 2003

POLLINATION ECOLOGY

FINAL REPORT
2003 BIENNIUM
CLARK COUNTY, NEVADA
(2004-2005)

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Introduction

The southwestern United States is one of the richest areas on earth for bees (Michener 1979). Many of its bees are endemics, species found nowhere else in the world. Although poorly studied relative to other parts of the Mojave, Clark County appears to be a hot spot of bee diversity and endemism; more than 30 of the nearly 600 bees known from Clark County are endemic to southern Nevada or its immediate vicinity.

There are mounting concerns of pollinator demise (Kevan & Viana 2004) with attendant loss of plant reproduction. Loss of pollinators would have a devastating impact on a variety of plants in Clark County from keystone plants such as mesquite to bee-pollinated rare plants. The fragmented habitats of the Mojave Desert in combination with the obligate relationship of some specialist bees on plants in these habitats are expected to make pollinator services particularly vulnerable. Methods that would allow rapid assessment of the state of pollination services are needed.

In the often unpredictable environment of the deserts, bees with specialized needs and patchy distributions may be particularly susceptible to extinction. Populations with small effective population size suffer from increased extinction risk due to loss of fitness resulting from the accumulation of deleterious alleles and inbreeding depression (Frankham 1995a; Frankham 1995b; Frankham 1998; Saccheri *et al.* 1998; Westemeier *et al.* 1998; Hedrick & Kalinowski 2000; Higgins & Lynch 2001; Frankham *et al.* 2002). Loss of genetic variation in small populations also hinders a population's ability to adapt to future changes in its environment (reviewed by Frankham *et al.* 2002). Since our ability to conserve pollinators requires that we correctly assess the health of their populations, appropriate monitoring methods are needed.

Bees, along with other Hymenoptera, are particularly vulnerable because of their sex-determination mechanism (Zayed *et al.* 2004). In the haplodiploid system of bees, sex is determined by genotype at a single gene (Beye *et al.* 2003): hemizygotes develop into haploid males from unfertilized eggs, heterozygotes and homozygotes develop into diploid females and males respectively, from fertilized eggs. Diploid males are either inviable, or effectively sterile, and their production is highly disadvantagous as it reduces population growth rates (Plowright & Pallett 1979; Cook & Crozier 1995), and effective population sizes (Zayed in press), and increases extinction risk (Zayed & Packer in prep). The number of alleles at the sex locus is in mutation-drift equilibrium controlled by the population's effective size: new sex alleles are created through mutation, but drift (random fluctuations in allele frequencies due to random sampling in finite populations) reduces their number (Yokoyama & Nei 1979). Since the effects of drift are magnified in small populations, they are expected to harbor less sex alleles than large populations. This in turn will increase the frequency of homozygotes at the sex locus, which will lead to increased diploid male production. High levels of diploid male production are thus an indicator of small / declining bee populations.

With so little known about the native bees of Clark County, there was need for studies to evaluate the status of rare bees, determine the pollinators of rare plants and keystone plants such as mesquite, and identify habitats with rich and/or unique bee faunas.

Previous Results

An initial assessment of the 21 bee species listed in the Multi-Species Habitat Conservation Plan (MSHCP) was conducted in 1998 (Griswold *et al.* 1999). Because native bees cannot be identified with surety in the field, it was necessary that specimens be collected for later identification in the laboratory. A total of 370 field days was logged by scientists and field technicians between March and October of 1998 with 589 sites sampled at least once and 719 unique site-dates. Sampling effort was concentrated in the late spring and early summer, the season when the majority of the target species were known to be active. More than 48,271 specimens were collected over the course of the field season. Only a few of these specimens were of the target species, but as already mentioned, bees can only be accurately identified in the laboratory. Retroactive data capture of all pre-1998 collecting from Clark County was combined with targeted sampling in 1998 to produce a comprehensive specimen level relational databank.

Some of the bees previously identified as species of concern proved to be more widespread than published literature would suggest, but remained endemic to particular habitats within Clark County. In one case, *Perdita fallugiae*, the bee was so abundant and widespread that, even though it is endemic to Clark County, it did not appear threatened and likely did not require conservation efforts. On the other hand, we were unable to locate three MSHCP bee species. They remain known from single sites. Results suggested most MSHCP evaluation species were restricted by floral specialization; a few by substrate requirements.Some additional bees, most of them new species, were discovered during this study which appeared to be rare and should be considered in management plans.

A byproduct of the 1998 study was a significant increase in our understanding of the bee fauna of Clark County. Bee diversity in this region proved remarkably high. A total of 593 species in six families and 67 genera were documented from the county. To give a context for this diversity, there are 365 species and 43 genera in all of New England (Griswold *et al.* 1998). As an indication of how little was known about Clark County bees, more than 220 species were added to the known fauna by this study. Many of these represented range extensions. A number of new species were discovered, largely in genera of small, pollen-specialists such as *Perdita* and *Hesperapis.* These results suggested that the diversity of bees in Clark County mightl prove to be one of the highest in the nation.

It would have been useful to determine the habitat requirements of the Clark County bee fauna. Stratified sampling by habitat was not possible because sampling was targeted rather than uniformly distributed across the county. However, the study did suggest some hot spots of diversity and endemism. Mesquite thickets and sand dunes represent such hot spots.

Because some of the target bees were thought to be associated with sandy substrates, significant collections on dunes and vegetated deep sands were made. Results of an analysis of samples from these localities showed patterns of high richness and endemism consistent with patterns found in the Great Basin (Rust *et al.*1983) and Colorado Plateau (Griswold *et al.* 1998). More than 250 species of bees were found to frequent sandy areas; 106 were recorded from the sands at St. Thomas Gap alone, the sandy site most intensively sampled. A number of these appear to

be obligate sand dwellers. Concern was raised that increased motorized recreational use of such areas would negatively impact bees, especially those restricted to sandy substrates.

Mesquite (*Prosopis*) habitat in Clark County was found to be very rich in native bees, a result consistent with studies of mesquite elsewhere (Simpson *et al*. 1977) showing that mesquite harbors large numbers of bees, many of them specialists. A wide array of bees were found to visit mesquite in Clark County (29 genera, 68 species). Seventeen species of bees are entirely dependent on mesquite for nesting success. Many other bees, while less restricted in pollen collection, nevertheless are largely dependent on mesquite. The quantities of pollen produced at a season when most, if not all, other flowering plants are past bloom support these generalists. Mesquite also provides nesting habitat for some bees that nest in beetle burrows in dead wood of the mesquite.

Objectives

Studies on bees are challenging, due to the ephemeral emergence and activity of many of these pollinators. Many bees, for instance, are solitary and nest in the ground. In some respects, they behave like annual plants, abundant in years of high precipitation, but occuring in low numbers or entirely absent in dry years. Thus, there is a need to identify a variety of bee studies and be flexible about which of them will be implemented. For example, pollinators of mesquite-acacia are present in most years (determined by the production of pods), while some species specific to the bearpoppy may only occur in years of high winter precipitation. Identifying a variety of potential studies can advance our knowledge of pollinators, without encumbering the research.

In consultation with the Rare Plant Working Group five such potential foci were identified for the 2003 Biennium. These included:

1) Assessments of the MSHCP listed bee species.

2) Use pollinators of mesquite to determine the minimum stand size of mesquite-acacia adequate to maintain this woodland system.

3) Surveys for pollinators of rare plant species.

4) Stratified inventories for bees, concentrating on potential "hot spots" of biodiversity and endemism in the Spring Mountains, McCullough Range, Highland Range, Cold Creek, Newberry Mountains, sand dune habitat (including white-margined Penstemon habitat), "mesic washes" such as Piute Wash, springs and associated riparian areas,and chaparral vegetation types.

5) Develop research techniques for locating nesting sites for ground-dwelling bees on gypsum.

Which foci would be implemented was left open since climatic conditions would dictate which were feasible. Many of the target bee species and the rare plants they depend on occur only sporadically. Thus the choice of studies would depend on precipitation patterns. Priority would be given to surveys of ephemeral bees and plants when optimal conditions presented themselves, since most of the MSHCP bee species are only active in a few years. If such conditions were not present, more predictable objectives would be chosen. At a minimum, a stratefied inventory could be conducted in the Spring Mountains, McCulloughs, and other mid-high elevation areas. Because mesquite bloom is not tied to annual precipitation, pollinator assessments of this key plant would be a consistent option.

In addition, a long-term research strategy for native pollinators was to be developed, which a) prioritized research, b) identified areas of high sensitivity, connectivity, and richness, and c) provided guidance and recommendations for future research.

Drought conditions in the spring of 2004 prevented work on most low elevation target bees so efforts were focused on mesquite pollinators and some higher elevation rare plants. Spring bloom

was much better in 2005, allowing us to concentrate on evaluations of target bees. We thus focused on three objectives:

Bee Species of Concern

We targeted work to enhance our understanding of the 21 evaluation and 7 watch bee species in the MSHCP (Table 1). Our goals were to provide information on the distribution, relative abundance, and habitat associations of these native bees thought to be sensitive or rare. We used results from the surveys conducted in 1998 to inform our current efforts. The goals depended on the state of knowledge for each species. For species known only from the type locality we conducted random samples in the vicinity of the site in an attempt to detect the species and determine its floral preferences. For species found in 1998 our focus was on delimiting distributions and confirming floral hosts.

Mesquite Pollinators

Mesquite is known to host numerous pollinators, some of which forage only on mesquite (specialists), some of which visit a variety of other flowering plants (generalists). We hoped to begin to address several questions: What is the effect of patch size on pollinators? Do small patches support specialist pollinators? What is the distribution of specialists?

Pollinators of Rare Plants

Many rare plants require pollinators for successful reproduction. These are most frequently bees. Our goal was to conduct preliminary survey work to determine the potential pollinators of these rare plants. First priority would be given to plants in genera known to attract bees.

Methods

All published records for each species were collected and entered in a database. These records consisted of localities, dates of collection, and in some cases floral visitations. Based on these data and our general knowledge of native bees it appeared that most targeted bees were active during only one, probably short, season and that most, if not all, were specialist pollinators restricted to only one or a few kinds of flowering plants. Because native bees cannot be identified with surety in the field, it was necessary that all collected specimens be taken to the laboratory for later identification. Uniform fine-scale sampling across an area as large as Clark County would not be possible within the constraints of funding and field personnel. Therefore, database records were used to prioritize sampling sites both spatially and temporally. Because most target species were poorly known considerable broadscale spatial and temporal sampling would be necessary.

GIS referenced samples were obtained both by net collecting and by passive sampling using pan traps. Net collections were made wherever target plants in bloom were located. Sites were sampled for limited periods of the day to maximize the number of sites sampled. Since most bees are active for an extended period of the day, limited sampling was deemed adequate. To determine the degree of specialization in floral visitation we attempted to sample across the range of flowering plants at each site and recorded floral visitation for each specimen collected on a flower. Pantraps were used to augment the number of sites sampled. They were also used at some net collected sites to increase the period of the day which could be sampled at these sites. Pantrap samples consisted of transects of 24 Solo plastic bowls (4 each of white, light blue, dark blue, and yellow bowls) placed 1-2 meters apart and filled with water and a biodegradable surfactant. Pantraps were out at least for the principal flight times of most bees (9 am to 4:30 pm) and when possible for a 24-hour period.

For all three components of this study, samples were GIS referenced using GPS units. Since bees are vagile, extreme accuracy was not required. Sampling sites typically covered 1-5 hectares around the references point. Samples were brought back to the laboratory at the end of the season to be processed. Before specimens could be identified each had to be mounted, labeled with locality, coordinates, date, collector, and floral association. Samples were batch entered into a relational database that also generated standard insect labels with unique matrix codes for each specimen. Specimens were then identified, species identities and gender entered in the database, and the resulting data analyzed.

Bee Species of Concern

Evaluation and watch species were divided into three groups: A) bees known only from the original collection; B) bees known from multiple locations but without clear indication of floral requirements; and C) bees with some distributional data and apparent floral preferences. Efforts for Group A focused on collections at and in the vicinity of the original collection at the season of the year when it was obtained. All flowering plants in the area were sampled for bees. For Group B we conducted similar sampling on all flowering plants to determine floral preferences and utilized what we could infer about habitat to locate similar potential habitat to help define species ranges. Sampling for Group C consisted of locating presumed host plants, then sampling

them periodically throughout bloom to determine distribution and seasonality. Co-blooming plants were concurrently sampled to confirm floral relationships.

Mesquite Pollinators

The protocol for sampling consisted of collecting by two collectors for five minutes in the morning (after 9:30) and five minutes in the afternoon (before 3:30) on each of six trees for a total of two hours of collecting. In order to get as complete a record of the mesquite fauna, additional non-timed collecting was conducted if bee species were encountered that were clearly different from those captured in the timed collections. Collections were made every two weeks for the duration of flowering to assess seasonal differences in bee faunas. An attempt was made to sample as many populations as possible (Figure 1).

Populations of mesquite were visited periodically throughout the summer and early fall (July through September) to detect a possible second bloom during the summer season and to complete our initial analysis of temporal and spatial pollinator patterns. To assess temporal patterns of bee activity and evaluate how well single AM and PM collections captured pollinator diversity, one population at Corn Creek Springs was sampled every hour from dawn to dusk.

Pollinators of Rare Plants

Sites where rare plants occurred were located with the assistance of agency botanists. Plants in bloom were observed for a minimum of one half hour for bee visitors. Vouchers of visitors were obtained for identification. Where possible we visited multiple plant populations to determine the degree of consistency in pollinators. Care was taken to avoid damage to the plants.

Results

The four field technicians and visiting researchers logged 346 person-days of sampling in 2004, 330 in 2005. Samples were made at 356 sites in 2004, 446 in 2005 throughout the county (Fig. 1). Many sites were visited multiple times. Collections resulted in 19,000+ specimens in 2004

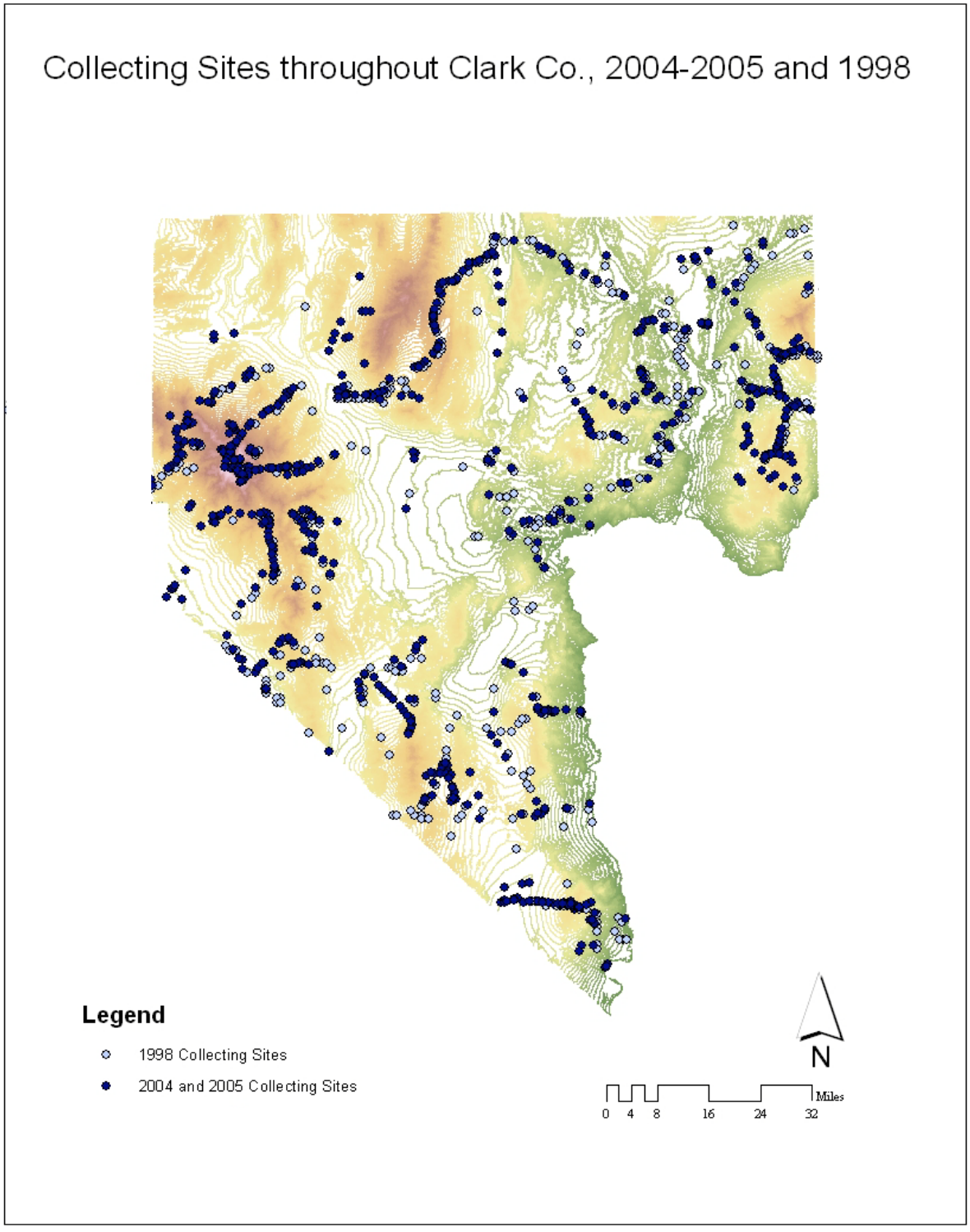

Figure 1.

and over 17,300 in 2005. These numbers may suggest significant impact on pollinator faunas but they represent an average of only 45 specimens/site/year spread across almost 600 species of bees and the entire flowering season.

Surveys during the spring of 2004 concentrated on mesquite sites. The choice to emphasize mesquite pollinators over efforts to complement inventories of MSHCP listed bees conducted in 1998 (Griswold *et al.* 1999) was dictated by the inhospitable climatic conditions in 2004. A number of the target bee species are active only in April, a month that in 2004 was frequently cool, windy and stormy, conditions under which bees typically do not fly. Further, the dry conditions in 2004 prevented or severely curtailed flowering of the plants that are the required hosts of several of the spring evaluation and watch species. General pollinator abundance during 2004 was significantly reduced over that encountered in 1998. Summer-fall inventories were predominantly in the higher elevations of the Spring Mountains with particular emphasis on rare plants. Periodic explorations of other parts of the county were made during this period to seek low-elevation fall flowering.

Conditions for the 2005 season differed greatly from those encountered in 2004. Winter-spring precipitation was abundant. Many species of flowering plants responded with exceptional bloom providing the opportunity to focus efforts during the spring season on MSHCP listed species. Some sampling was also conducted on MSHCP listed plants.

Mesquite Pollinators

Numerous species of bees depend on mesquite. Adults utilize nectar for fuel; females collect pollen and nectar to provision their nests. Twenty-five species of mesquite visitors (plus some subspecies) are thought to be specialists in the hot deserts of North America, restricting their pollen collections to *Prosopis* (Simpson *et al.* 1977). They are thus limited in distribution to mesquite woodland habitat.

Eight sites were sampled using the standardized protocol. Bloom of some populations, particularly at lower elevations and those located late in the season, was mostly past. Twelve such populations could not be sampled according to the protocol and were sampled in a random manner to obtain a preliminary indication of the fauna.

Seventeen of the 25 mesquite specialists were detected in Clark County in 2004. This is remarkable given the geographic extent of mesquite in North America. Specialists differed greatly in their abundance and in the number of locations where they were present (Table 2). The specialist fauna was dominated by three species of *Perdita* (*P. punctosignata sulphurea, P. luciae decora,* and *P. triangulifera*). They accounted for 64% of the total individuals. Four specialists were rare both in abundance and in the number of sites where they were encountered: *Perdita pallidipes, Perdita prosopidis, Perdita punctosignata flava, Perdita sonorensis,* and *Colletes aff. perileucus*. Others were more widely distributed, but never common. Populations of bees, like many other insects, frequently experience large annual fluctuations. Therefore, it is possible that specialist bees rarely encountered in 2004 would be more abundant in another season. However, specialists on a predictable floral resource such as mesquite are expected to be

less variable than those on sporadically blooming annuals. None of the rarely encountered bees in our 2004 study were abundant in opportunistic collections on mesquite made in 1998.

The single dawn to dusk survey of pollinators conducted near Corn Creek Springs suggests that mid-morning and early afternoon sampling will capture the suite of pollinators present at a location (Fig. 2). With the exception of one early flying generalist, *Anthophora californica*, bee species were present during normal sampling hours. Visitation rates of the common species appear relatively constant from 9:30 am until mid afternoon. There is significant decrease in activity during the hot, late afternoon hours of the day followed by an upsurged in activity early in the evening. These results suggest that the timing of sampling in the protocol developed in 2004 is adequate to capture the diversity of mesquite pollinators. Some additional early morning sampling at other sites should be conducted to determine if these results apply consistently across the county. Other late spring perennials are known to be visited by bees that fly only in the early morning (Hurd & Linsley 1975, Zavortink 1974) in hot deserts of the Southwest including Clark County.

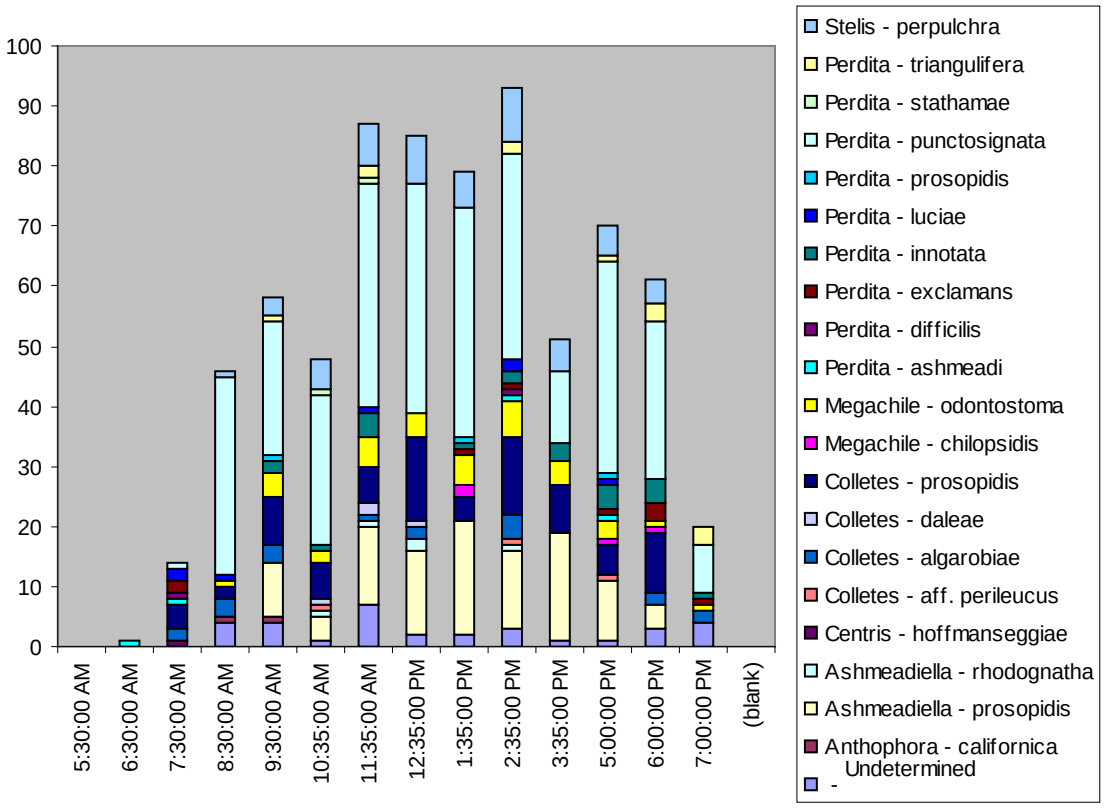

Figure 2. Diurnal Patterns of Pollinator Visitation to Mesquite.

Individual trees varied greatly in their attractiveness to pollinators. For example, one of the six trees in the all day study at Corn Creek Springs accounted for 86% of the recorded visitors from all six trees. Similar disparities occurred at other sites. A recent study of *Prosopis glandulosa* var. *torreyana* in the Chihuahuan Desert found that populations of this mesquite include

individuals that do not produce nectar. Nectarless individuals have significantly lower rates of visitation than do plants producing nectar (Golubov *et al.* 1999). Whether nectar production accounts for the differences in the visitation rates observed in Clark County would require additional study.

Mesquite bloom was almost entirely limited to the spring. The only site where mesquite experienced a full second bloom was on an isolated mesquite tree in the McCullough Mountains. A diverse array of generalist bees was present at this late summer bloom; no specialists were recorded. At other sites there was either no bloom or extremely limited bloom; pollinators were absent. Specialist activity thus appears restricted to the spring.

Pollinators of Rare Plants

In 2004 we visited blooming populations of nine covered species (*Angelica scabrida, Antennaria soliceps, Arctomecon merriamii, Astragalus aequalis, Astragalus geyeri var. triquetrus, Cirsium clokeyi, Penstemon albomarginatus, Penstemon leiophyllus var. keckii, Salvia dorrii var. clokeyi*), two evaluation species (*Penstemon fruticiformis amargosae, Enceliopsis argophylla*) and a USFS species of concern (*Phacelia hastata* var. *charlestonensis*). In 2005 we continued efforts to determine pollinators of sensitive plants in the county. We visited populations of seven plants in bloom (including three additional species): *Penstemon albomarginatus, Penstemon bicolor, Penstemon thompsoniae jaegeri, Astragalus aequalis, Astragalus oophorous, Phacelia hastata var. charlestonensis,* and *Salvia dorrii var. clokeyi*. Rare plants varied greatly in their attractiveness to potential pollinators from bees abundant to absent. Details follow.

Angelica scabrida
Visits to two populations on July 21 and 22 yielded 13 bee visitors to *Angelica scabrida*: a male *Anthidium maculosum,* four male *Anthophora urbana*, two female *Lasioglossum* sp., one *Xeromelecta californica*, and five honeybees (*Apis mellifera*). None of these bees are specialists with potential fidelity to this rare plant. Almost half are males which often are poor pollinators.

Antennaria soliceps
No pollinators were detected at this plant.

Arctomecon merriamii
Study of pollinators to *Arctomecon merriamii* on 19 April 2004 at a site in the Desert Range National Wildlife Refuge yielded four species of visitors: *P. mohavensis, Perdita fallugiae, Lasioglossum sisymbrii,* and *L.* undetermined species. Both sexes of *Perdita mohavensis* were abundant on the bear poppy and may be an effective pollinator. This species is a specialist on Papaveraceae. The other three species are generalists and were represented by single specimens.

Astragalus aequalis
Two females of *Anthidium atripes* were the only visitors observed in 2004. A female *Anthidium mormonum,* a female *Protosmia rubifloris*, and two males and one female of *Ashmeadiella timberlakei* were found on *Astragalus aequalis* in 2005. The *Anthidium* and *Ashmeadiella* are

likely to be effective pollinators. They show decided preference for milkvetches. Females of *Anthidium* are strong fliers and visit numerous flowers on a foraging trip.

Astragalus geyeri var. triquetrus
No bees were detected on this plant. Additional study should be conducted. Species of *Astragalus,* including a number of threatened and endangered species, are well visited by bees.

Astragalus oophorous
No bees were detected on this plant. As with *Astragalus geyeri var. triquetrus, a*dditional study should be conducted because of the probability of bee visitors.

Cirsium clokeyi
Pollinators were sampled at six sites during the summer of 2004. Bees were common. Species present, in descending order of abundance, were: *Anthophora urbana, Apis mellifera, Dianthidium heterulkei, Lasioglossum sp., L. egregium,* and *Xylocopa californica.*

Enceliopsis argophylla
Visitors to *Enceliopsis argophylla* were sampled four sites on both east and west sides of Lake Mead. Visitors included the specialist *Andrena balsamorhizae* (an evaluation species) and diverse bees that do not specialize on *Enceliopsis argophylla*: *Xeralictus bicuspiadariae, Perdita meconis, P. mohavensis, Lasioglossum sisymbrii,* and an undetermined species of *Lasioglossum.*

Penstemon albomarginatus
Visitors to *Penstemon albomarginatus* are infrequent. We visited plant populations in 1998, 2004, and 2005. Conditions were sometimes suboptimal for bees: cool, cloudy, and/or windy. We detected few visitors. They included *Anthidium paroselae, Ashmeadiealla gillettei, A. holtii, A. xenomastax,* and *Lasioglossum sisymbrii*. Species of *Penstemon* are ordinarily very attractive to bees and are well visited. Typical specialists of *Penstemon* have not been found on *P. albomarginatus*. This is likely in part because of the atypically small diameter of the flowers. Focused sampling for standardized times on a three or four day schedule would be necessary to determine the visitation rate to this rare *Penstemon.*

Penstemon bicolor
Sampling for visitors to *Penstemon bicolor* was limited to single visits to two locations. Visitors included *Agapostemon, Anthophora centriformis, A. coptognatha, A. dammersi,* and *Atoposmia aff. triodonta,* a *Penstemon* specialist and probable new species.

Penstemon fruticiformis amargosae
A visit to this rare *Penstemon* in the spring of 2004 yielded four species of bees: *Anthophora urbana, Apis mellifera, Halictus tripartitus,* and *Lasioglossum* sp. No specialist bees were detected.

Penstemon leiophyllus var. keckii
We visited eight populations of *Penstemon leiophyllus var. keckii* between late June and mid August of 2004. *Anthophora urbana* was the most frequent visitor overall and the most widely

distributed. It was the sole visitor at six of the eight populations at the time of sampling. *Lasioglossum* sp. was present at the two other sites; *Osmia trevoris* was present at one of these.

Penstemon thompsoniae jaegeri
We visited a single site on 2 June 2005. Bees were abundant and diverse. Seventeen species were visitors: *Agapostemon angelicus, Anthidium atripes, A. maculosum, A. mormonum, Anthophora coptognatha, A. lesquerellae, A. urbana, Ashmeadiella cactorum, A. meliloti, A. timberlakei, Atoposmia rupestris, Dioxys pacificus, Halictus tripartitus, Lasioglossum sisymbrii, L.* sp., *Protosmia rubifloris,* and *Sphecodes* sp.

Phacelia hastata* var. *charlestonensis
Four populations were visited once each between 21 June and 12 July 2005. Sites differed in abundance and richness in bees collected. Eight species were found including six that are frequent visitors to *Phacelia* (*Anthidium mormonum, Ashmeadiella australis, A. cactorum, A. meliloti, A. timberlakei*, *Atoposmia copelandica*) and two generalists (*Halictus tripartitus* and *Lasioglossum* sp.).

Salvia dorrii var. clokeyi
In 2004 we sampled at four sites; two of them were visited twice. In 2005 we revisited one site and sampled an additional four populations. Visitors were common. They included: *Agapostemon angelicus, A. texanus, Anthidium formosum, A. maculosum, A. mormonum, Anthophora urbana, Ashmeadiella difugita, Dianthidium parvum, D. ulkei, Lasioglossum sp.,* and *Xeromelecta californica*. *Anthophora urbana* accounted for 55% of the visitors.

Evaluation and Watch Species

We were able to locate populations of 17 of the 21 evaluation species during this biennium. In addition, two watch species were located, *Perdita eucnides eucnides* and *Lithurgus listrotus.* This is the first record of the latter for Clark County. Two evaluation species, *Perdita flaviceps* and *Perdita nevadiana*, remain elusive; they have not been detected since they were originally described, each from a single individual. Most evaluation and watch bees appear rare. *Perdita fallugiae* is the exception. It is much more abundant and widespread than the published literature suggested. Consideration could be given to removing it from the MSHCP list. *Diadasia proridens* should be removed from the MSHCP evaluation list. It was a manuscript name given to it by the reviser of the genus. Subsequent study determined that it was not a distinct species and the name was never published.

We now have convincing data for floral preferences on 18 of the evaluation and watch species. Of these, 14 are floral specialists at least at the generic level. Specialization, as defined here, is for pollen collection for larval provisions. Visitation for nectar is often less specialized and is obligately so where host plants do not produce nectar.

Floral hosts are obviously not the only restriction for evaluation and watch species. All have narrower distributions than their hosts. Other factors that constrain bee distributions are more difficult to assess. Substrate is one likely factor since appropriate nesting substrate is essential for reproductive success. Little is known about the vast majority of ground nesting bees but

some are known to require specific soil types (Cane 1992). Substrate restrictions appear to be the case for three evaluation species: *Andrena balsamorhizae* on gypsum soils and *Perdita crotonis caerulea* and *Perdita euphorbiana* on sandy substrates.

Individual accounts are presented in Appendix A. Localities and their geocoordinates are listed in Appendix B.

Additional Observations

Clark County is a **hot spot of bee diversity.** Many of the bees collected in this study proved not to belong to the MSHCP listed species, nor were they part of the studies on mesquite and rare plants. These were identified at USDA-ARS expense. Together they document the rich diversity claimed for bee faunas of the southwestern deserts (Michener 1979). Almost 600 species of bees are now known from Clark County, Nevada (Appendix C), nearly twice as many as in all of New England. And they provide a picture of the ever changing mosaic of distribution in time and space that makes the desert a fascinating, albeit sometimes frustrating, place to study bees and pollination. With time they will build an understanding of the complex web of relationships of desert plants with specialist and generalist bees that will hopefully provide the knowledge to protect vital pollination services.

Bumble bees (*Bombus*) are uncommon to absent in desert areas. The Spring Mountains represent a sky island of more mesic habitat that should support bumble bees. We documented seven species in this mountain range (*Bombus crotchii, Bombus edwardsii,* B*ombus fervidus, Bombus huntii, Bombus morrisoni, Bombus sonorus,* and *Bombus vosnesenskii*). This diversity is remarkable and unexpected, based on known distributions of bumblebees. These are the first Nevada records for *Bombus crotchii* and *Bombus sonorous*. *Bombus fervidus, Bombus huntii,* and *Bombus vosnesenskii* were not known to occur in southern Nevada.

Dianthidium marshi was found in southern Clark County. This is the first record in the state of a rare species of the Mojave and western Sonoran Deserts. The single individual represents only the eighth specimen known (Grigarick & Stange 1968, Griswold 1979). The cause of the rarity is unclear; most other members of the genus are common. Nothing is known of the floral preferences of *D. marshi*. Members of this genus utilize resin to construct their nests.

The first record from Nevada of ***Trachusa bequaerti*** was found in southern Clark County in the spring of 2004. This resin bee, previously known only from scattered locations in the Sonoran Desert of California, occurs in association with smoke tree (Grigarick & Stange 1968).

Future Research

Results from the current study suggest several areas of future research that would inform the MSHCP process. They are outlined below.

IntensiveStudies of Specific MSHCP Listed Bee Species.

Data on a number of target species is adequate to provide the basis for intensive single species studies to develop predictive habitat models. Elements of these studies would include refining floral host requirements, determining nesting substrate, and identifying limiting climatic factors. In many cases this would require mapping of host plant distribution. Existing GIS coverages of soils, topography, habitat, etc. could be used to analyze determinants of occurrence. Such studies would require dedicated teams of researchers for the duration of the target bee's season of activity.

Pollination Biology of Mistletoe.

While mistletoe is toxic to people, the berries and leaves of mistletoe provide a high-protein resource for many mammals and avian species, especially in autumn and winter when other foods are scarce. The phainopepla (*Phainopepla nitens*) relies on *Phoradendron* berries as its main food source (Walsberg 1975), and several other species are partially dependent on the fruits.

True mistletoes are dioecious, and female plants have flowers and produce one seeded berries while male plants have small inconspicuous flowers that produce pollen. Insects (chiefly Diptera and Hymenoptera) are thought to be the main pollen vectors (Whittaker 1984). However, the specific role of insects, particularly bees, in pollination is yet to be determined. Anecdotal evidence suggests bees at least visit the plant, but the degree to which they act as pollen vectors is unclear. Further, the need for pollinators is not clear. The breeding system of *Phoradendron californicum* is unknown. Considering the significant impact that the fruits have on bird diet, understanding its pollinators is key.

A study of the pollination and reproductive biology would provide basic biological data that could be used to ensure the integrity of this important wildlife resource. Standard techniques for determining the breeding system of *Phoradendron californicum* that compared matched autogomous, geitonogomous, xenogomous treatments with unmanipulated controls should be employed. Pollinator visitation rates should be compared with fruit production to determine the contribution of pollinators to reproductive success.

Pollination and Reproductive Biology of Rare Plants

In our preliminary work on rare plants no attempt was made to determine the reproductive biology of MSHCP species. Systematic studies to determine the breeding systems and pollinator biology of these species would be beneficial. Studies of over 30 threatened & endangered rare plants in the western United States by researchers at the USDA-ARS Bee Biology & Systematics Lab indicate that most species require bees as vectors of pollen (V. J. Tepedino, pers. comm.).

Breeding experiments that compare matched autogomous, geitonogomous, xenogomous treatments with unmanipulated controls should be employed. Measurement of reproductive success across populations in comparison to potential reproductive output provides a measure of pollinator deficit. Pollinator visitation rates should be compared with seed production to determine the contribution of pollinators to reproductive success.

Studies of Unique Bee Habitats

Sand dunes and **vegetated sands** are home to an extraordinary diversity of bees (Rust *et al.* 1983, Griswold *et al.* 1998, Andrus & Griswold, unpub.). Studies of sand dunes elsewhere have demonstrated the richness of bee faunas associated with this loose substrate. A significant component of this fauna is dune restricted. For example creosote bush (*Larrea*) specialists *Habropoda pallida, Colletes stepheni*, and *Calliopsis larreae*, all of which have overall distributions encompassing much of the Sonoran and Mojave Deserts, are nevertheless very patchily distributed due to their restriction to dunes (Bohart *et al.* 1972, Hurd & Powell 1958, Rust 1987). Psammophytic bees should not be surprising since plants which are obligate psammophytes are known from the region (Pavlik 1985). Some of these sand dwelling plants are limited to only a few dunes or even a single dune (Pavlik 1989). Whether bees are similarly restricted to single dunes is unknown.

Dune faunas are vulnerable to the impacts of recreational use by vehicles. Vehicular activity destroys the flowering plants on which bees depend, destroy the nests of bees which nest shallowly in the soil, and disrupts nesting activity during the short period when bees are producing the next generation. Not all dunes have equally diverse faunas or psammophytic elements. A study which systematically sampled dunes could identify those most in need of conservation.

Springs and other riparian habitats may be areas of bee richness and support populations of rare bees. In a four year study of Grand Staircase-Escalante National Monument plots that had consistent moisture had larger bee populations with greater richness (O. Messinger unpub.). Plots with perennial water were richer than seasonally moist plots. If this is true for Clark County, these more mesic environments may be reservoirs for bee populations. They may also be home to habitat specific bee species. Springs have not been a focus of our collecting efforts. Systematic collecting of these unique environments across the flowering season would provide knowledge of plant-pollinator relationships of this rare habitat.

Monitoring the Status of Rare Bee Populations.

Standard censusing methods may substantially overestimate the size of bee populations (Zayed *et al.* 2004) especially for specialist bees (Packer *et al.* 2004) where it can be an order of magnitude less than related generalists. Assessment of diploid male frequencies is an effective way to detect pollinator declines (Zayed *et al.* 2004). This rapid detection method has several advantages over census-based methods: 1) diploid male frequencies are directly related to effective population size. 2) The data used for monitoring is not sensitive to bias in field collecting, and can be easily standardized. 3) In species with viable diploid males, it is possible

to establish baseline data on diploid male production from museum collections (with sufficient sample sizes).

In rare specialist bee species with disjunct populations this technique would provide a valuable conservation tool. It would allow managers to determine which populations were the most viable. It would provide a tool for detecting pollinator declines.

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Table 1

Status of MSHCP Listed Native Bees

Common Name	Scientific Name	Status*	Limited by: Floral Host*	Limited by: Substrate*
Dalea Blister Bee	*Ancylandrena koebelei*	Y	X	
Mojave Gypsum Bee	*Andrena balsamorhizae*	Y	X	X
Red-legged Lava Bee	*Ashmeadiella picticrus*	?	?	
Red-legged Beardtongue Bee	*Atoposmia rufifemur*	Y	?	
Virgin River Globemallow Bee	*Diadasia proridens*	N		
Flat-faced Cactus Bee	*Lithurgus listrotus*	Y	X	
Red-tailed Blazing Star Bee	*Megandrena mentzeliae*	Y	X	?
Beck's Perdita	*Perdita becki*	?	?	
Two-tone Perdita	*Perdita bipicta*	Y	X	
Mojave Twilight Bee	*Perdita celadona*	Y	X	
Big-headed Perdita	*Perdita cephalotes*	Y	X	
Las Vegas Perdita	*Perdita cracens*	?	?	
Virgin River Perdita	*Perdita crotonis caerulea*	Y	X	
Rock Nettle Perdita	*Perdita eucnides eucnides*	?	-	
Spurge-loving Perdita	*Perdita euphorbiana*	Y	X	X
Tiquilia Perdita	*Perdita exusta*	Y	X	X
Apache Plume Perdita	*Perdita fallugiae*	N	-	
Yellow-headed Perdita	*Perdita flaviceps*	?	?	
Moapa Perdita	*Perdita fulvescens*	Y	?	
Unadorned Perdita	*Perdita inornata*	Y	-	
Mojave Poppy Bee	*Perdita meconis*	Y	X	
Valley of Fire Perdita	*Perdita nevadiana*	?	?	
Virgin River Twilight Bee	*Perdita vespertina*	Y	X	
Mojave Mountain Perdita	*Perdita vicina*	Y	X	
Banded Perdita	*Perdita vittata conformis*	?	?	
Desert-loving Perdita	*Perdita xerophila discrepans*	Y	X	
Koso Phacelia Bee	*Protodufourea koso*	?	X	
Michener's Phacelia Bee	*Xeroheriades micheneri*	?	X	

*Y = Concern; N = Not of Concern; ? = Uncertain; X = Known or Presumed Limitation

Table 2.
Bee Species found on Mesquite in Clark County, Nevada.
Bees in bold are those that specialize on mesquite.

Family	Species	Percent Total Individuals
Andrenidae		
	Perdita ashmeadi simulans	**3.20%**
	Perdita difficilis	**0.59%**
	Perdita exclamans	**7.03%**
	Perdita innotata	**3.32%**
	Perdita luciae decora	**14.37%**
	Perdita pallidipes	**0.20%**
	Perdita polytropica	3.40%
	Perdita prosopidis	**0.24%**
	Perdita punctosignata	**28.11%**
	Perdita punctulata	0.08%
	Perdita sonorensis	**0.79%**
	Perdita stathamae	**0.91%**
	Perdita triangulifera	**10.23%**
Apidae		
	Anthophora californica	0.32%
	Anthophora urbana	0.04%
	Apis mellifera	3.20%
	Centris cockerelli	0.55%
	Centris hoffmanseggiae	0.12%
	Centris rhodopus	0.87%
	Ericrocis lata	0.08%
	Habropoda pallida	0.08%
	Xeromelecta californica	0.04%
	Xylocopa californica	0.04%
Colletidae		
	Colletes aff. algarobiae	0.16%
	Colletes aff. perileucus	**0.16%**
	Colletes algarobiae	**1.78%**
	Colletes daleae	0.20%
	Colletes prosopidis	**3.91%**
	Colletes salicicola	0.16%
Halictidae		
	Lasioglossum argemonis	0.04%
	Lasioglossum pulveris	0.04%
	Lasioglossum sp.	2.65%
	Lasioglossum sp. M2	0.20%
Megachildae		
	Anthidiellum ehrhorni	0.16%
	Ashmeadiella aridula	0.08%
	Ashmeadiella bigeloviae	0.16%
	Ashmeadiella breviceps	0.08%
	Ashmeadiella bucconis	0.04%
	Ashmeadiella foveata	0.04%
	Ashmeadiella meliloti	0.08%
	Ashmeadiella prosopidis	**5.05%**

Family	Species	Percent Total Individuals
	Hoplitis biscutellae	0.16%
	Megachile chilopsidis	0.28%
	Megachile discorhina	0.04%
	Megachile lobatifrons	0.20%
	Megachile newberryae	**0.51%**
	Megachile odontostoma	**2.29%**
	Megachile policaris	0.08%
	Stelis perpulchra	3.20%

Appendix A.

CLARK COUNTY BEE SPECIES ACCOUNTS

(In alphabetical order by scientific name)

Ancylandrena koebelei
Dalea Blister Bee

***Ancylandrena koebelei* male**

Distribution: Endemic to the eastern Mojave Desert south along the Colorado River to Blythe. The only extralimital records are three localities in California: Surprise Canyon, Panamint Mountains, Inyo County; 22 km S Needles, San Bernardino County; Blythe, Riverside County. Despite numerous collections over three years on its host plant, *Psorothamnus* (indigo bush), throughout Clark County, we have records of this bee at only 19 locations, mostly along the drainages of the Colorado River and its tributaries. So far it has not been detected from southern Clark County.

Habitat: *Ancylandrena koebelei* appears restricted to creosote and mixed desert scrub.

Phenology: Within any one year of our collecting *A. koebelei* was caught over no more than a three week period**;** it flies from mid-April to the end of May (only one generation per year). Indigo bush, *Psorothamnus* blooms from mid-April through mid-June.

Nesting Biology: *A. koebelei* belongs to the family Andrenidae, the majority of which nest in the soil. It is thus presumed that *A. koebelei* excavates nests in the soil.

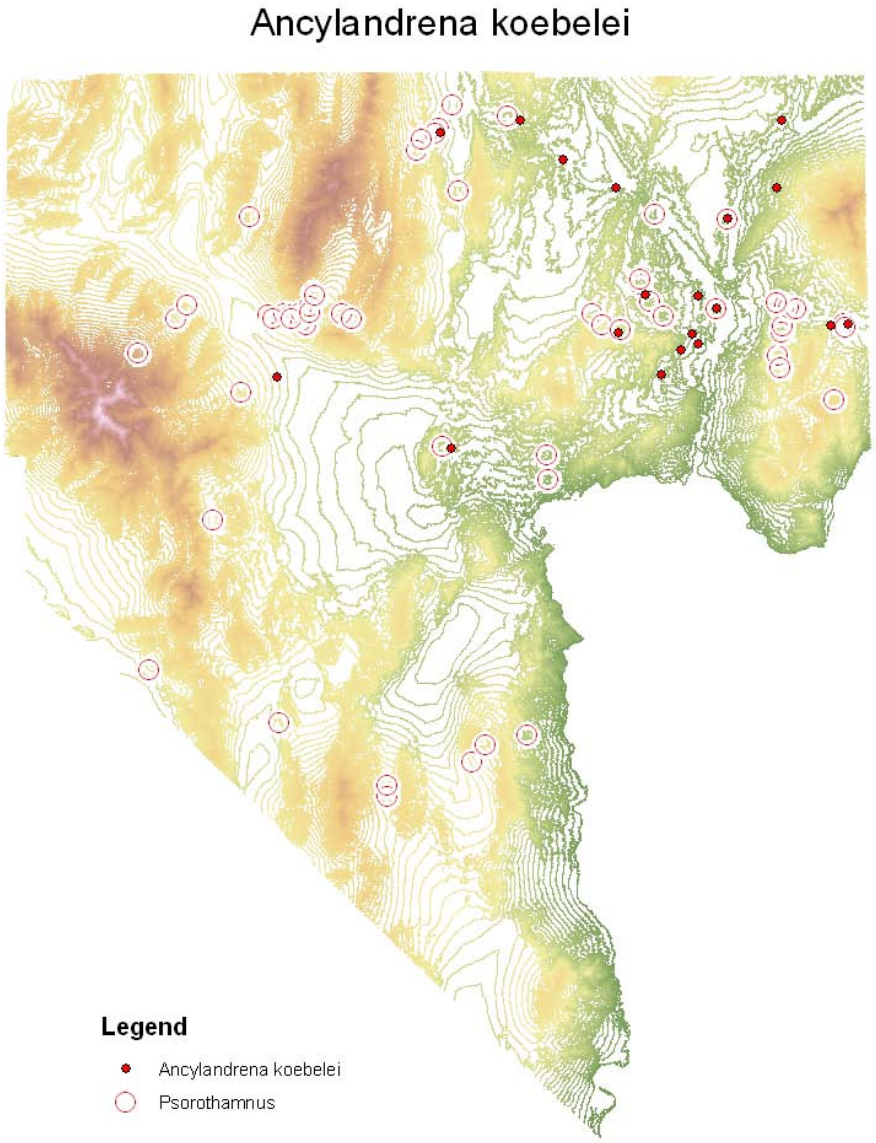
Floral Preferences: All of our records of *A. koebelei* are from *Psorothamnus* and *Dalea*. Others have observed this bee visiting *Oenothera* and *Stanleya*, presumably for nectar. Foraging activity is restricted to the very early morning. Greatest activity is from one half hour before sunrise to one hour after sunrise. Some individuals have been collected from one to two hours after sunrise, but none have been observed thereafter.

***Ancylandrena koebelei* female**

Taxonomic Status: *Ancylandrena koebelei* Timberlake is morphologically distinctive. It differs from the other species of *Ancylandrena* in having an ivory colored or yellow 'blister' on the basal half of the mandibles and a large mark on the clypeus. There is also a large patch of brown hair on the thorax. Males and females have enlarged ocelli.

Comments: Zavortink (1974) reported that this species was common during May of 1969 in the foothills of the Spring Mountains. We did not encounter populations in numbers greater than nine individuals in any of the three years that we collected—in fact no individuals were found in 2004 and only five were collected in 2005.

References: Timberlake 1951; Zavortink 1974.



Andrena balsamorhizae
Mojave Gypsum Bee

***Andrena balsammorhizae* female**

Distribution: *Andrena balsamorhizae* is now recorded from 37 locations around Lake Mead and in the Las Vegas Valley. Endemic to Clark County, Nevada, and the Arizona side of Lake Mead. Prior to 1998 known only from the northern part of Lake Mead, south of Overton. Occurs elsewhere around Lake Mead and in the Las Vegas Basin where it is restricted to the gypsum soils associated with its host plant. Populations are typically small and localized. Original collections of the bee were at three locations around Lake Mead in numbers ranging from one to 15 individuals. In 2004 only three individuals were collected, both on April 7. The only two individuals found in 2005 were at the same locality (1.5 miles W of Las Vegas Bay).

Habitat: Gypsum substrates where its host plant, *Enceliopsis argophylla,* exists.

Phenology: Single spring generation. Flight period from March to early May. Records range from 12 March to 7 May.

Nesting Biology: Presumed to excavate nests in soil. Soil nesting is characteristic of the Andrenidae, the family to which *Andrena balsamorhizae* belongs.

Floral Preference: Misidentification of the original plant specimens on which this bee was collected has led to its misleading scientific name, which suggests that this bee visits another composite, *Balsamorhiza*. In truth this bee pollinates only *Enceliopsis argophylla*, which is the sole source of pollen for its

***Andrena balsamorhizae* male**

offspring. This does not mean that *E. argophylla* relies solely on *A. balsamorhizae* for cross-pollination. Our records for *E. argophylla* include numerous visits by bees other than *A. balsamorhizae*.

Taxonomic Status: *Andrena balsamorhizae* LaBerge belongs to the relatively large subgenus *Callandrena*. Taxonomically it is similar to *A. gardineri* and *A. biscutellata*, both of which occur east of the Rocky Mountains. The females are readily distinguishable from most other *Andrena* because of their red abdomen. Males have short, dense hairs on the thorax, and a noticeably high vertex. There are no other bees with red abdomens that would be expected to visit *Enceliopsis argophylla*.

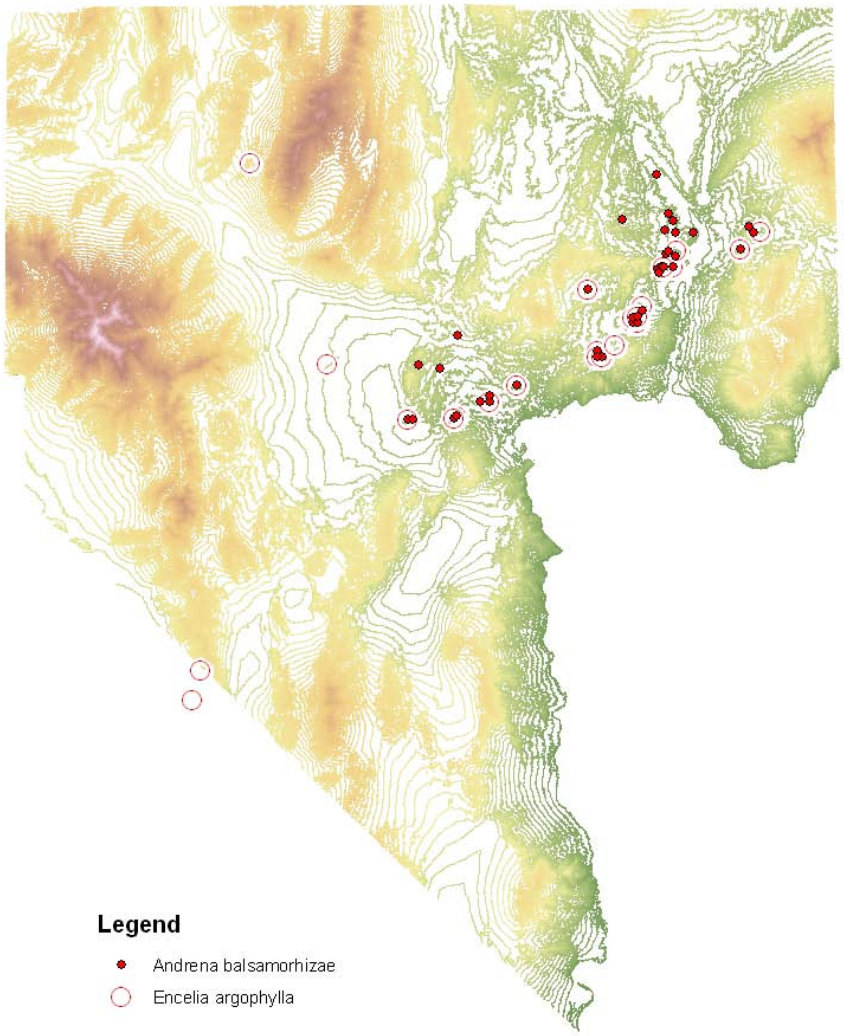
Comments: Restriction of pollen collecting to a single species of plant is rare among bees. The Mojave Gypsum Bee (*Andrena balsamorhizae*) is one of these rare exceptions. Collections on 16 populations of other species of *Enceliopsis* in Clark County, Ash Meadows and Death Valley National Park failed to produce this bee, supporting its limitation to *Enceliopsis argophylla.* The Mojave Gypsum Bee was not found on any of the other spring composites sampled in Clark County. This bee was not collected at all on found populations of *E. argophylla.* Because of its extremely narrow host plant range, and limited distribution, this bee is likely susceptible to extinction. Populations of *A. balsamorhizae* detected in 1998 along the west side of I-15 north of Las Vegas are presumed extinct. Sited are now industrial areas that lack the host plant. More sampling is needed in the Las Vegas Valley to determine the current extent of the bee.

References: LaBerge 1967.

Enceliopsis argophylla
Terry Griswold

Enceliopsis argophylla
Terry Griswold

Andrena balsamorhizae



Atoposmia rufifemur
Red-legged Beardtongue Bee

***Atoposmia rufifemur* male**

Distribution: Rare in eastern Mojave, western Sonoran, and southwestern Great Basin Deserts. Extremely uncommon in collections; known from only 13 specimens prior to our work in Clark County. Extralimital locations are California: Santa Rosa Hills, Inyo Co.; Eight miles N of Vidal junction and Granite Pass, San Bernardino Co.; 15 mi E Indio, Riverside Co.; Nevada: 22 mi S Fallon, Churchill Co. Only two specimens were found in 2004 and 2005, one on 8 April and one on 20 April.

Habitat: Creosote dominated basins. Due to the lack of data we are unable to retain habitat restrictions.

Phenology: Single spring generation. Flight period from March through April. Records range from 12 March to 27 April.

Nesting Biology: Nesting biology is unknown. Known nesting sites for other *Atoposmia* include hollow stems, soil, cracks between rocks, and gas pockets in volcanic rocks (Parker 1975, 1977).

Floral Preferences: Floral preferences are unknown. We have one record of female *A. rufifemur* visiting *Penstemon palmeri*. All other collected specimens were not visiting flowers at the time of capture, nor do they have pollen in their scopa for pollen identification.

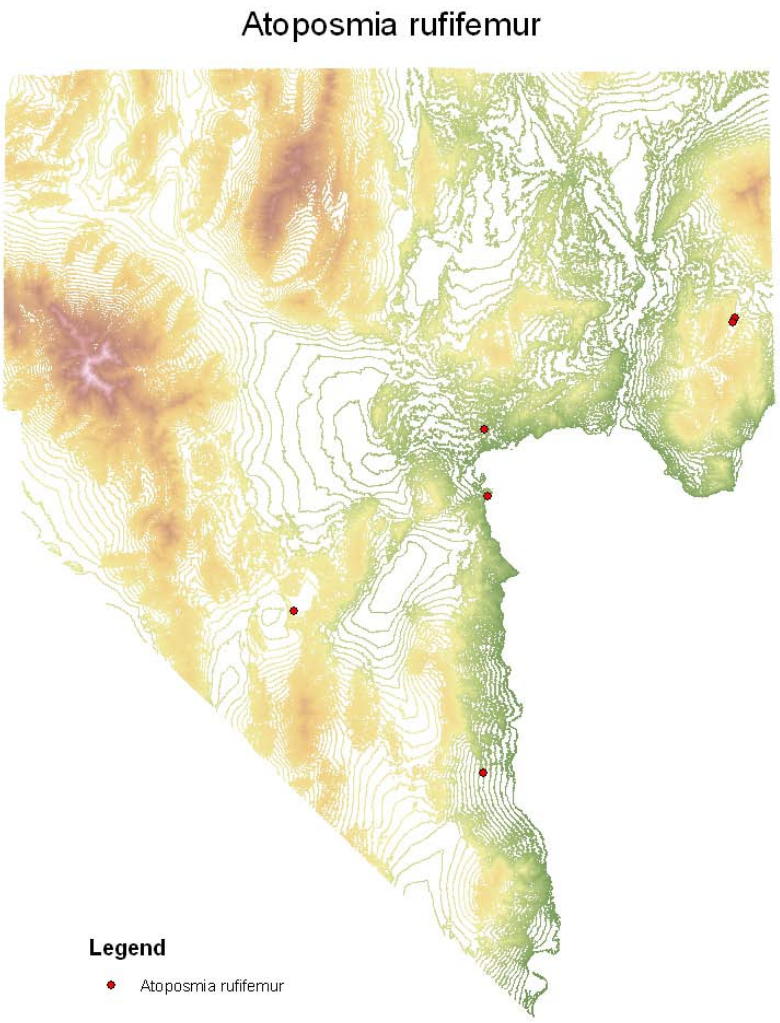
Taxonomic Status: A distincitive species in the subgenus *Eremosmia*. No taxonomic ambiquities. *Atoposmia* was formerly called *Anthocopa*. Most

***Atoposmia rufifemur* female**

published information on the genus uses this previous name.

Comments: This new species of bee seems to be extremely rare. Though the overall geographic range is relatively large, collections are extremely patchy, suggesting unknown restrictive parameters. These widely dispersed populations, when found, are small. At all but two localities collections are of a single specimen. The subgenus *Eremosmia* is a focus of ongoing systematic work at the lab. We have studied all available North American material in this group, increasing our confidence in the evaluation presented here.

References: Michener 1943



Lithurgus listrotus
Flat-faced Cactus Bee

Distribution: *Lithurgus listrotus* is a rare bee previously known only from a few locations in the foothills of the mountains in the Mojave National Preserve and from one one location on the western edge of the Sonoran Desert, Deep Canyon, and Riverside County, California (Snelling 1983). It was placed on the watch list because of its rarity and proximity to Clark County. Collections in 2005 documented the presence of this rare cactus bee at Sacatone Wash in the Newberry Mountains.

Habitat: Mojave mixed desert scrub.

Phenology: *Lithurgus listrotus* appears to have a single generation in the late spring. The single collection was on 9 June.

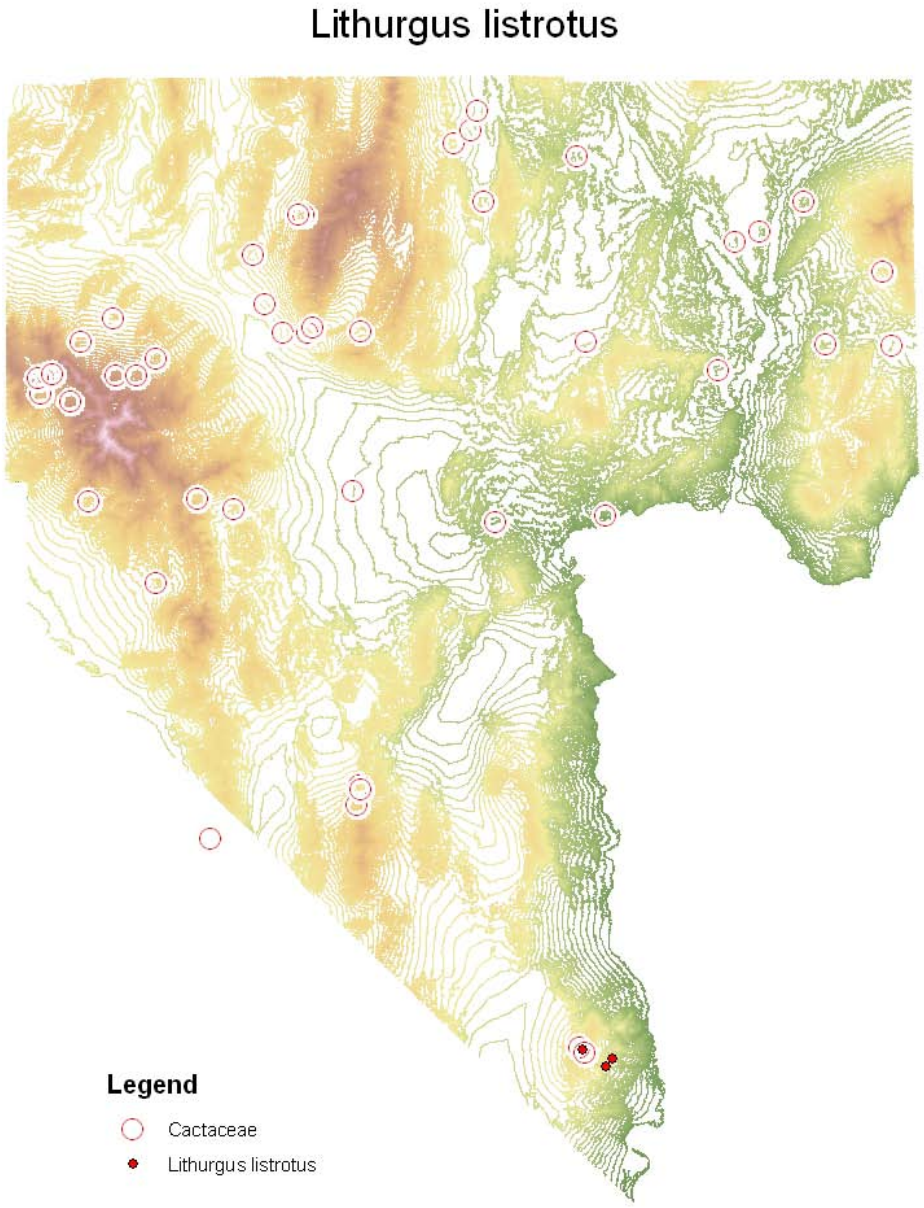
Nesting Biology: Unknown but likely similar to other species of *Lithurgus* which nest in punky wood.

Floral Preferences: *Lithurgus listrotus* is a specialist on *Cactaceae* with probable preference for *Opuntia.* All other North American species in the genus are also *Cactaceae* specialists.

Taxonomic Status: *Lithurgus listrotus* Snelling belongs in the subgenus *Lithurgopsis.* Both males and females of *Lithurgus listrotus* can be distinguished from all other North American *Lithurgus* by the flat supraclypeal area with a shiny impunctate median line extending onto the clypeus (Snelling 1983).

Comments: The limited distribution of *Lithurgus listrotus* is surprising. All other North American *Lithurgus* have wide distributions. This bee was hypothesized to occur in Clark County based on its presence in adjacent San Bernardino County, California. Numerous collections on cactus in other parts of Clark County have failed to detect its presence. The extent of its distribution in the Newberry Mountains is unclear.

References: Snelling 1983.


Lithurgus listrotus
Legend
Cactaceae
Lithurgus listrotus

Megandrena mentzeliae
Red-tailed Blazing Star Bee

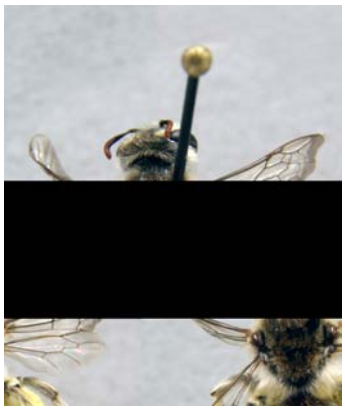
***Megandrena mentzeliae* male**

Distribution: Prior to 1972, *Megandrena mentzeliae* was known only from one locality in the foothills of the Spring Mts 13 miles NW of Las Vegas, NV. Zavortink, who made the original description of the bee, had found no populations of *M. mentzeliae* south of Las Vegas, despite extensive collecting on its host plant. Three years of collecting in Clark County has expanded its known range to include low elevations in the northern half of the county, from the foothills of Las Vegas Valley nearly to the Arizona border. It did not expand its known distribution further south despite the presence of its host plants to the south. It remains endemic to a small area of the northwestern Mojave Desert.

Habitat: Gravelly slopes in creosote and mixed desert scrub.

Phenology: *Megandrena mentzeliae* emerges in synchrony with its host plant. Our records indicate that the species as a whole flies for one month in the early spring (mid April to mid May), however we have records at any one location for one date only, indicating that individual populations may be much more short lived.

Nesting Biology: Because its host plant is restricted to disturbed sandy and gravelly soils, this bee likely nests in areas close by. Its nesting biology is unknown—no nests have been located to date. However, Zavortink (1972) reports that males and females that he collected often had fine soil particles encrusted on the pygidial plate, suggesting that these bees nest in the soil. This is compatible with known nesting for the family which is universally in the soil.



***Megandrena mentzeliae* female, with pollen loads**

Floral Preferences: *Megandrena mentzeliae* is a narrow oligolectic. Females restrict their pollen gathering not only to one genus, but to specific members of the genus. Our collections have expanded its known hosts to include not only *Mentzelia tricuspis*, but also *Mentzelia involucrata.* Females forage throughout the day, but are

more common in the morning. Zavortink reports that *M. mentzeliae* are very effective outcrossers of these plants; efficiently rake pollen from the stigma and frequently fly a considerable distance before relanding, make direct contact of the scopa with the style. It is interesting to note that there are no observations of *M. mentzeliae* males or females gathering nectar. We collected this bee on *Sphaeralcea*, *Psorothamnus*, *Delphinium*, and *Larrea*—thus these plants are possible nectar resources for the bee.

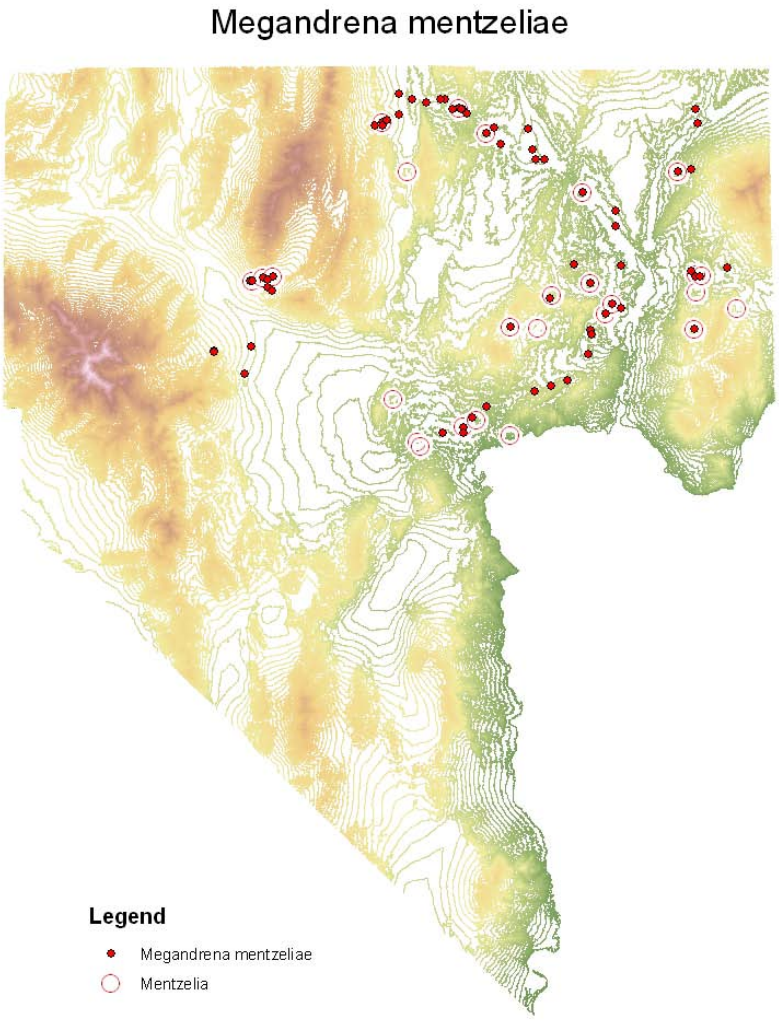
Taxonomic Status: *Megandrena mentzeliae* Zavortink is a distinctive species not closely related to any other bee in its family, and has been placed in its own subgenus, *Erythandrena*. It differs from other species of *Megandrena* in that the female has long curved hairs on the foretarsus, and the males have noticeably large heads. The blood-red color of the abdomen and its fairly large size make it easily distinguishable from all other visitors to *Mentzelia*. There are a few other bees with red abdomens, such as *Andrena balsamorhiza* but they do not occur on *Mentzelia*.

Comments: *Megandrena mentzeliae* was detected at 58 of 100 sampled populations of its host plants, *Mentzelia involucrata* and *Mentzelia tricuspis*. Some of the collecting sites were a kilometer or less apart so the number of populations is less than the 58 sites recorded.

References: Zavortink 1972.

Mentzelia involucrata
Gary A. Monroe @ USDA-NRCS PLANTS Database

Perdita xerophila discrepans
female



Perdita bipicta
Two-tone Perdita

***Perdita bipicta* male**

Distribution: Despite extensive collecting on *Eriogonum* (buckwheat), *Perdita bipicta*'s assumed host, throughout Clark County, three years of sampling have produced only one specimen. Other than our one specimen, this bee is known only from a series of four females and three males that were collected near Mesquite.

Habitat: Unknown.

Phenology: Known records are from the 2nd of May and 4th of June. It is presumed that there is only one generation, as with other species that are closely related, but without more specimens it is hard to be certain. Close relatives are known to fly from spring throughout the summer monsoon season. Whether this represents multiple generations or opportunistic emergence timed with plant boom is unclear.

Nesting Biology: Unknown, though all known nests of *Perdita* are in the ground.

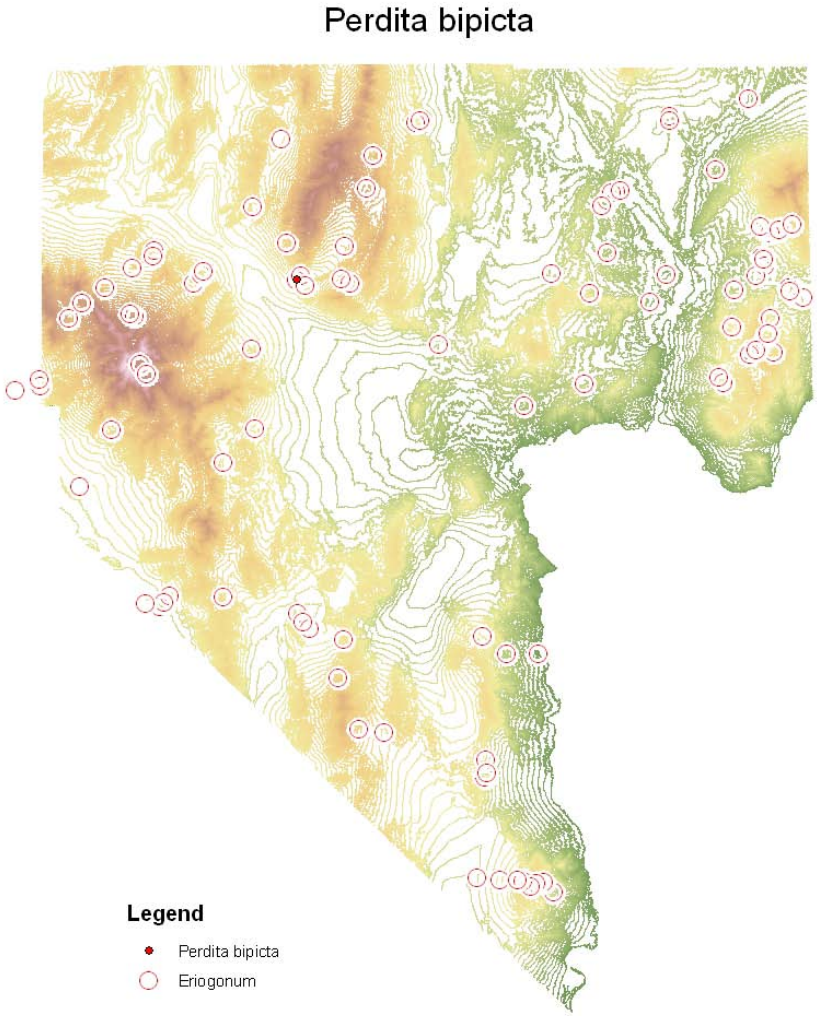
Floral Preferences: With such a small sample, it is hard to be certain. The original collections were on *Eriogonum*, as was the single 2005 collection. Other members of the ventralis group, of which this bee is a member, are specialists on *Eriogonum*. However, more than 130 collections *Eriogonum* throughout the county have failed to include this bee.

***Perdita bipicta* male**

Taxonomic Status: *Perdita bipicta* belongs in the subgenus *Perdita*, *ventralis* group, *nasuta* subgroup. Males in this subgroup have inflated scapes (the first segment of the antenna). Compared to related species it is paler with abdomen almost entirely light.

Comments: The rarity of this species is enigmatic. Other species within the subgroup, with the exception of another evaluation species, *P. xerophila discrepans*, are common. Even *P. xerophila discrepans* is more abundant. It might be argued that *P. bipicta* must specialize on some other plant. However, this seems unlikely. *Eriogonum* is clearly the preferred host for the nasuta subgroup. Almost all (92%) of the 1724 floral records for the five Clark County species of the nasuta subgroup recorded in the three years of sampling are from *Eriogonum.*

References: Griswold *et al.* 1998.



Perdita celadona
Mojave Twilight Bee

***Perdita celadona* female**

Distribution: Apparently endemic to Clark County. Known from only three sites in the Virgin River drainage ranging from Mesquite south to St. Thomas Gap. Despite numerous collections on *Camissonia*, the host plant for *Perdita celadona*, including dusk collections across three years, the bee appears not only spatially limited, but not abundant when it is found—we have added no specimens to previous records (Griswold *et al.* 1999) for this bee.

Habitat: Creosote scrub.

Phenology: Single spring generation. Flight period from May to early June. Records range from the 8th of May to the 8th of June.

Nesting Biology: Nesting biology is unknown, but it is presumed that this bee nests in the soil, as do known *Perdita*, and Andrenidae.

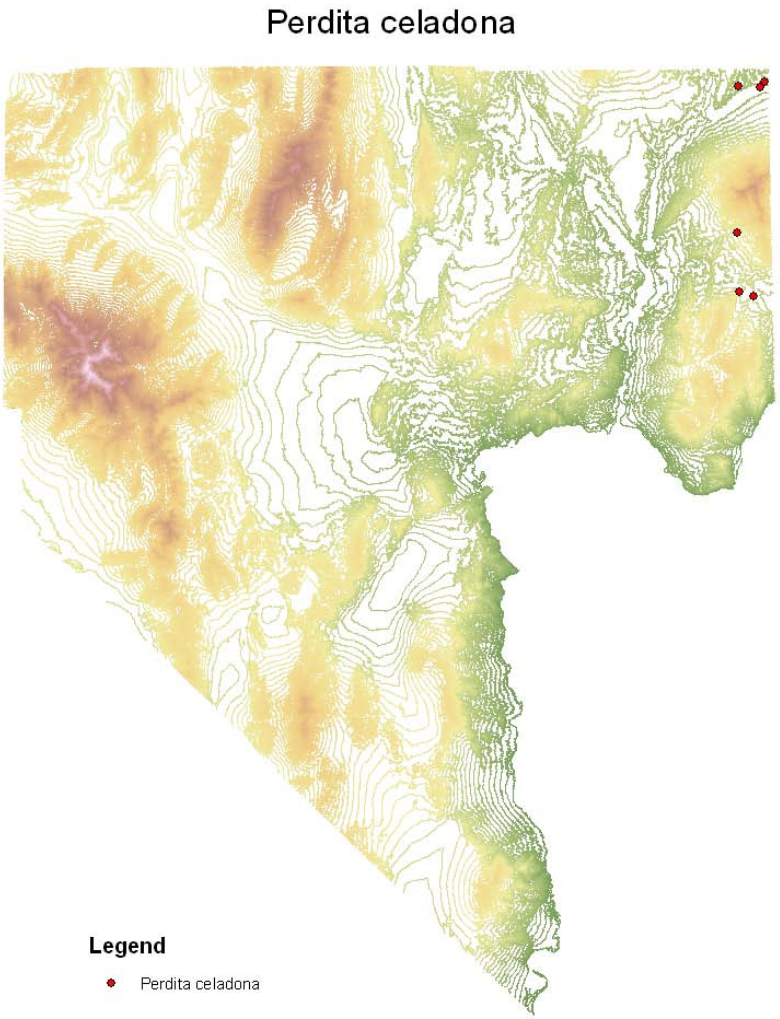
Floral Preferences: *Perdita celadona* specializes on *Camissonia*, including species that were once classified as *Oenothera* (explaining specimen records listing the floral record seemingly erroneously). Both sexes are active for only a short period of time at dusk, when the females actively collect the uniquely shaped pollen of *Camissonia*.

***Perdita celadona* male**

Taxonomic Status: This new species belongs to the subgenus *Xerophasma*. The subgenus can be recognized by the enlarged ocelli, and small triangular submarginal cell in addition to the two submarginal cells normal for *Perdita*. *Perdita celadona* is darker that other species in the subgenus. In 1954 when Timberlake revised the subgenus, *Xerophasma* included only one species each from the Sonoran and Chihuahuan deserts. It now appears that the eastern Mojave Desert is the center of distribution. There of the five species are present in eastern Clark County.

Comments: *Perdita celadona* co-occurs with *P. vespertina* on its host plant. Why it appears to be rare is unclear. Cenuses for these two species are constrained by the brief daily period of activity at dusk. Only one site can be sample per collector per day. Census efforts are exacerbated by the ephemeral nature of their floral host. *Camissonia* are annuals which do not bloom in years with inadequate rains. Even in years of good precipitation, rains are patchy. A dedicated team which could locate host plant populations during the day for evening sampling would be necessary throughout the spring. It is possible that pan-trapping could increase the number of sites sampled per day. *Perdita celadona* was found in pan-traps placed out overnight.

References: Timberlake 1954.



Perdita cephalotes
Big-headed Perdita

Perdita cephalotes, female

***Perdita cephalotes* male**

Distribution: Sporadically distributed across the eastern Mojave Desert and the adjacent Colorado Plateau. Nine extralimital records are known: Inyo and eastern San Bernardino County, California; northern Mohave County, Arizona; Moab, Capitol Reef National Park, and Grand Staircase-Escalante National Monument, Utah.

Habitat: Large, low elevation washes, typically with low gradients in creosote-dominated basins.

Phenology: Single late fall generation. Records from three years of collecting range from 23 September through 24 October.

Nesting Biology: Nesting biology, as with many rare *Perdita* is not known, but it is presumed to nest in the soil. Known nests for other *Perdita* are in the ground.

Floral Preferences: *Perdita cephalotes* appears to specialize on *Chrysothamnus*, including some species now placed in *Ericameria.* These are widespread and abundant fall-blooming shrubs. We found *P. cephalotes* abundant at ten distinct localities in 2005; all were found on *Chrysothamnus paniculatus* or *Ericameria discoidea*.

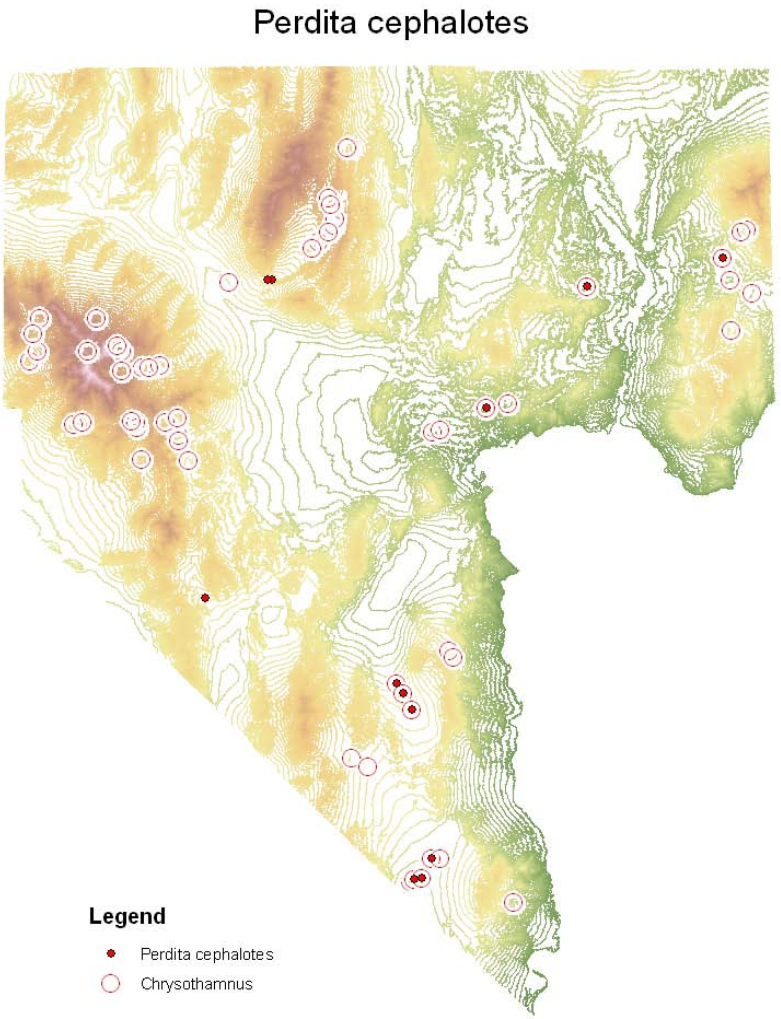
Perdita cephalotes, female

Taxonomic Status: This very distinctive species has been placed in its own subgenus, *Xeromacrotera,* based on male characters. Prior to this study, the female was unknown. Collections on *Chrysothamnus* in 1998 included numerous *P. cephalotes* males. Females collected with these males key to *P. excellens*, assigned to the subgenus *Procockerellia*, and known for only the females. While the association of the sexes is serendipitous, the synonomy it reveals suggests that a taxonomic re-evaluation of these two subgenera is in order.

Comments: Prior to our survey *Perdita cephalotes* was a rarely collected species known from only five males. The synonomy indicated above expands the known range and incidence of the species considerably. However, the species remains rare in collections, with a much more patchy distribution than its wide ranging host. Because the female was unknown prior to 1998, collections from that year did not focus on *Chrysothamnus/Ericameria*, its apparent host plants. By placing more emphasis on collections for this plant, we have increased its known distribution within Clark County significantly. Further, we have increased the number of specimens known by several orders of magnitude. However, of the more than 50 localities throughout Clark County at which we have collected on *Chrysothamnus/Ericameria*, *P. cephalotes* is known from only 12. This matches our experience elsewhere. For example, no specimens were found in a multiple year study of the bees of the San Rafael Desert, Utah, which included numerous collections on *Chrysothamnus/Ericameria*. Substantial collecting o*n these plants* in Grand Staircase-Escalante National Monument has expanded its known range significantly and linked what appeared previously to be isolated populations; but these collections have also emphasized its patchy distribution. It was present at seven out of 37 sites where its host plants were present. Despite its abundance when found, we suggest that this bee remains a species of concern because of its infrequent occurrence.

References: Timberlake 1954, 1958, 1968, 1971; Griswold *et al.* 1998.

Chrysothamnus viscidiflorus
Al Schneider @ USDA-NRCS PLANTS Database



Perdita cracens
Las Vegas Perdita

Distribution: Endemic to Clark County, Nevada. Only unequivocal record is for the single holotype female, from the Las Vegas Valley, other possible records are also from the Las Vegas Valley.

Habitat: Unknown.

Phenology: Number of generations unknown. From our limited sample, flight period is apparently late spring—the type was collected on the 25th of May. Possible records (sec below) range from 31 May to 14 June.

Nesting Biology: Unknown, but presumed to excavate nests in the soil like known *Perdita*.

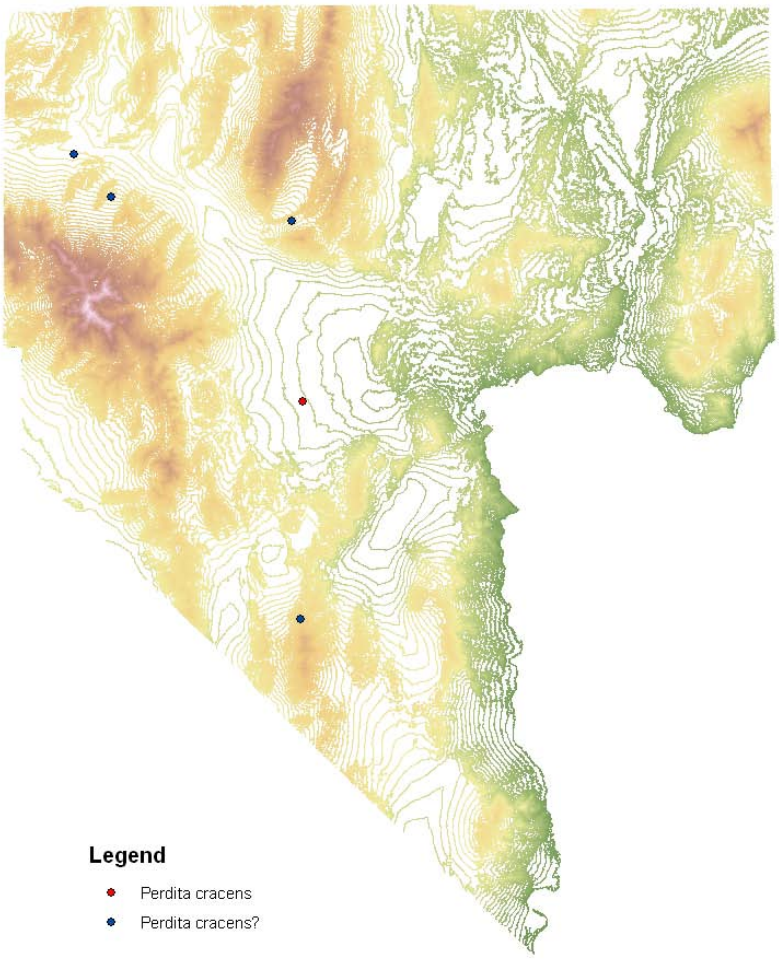
Floral Preferences: Unknown. The single certain plant record is *Mentzelia tricuspis*. May be a specialist on *Salazaria mexicana* (see below).

Taxonomic Status: In the original description *Perdita cracens* was tentatively placed in the *sphaeralceae* group of the subgenus *Perdita* (Timberlake 1980). Discovery of the unknown male is needed to determine its placement. In 2004 and again in 2005 we collected small series of females on *Salazaria mexicana* that have the all dark body without light markings and the long head described for this species. There are a number of all dark *Perdita* in the Mojave Desert, but most do not have long heads. It is therefore possible that these specimens represent *P. cracens*. In 2005 a small series of males were collected at the same time and on the same plant. They also have somewhat elongate heads and may represent the unknown male. (Sex associations in bees are frequently challenging because of sexual dimorphism. Males differ from females in many characters including markings, mandibles, antennae, legs, structures at the end of the abdomen). These males belong in the subgenus *Epimacrotera* and appear to be near *Perdita nigrocaerulea* Timberlake (1954). This species is also known only from the holotype. Study of the types of *Perdita cracens* and *P. nigrocaerulea*, housed in the collections of the Los Angeles Museum of Natural History and the California Academy of Sciences, respectively, will have to be conducted to determine if the tentative identifications are correct.

Comments: The only certain record for *Perdita cracens* remains that of the holotype. The locality was published five miles south of Las Vegas. Unfortunately this locality data is in error, according to the collector, R. R. Snelling (personal communication); the actual site is in the foothills of the Charleston Mountains about 13 miles northwest of Las Vegas, between 3000 and 3400 feet. If the collections referred to above prove to be correct further collecting efforts can be invested in these locations to determine if *Salazaria mexicana* is the floral host. If so, then structured spatial sampling on this shrub can be conducted to determine the geographic range of *P. cracens.*

References: Timberlake 1980.

Perdita cracens



Perdita crotonis caerulea
Virgin River Perdita

***Perdita crotonis caerulea* male**

Distribution: Endemic to Clark County, Nevada, and adjacent Washington County, Utah.

Habitat: Sand dunes and vegetated sands in lower elevation basins.

Phenology: Multiple generations, depending on bloom. Flight period from May to October. Records range from the 12th of May to the 13th of October.

***Perdita crotonis caerulea* male**

Nesting Biology: Nesting biology unknown. Presumed to nest in soil, like other *Perdita*.

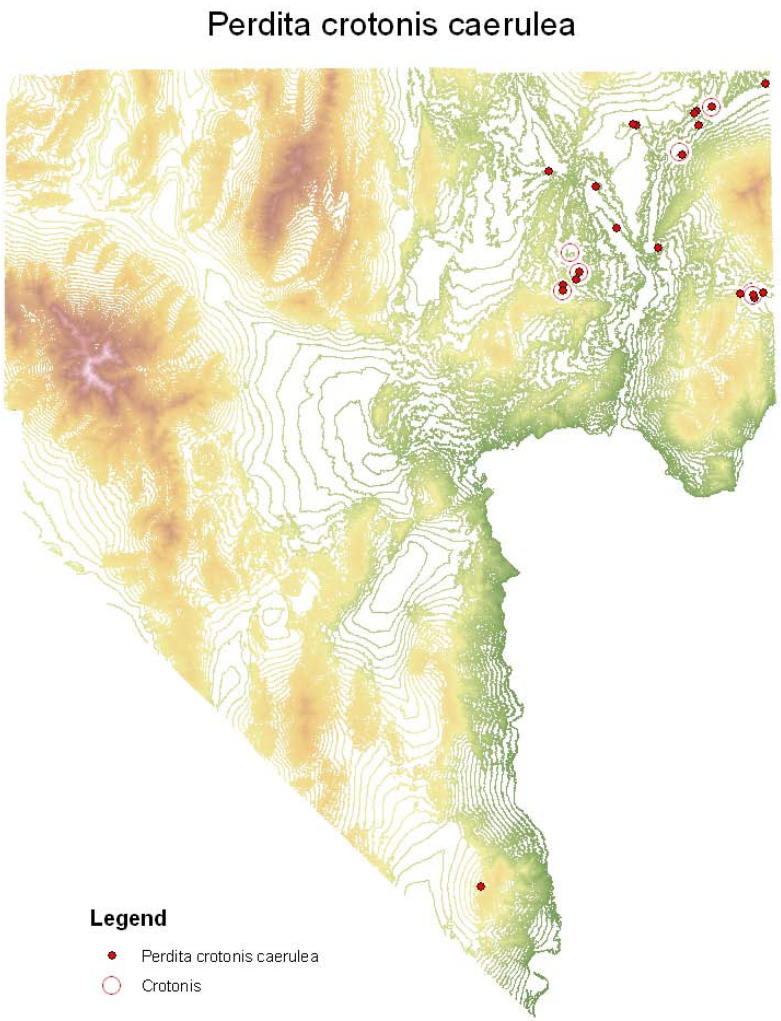
Floral Preferences: Specialist on *Croton*.

Taxonomic Status: *Perdita crotonis caerulea* Timberlake is a member of a complex of 11 subspecies of *P. crotonis* belonging to the *octomaculata* group of *Perdita* (*Perdita*). This complex is in need of revisionary study. Some of the subspecies appear to be valid species.

Comments: *Perdita crotonis caerulea* has been collected at nearly all sites where *Croton* was found. However, no specimens were found in 2004, despite the presence of *Croton*, and collections on the host plant spanning its flight period. Moreover, *Croton* appears restricted to the Virgin River drainage in northeastern Clark County. Its apparently sporadic nature, its limited distribution, and the restriction of the plant to sandy soils suggest that the species should be of concern. The chief threat would likely be off-road vehicle activity which could destroy not only the host plant, but also nests of the bee in sand.

References: Timberlake, 1968.

***Perdita crotonis caerulea* male**



Perdita eucnides eucnides
Rock Nettle Perdita

Distribution: Known from the Death Valley and the surrounding desert ranges in California and Churchill County, Nevada.

Habitat: Unknown but appears broad. Records from the Death Valley region range from the floor of Death Valley to 8000 feet in the Panamint Range.

Phenology: Apparently a single spring generation. Known flight period from 7 May to 15 June.

Nesting Biology: Presumed to excavate nests in the soil as do all known *Perdita.*

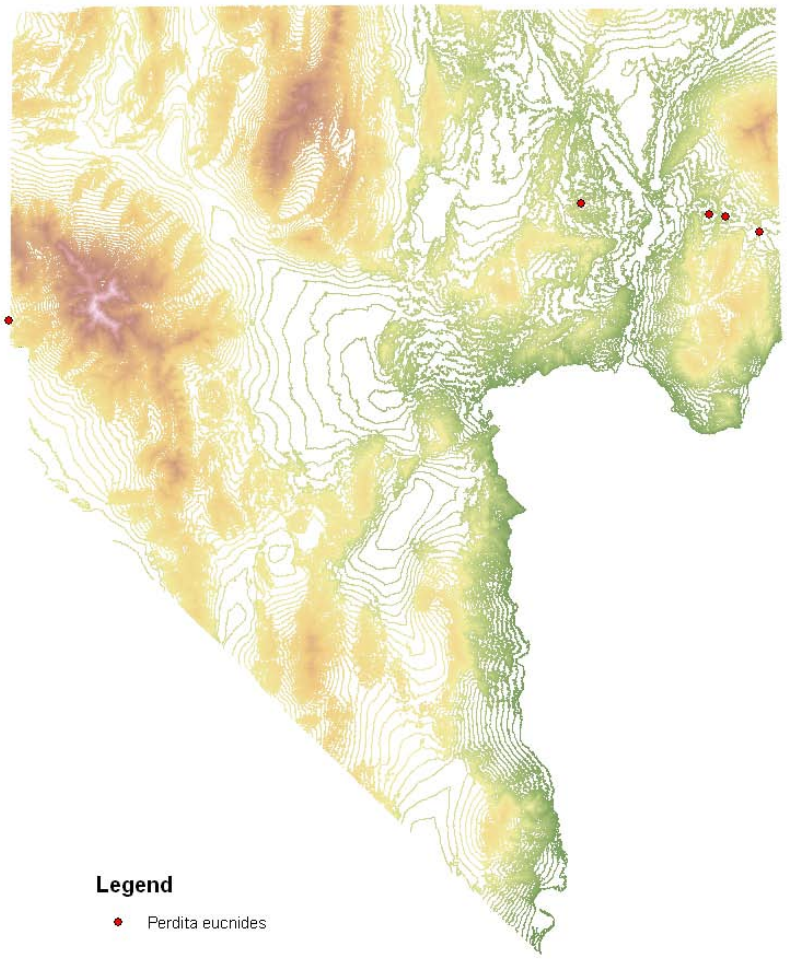
Floral Preferences: Though named after rock nettle (*Eucnide*) this species appears to be a generalist. It has been collected on *Cowania, Dalea, Eriodictyon, Eriogonum, Eucnide, Petalonyx, Stanleya,* and *Stephanomeria.* Only one out of 46 specimens collected in Clark County was found on *Eucnide.*

Taxonomic Status: *Perdita eucnides eucnides* Timberlake is a member of the *sphaeralceae* group of *Perdita (Perdita).* The other subspecies, *Perdita eucnides platyzona* Timberlake, is the western Sonoran Desert of Imperial County, California, Yuma County, Arizona and adjacent Baja California, Mexico.

Comments: Despite its apparent generalized pollen collecting behavior, *Perdita eucnides eucnides* is rarely collected. In three years of sampling it has been detected only seven times at 3 localities in 1998 and four in 2005. It was not detected in 2004. The limited data is not adequate to predict habitat or floral preferences. This bee should remain on the watch list.

References: Timberlake 1964.

Perdita eucnides



Perdita euphorbiana
Spurge-loving Perdita

***Perdita euphorbiana* male**

Distribution: Endemic to the Virgin River drainage, of eastern Clark County, and adjacent Washington County, Utah.

Habitat: Apparently restricted to sand dunes.

Phenology: At least two, perhaps multiple generations. Flight period from late May to early October. Records include 20 May, 22 July, 13-28 August, 26 September, and 6 October. It is likely that emergence is timed with the flowering of its pollen source.

Nesting Biology: Presumed to excavate nests in the soil. It may require deep sands to nest.

Floral Preferences: Specializes on *Chamaesyce* with erect rather than prostrate growth forms and elongate leaves.

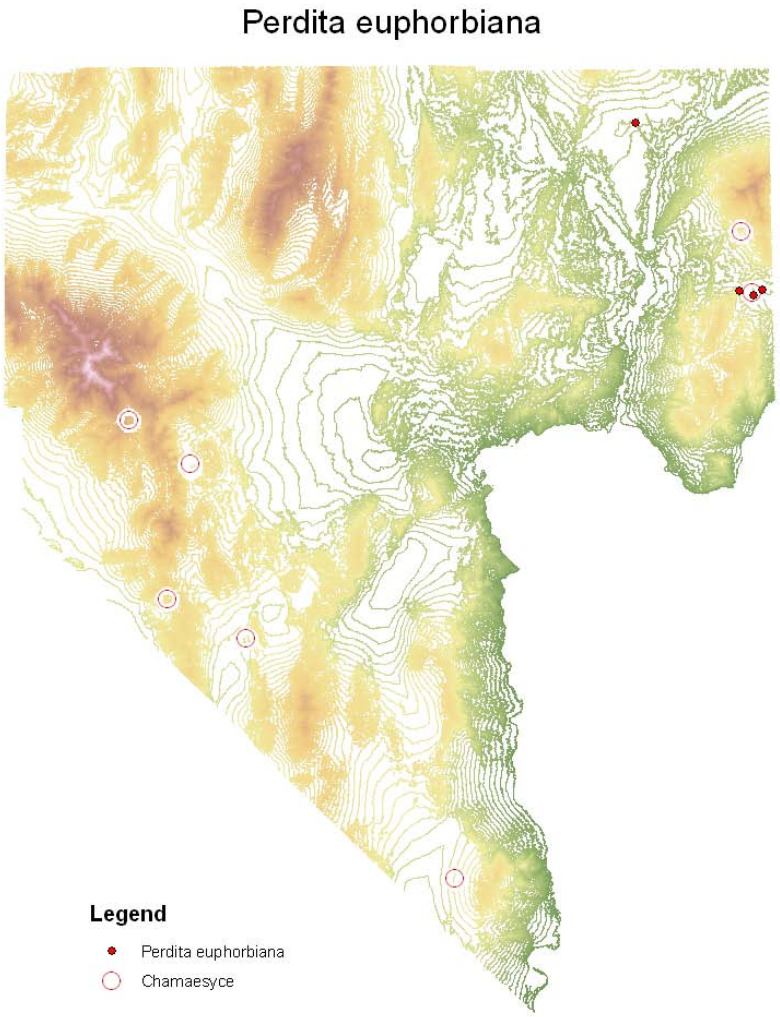
***Perdita euphorbiana* male**

Taxonomic Status: Member of a complex of species of the *octomaculata* group of *Perdita (Perdita),* all of which are specialists on *Chamaesyce.*

Comments: *Perdita euphorbiana* is apparently restricted to areas of deep sands. All collections are from sand dunes, despite the presence of *Chamaesyce* elsewhere.

References: Griswold *et al.* 1999.

***Perdita euphorbiana* female**



Perdita exusta
Tiquilia Perdita

***Perdita exusta* female**

Distribution: Endemic to Clark County. Occurs from Las Vegas Dunes northeast to the vicinity of Riverside. Collecting in 2004 and 2005 did not add to the known range of this bee; only eight additional specimens were collected in 2004 (all from one locality) and none were collected in 2005.

Phenology: *P. exusta* has a single spring generation. It does not occur on its host plant during the plant's summer bloom. Flight period is from late April through May (records range from 27 April to 28 May).

Nesting Biology: Unknown but presumed to excavate nests in the soil. Known nests for other *Perdita* as well as other members of the family Andrenidae, are all from the ground.

Floral Preferences: Specialist on *Tiquilia hispidissima.* May be a monolege, a bee restricted to a single plant species for pollen collection. The occurrence of true monolecty is extremely rare; most bees that use only one species as a host do so because there is only one species of the plant genus present (e.g. *Larrea tridentata* specialists). This bee has not been collected on any other species of *Tiquilia*. Whether this is because of other environmental factors that limit its distribution or represents a case of true monolecty is unknown. Early collections mistakenly recorded the host as *Nama.*

Taxonomic Status: A distinctive species belonging to the subgenus *Heteroperdita*.

***Perdita exusta* male**

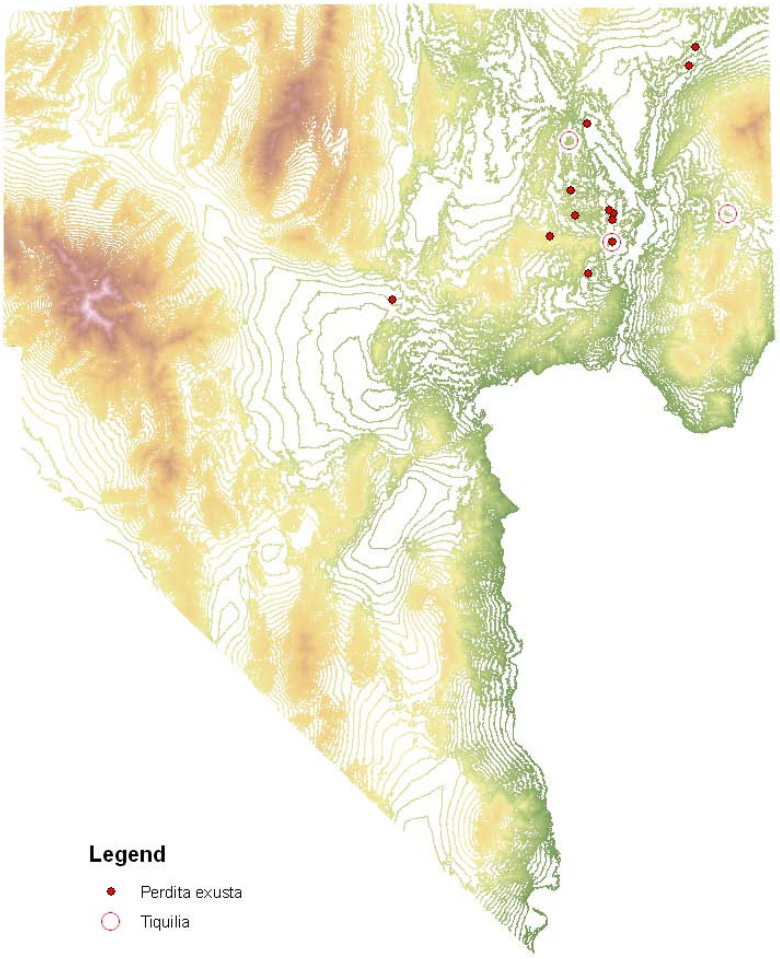
Perdita exusta **male**

ten species of the subgenus *Heteroperdita* known from Clark County. All
uilia. *Perdita exusta* is spatially more restricted than *Tiquilia hispidissima*
uring the fall bloom of *T. hispidissima*. More collecting needs to be made in
st of the Virgin River and in the southern part of the county.

d *et al*. 1999.

Tiquilia hispidissima
W.L. Wagner @ USDA-NRCS PLANTS Database

Perdita exusta



Perdita fallugiae
Apache Plume Perdita

***Perdita fallugiae* male**

***Perdita fallugiae* male**

Distribution: Endemic to Clark County, Nevada. Prior to this study, *Perdita fallugiae* was known only from Kyle Canyon in the Charelston Mountains. We now know it to be widespread, though annually sporadic, at mid elevations throughout the county.

Habitat: Dry mountain washes where Apache Plume exists.

Phenology: There is one spring generation for this bee, the flight period runs from late April through June.

Nesting Biology: Nesting biology is unknown, but it is presumed that this bee nests in the soil as do known *Perdita*.

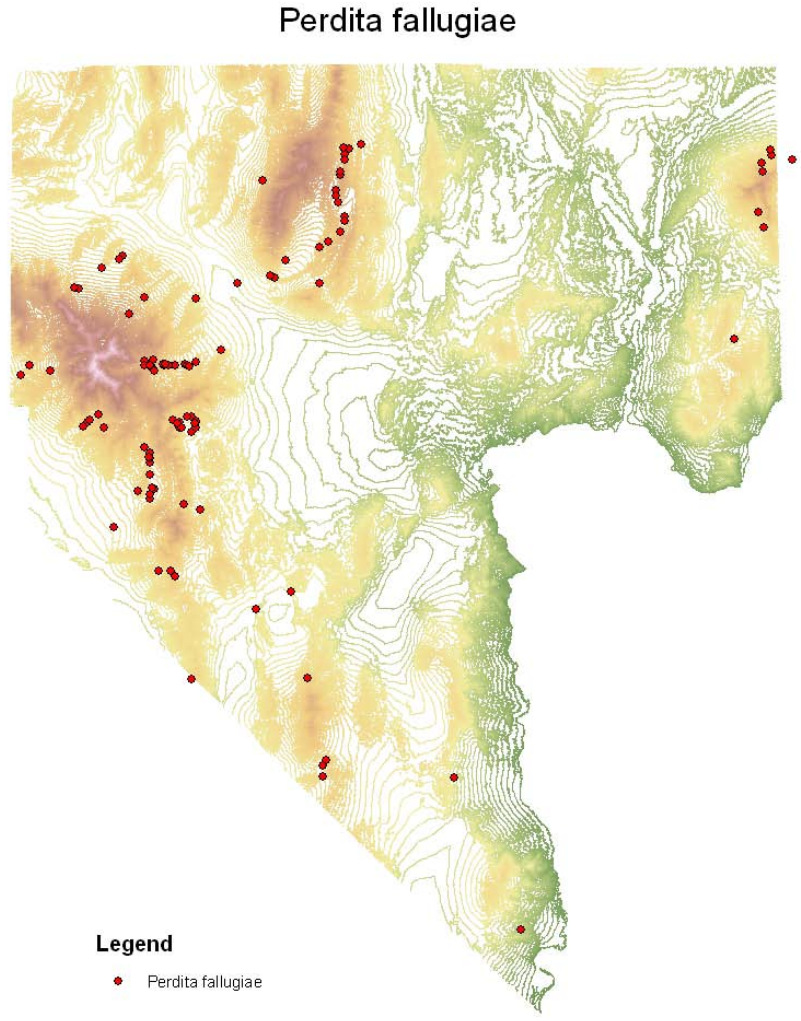
Floral Preferences: Originally suspected of being a specialist on *Fallugiae,* one of the few plants on which it was initially recorded. Our extensive collections clearly indicate that this bee is not an oligolege; its diet includes no less than 25 plant species.

Taxonomic Status: *Perdita fallugiae* Timberlake belongs to the *californica* group of the subgenus *Pygoperdita*. Closely related to *Perdita duplonotata* and a new species near *P. duplonata*. All three are commonly collected at the same sites.

Comments: The Apache Plume Perdita appears to be widespread within shrub communities in the mountains of Clark County. Data from two additional years suggest that populations may fluctuate up to five fold between years, an observation that has been repeatedly observed for bee communities in a variety of habitats (Williams *et al*. 2001). However, because our collections were not systematic, this observation is only anecdotal. Regardless, our initial reasoning that this common bee need no further monitoring are supported by the data we have gathered in two additional years of collecting.

References: Timberlake 1956.

***Perdita fallugiae* female**



Perdita flaviceps
Yellow-headed Perdita

Distribution: Known only from "Las vegas." The unique type labeled simply collections in 1998, 2004, and 2005 failed to detect this species.

Habitat: Unknown

Phenology: Little is known for this bee. Number of generations cannot be determined from the sole record from the 17th of September. At the least it has one fall generation.

Nesting Biology: Nesting is likely in the soil, as it is with known *Perdita.*

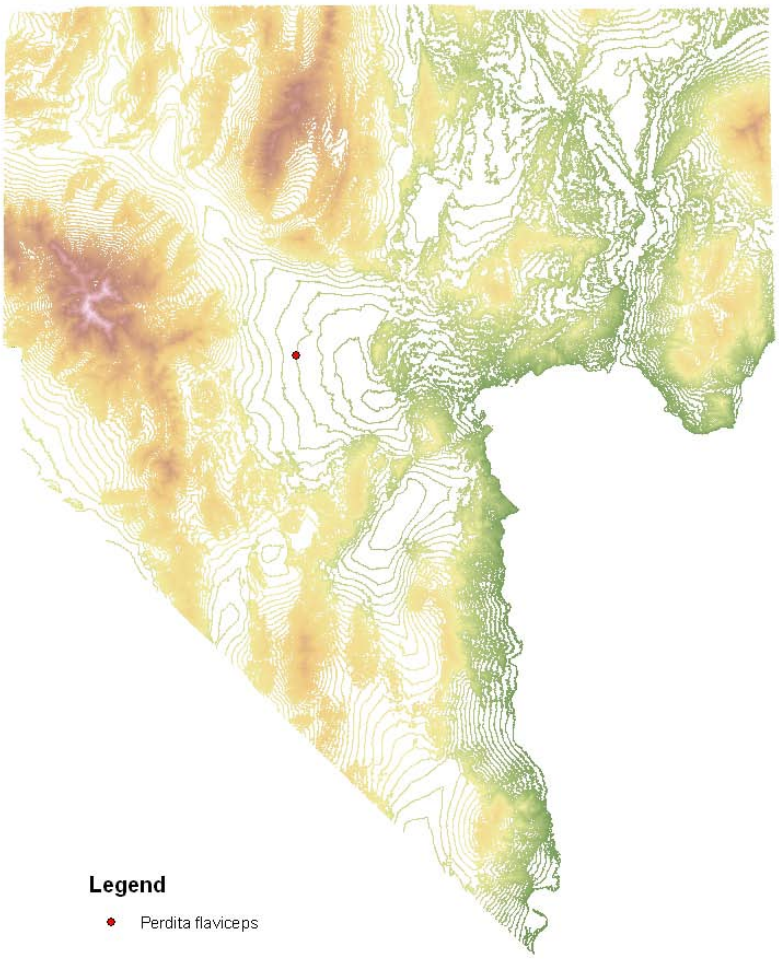
Floral Preferences: Unknown.

Taxonomic Status: *Perdita flaviceps* Timberlake belongs to the *octomaculata* group of *Perdita (Perdita).* Female is unknown.

Comments: The type, which is the only known specimen, was collected in 1908 with locality data that reads simply "Las Vegas." Early collectors seldom gave specific details of collecting sites—the actual locality could have been anywhere within considerable range of Las Vegas. Our collections (more than 800 in total) in the Las Vegas Valley and elsewhere in Clark County failed to discover this species. Original speculation was that the bee did not emerge because its host plant was not present. Three years without its presence tend to rule out this postulate. We must contend with the possibility that this species has been extirpated by the significant growth of this century.

References: Timberlake 1960.

Perdita flaviceps



Perdita fulvescens
Moapa Perdita

***Perdita fulvescens* female**

Distribution: Apparently endemic to eastern Clark County, Nevada. Known only from two sites, one each in the Muddy River and Virgin River drainages.

Habitat: Arid river valleys.

Phenology: Based on only two records, the number of generations is unknown, and the flight period is not clear. It is clear that the bee is present in both spring and fall, as the known records are from the 1st of May and the 31st of August.

Nesting Biology: Nesting biology unknown. Other *Perdita* species nest in the soil, thus it is presumed that *P. fulvescens* does the same. Whether it is restricted to particular soil types is not known.

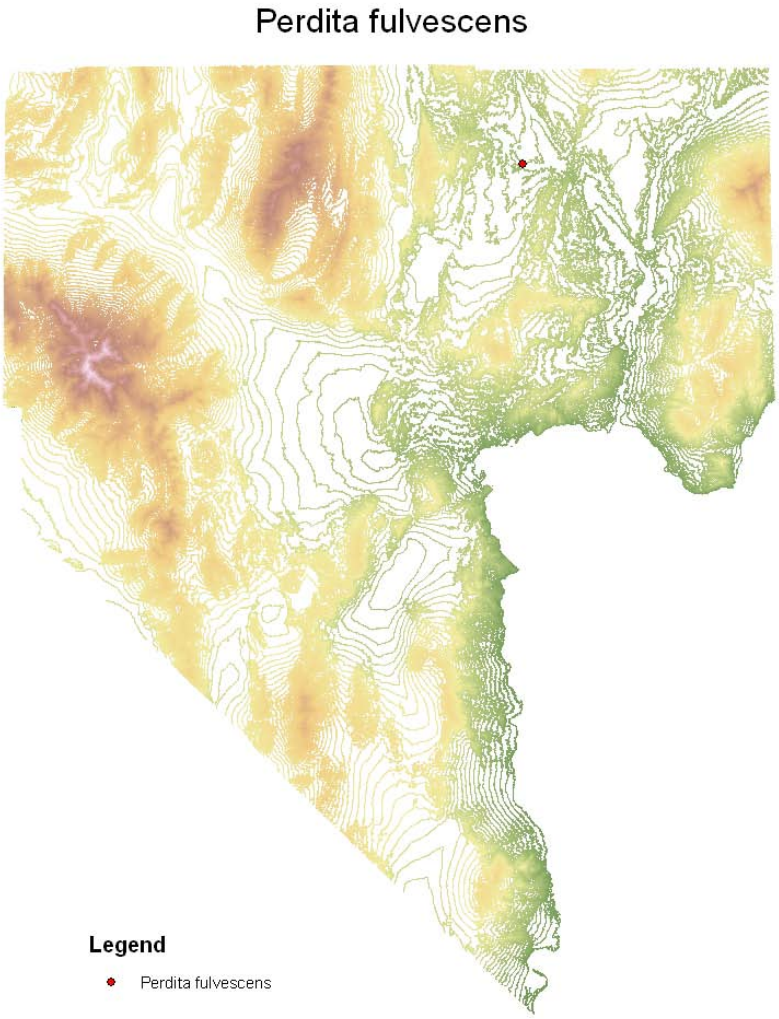
Floral Preferences: Since the floral preferences of presumably closely related *Perdita* are also unknown, and the records for this bee include no floral records, our knowledge of its floral preferences is nonexistent.

Taxonomic Status: *Perdita fulvescens*Timberlake is known only from three female specimens. Its placement within *Perdita* is unclear. It is thought to belong to either the *calloleuca* or *sphaeralceae* group of *Perdita (Perdita).* Males are needed to confirm which group.

***Perdita fulvescens* female**

Comments: Originally described from a single female labeled simply Moapa. Two additional females were collected 4.5 miles west of Riverside in 1997, along the Virgin River at a location that included dunes near alfalfa fields (F.D. Parker pers. comm.) Our surveys over the following years have failed to produce any additional material, despite intense collecting in the areas of both known occurrences.

References: Timberlake 1980.



Perdita inornata
Unadorned Perdita

***Perdita inornata* male**

Distribution: Moderate elevations in the desert ranges of the Mojave. Known from the Charleston Mountains, the mountains of Desert Range Nevada Wildlife Refuge, and the South Virgin Mountains. Extralimital sites are Panamint Mountains and Clark Mountain, California and South Rim, Grand Canyon, Arizona.

Habitat: Arid washer of the higher mountain ranges.

Phenology: Records indicate one or two generations. Collections in 1998 ranged from the 4th of June to the 30th of August with one anomalous record from the 8th of May. Records from 2004 and 2005 ranged from June 1 to July 12 and from September 1 to September 15 and included records from both spring and fall at single sites. There were no records in 2004 or 2005 in August, suggesting bivoltinism.

Nesting Biology: Nesting biology unknown, but presumed to excavate nests in the soil, as do other *Perdita* and most members of its family, Andrenidae.

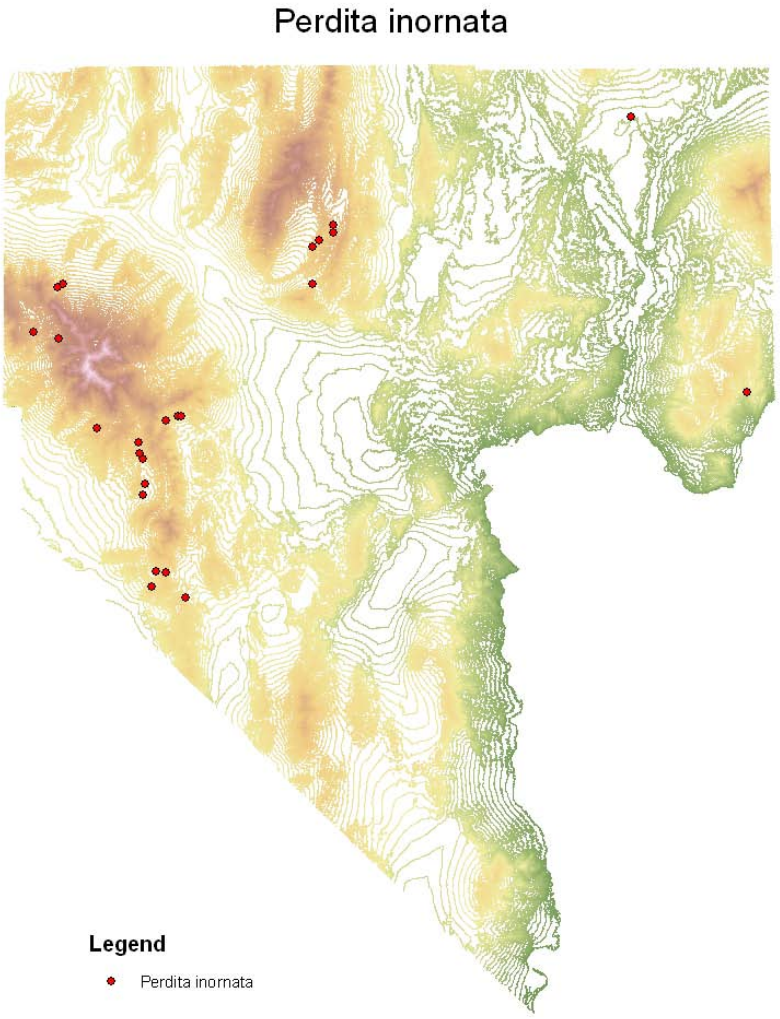
Floral Preferences: Unknown. The floral evidence suggests this bee is polylectic. Females have been taken at many abundant fall blooming shrubs, including *Gutierrezia sarothrae*, *Petrophyton caespitosum*, *Chrysothamnus* sp., and *Heliomeris multiflora*. Females active in the spring have been collected on *Purshia mexicana*, *Agave utahensis*, *Fallugia parado*, and *Eriodictyon*.

***Perdita inornata* male**

Taxonomic Status: *Perdita inornata* Timberlake belongs in the *ventralis* group, subgroup *subfasciata* of *Perdita* (*Perdita*). This is one of the few Perdita that are all dark in the female.

Comments: Sampling in 1998 resulted minimal collections of *P. inornata*. Collections in 2004 and 2005 did not result in many more specimens, but those that were collected were found at the same locations, suggesting that populations are small and widely dispersed, but predictable from year to year.

References: Timberlake, 1962.



Perdita meconis
Mojave Poppy Bee

***Perdita meconis* male**

***Perdita meconis* male**

Distribution: This rare bee is endemic to the eastern Mojave Desert. It is very patchily distributed. Most known populations are in Clark County. Extralimital localities are restricted to several sites within five miles of Kelso, San Bernardino County, California and a single population southeast of St. George, Utah.

Habitat: Creosote and mixed desert scrub.

Phenology: One single spring generation. Flight period from mid April through early June.

Nesting Biology: It is presumed that this bee excavates nests in the soil, as is true for all *Perdita* with known nesting biologies.

***Perdita meconis* male**

Floral Preferences: Specialist on a few large flowered Papaveraceae: two species of bear poppies (*Arctomecon humilis* and *A. californica*), and prickly poppies (*Argemone*). Intensive inventories on the third species of bear poppy, *Arctomecon merriami*, in the Death Valley region failed to detect the species.

Taxonomic Status: *Perdita meconis* Griswold is a distinctive species belonging to a complex of poppy specialists in the subgenus *Pygoperdita*. The yellow face in the male will distinguish it from all other poppy visiting species except *P. robustula* which has a red rather than dark and light banded abdomen.

Comments: The distribution of this species is enigmatic. Its host plants are very patchily distributed. Both *Arctomecon humilis*, a federally listed species, and *A. californica* are rare. For

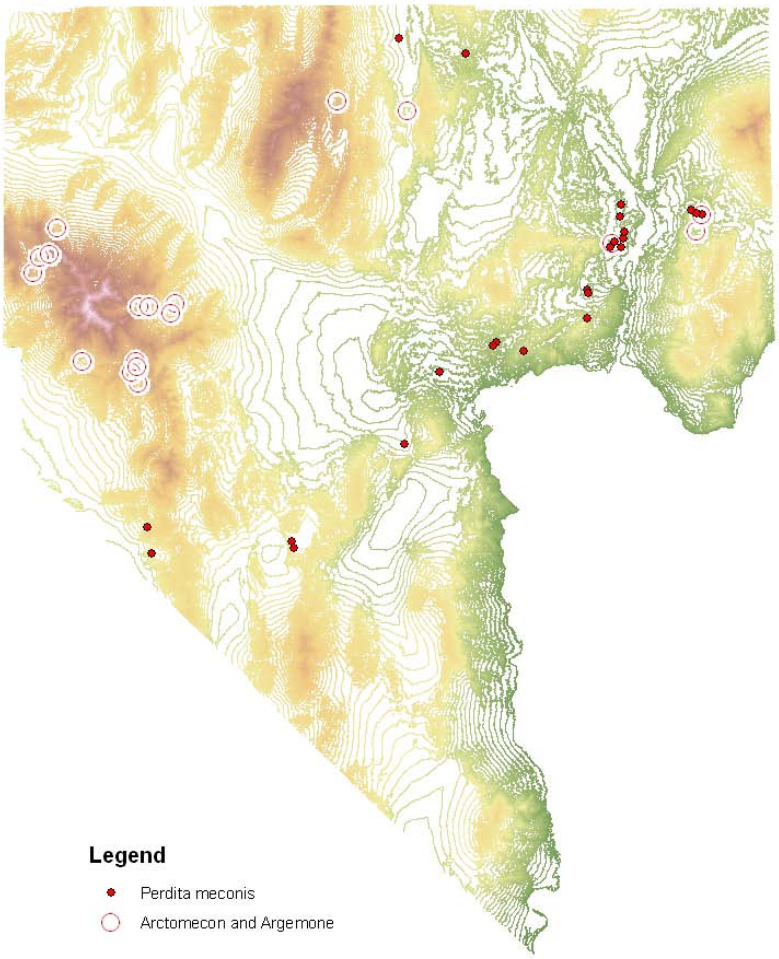
reasons that are unclear, the bee is absent from many host plant populations. It is found at only one of six populations of *A. humilis* even though the populations are only a few miles apart, seemingly within range of colonization. In a previous survey of both bear poppy and prickly poppy populations in southeastern California, southern Nevada, southwestern Utah, and northwestern Arizona a total of 86 sites were sampled. The bee was absent at most sites, including all populations of the third species of Bear Poppy, *A. merriamii*, in Death Valley National Park, and all Arizona populations of *Argemone* outside of Lake Mead National Recreation Area. It was not detected in any of the southwestern Utah prickly poppy samples. Several factors may account for the sporadic distribuition of the bee, not the least of which involves the unpredictable nature of its host. Over a 16 year period, observations of *A. humilis* in a 0.07 ha plot fluctuated from as few as 3 individuals to over 1300. The persistence of an oligolectic bee on such a variable resource is unlikely. An understanding of which plant populations vary the least across years may aid our understanding of where the bee is likely to occur. Additionally, understanding the nesting habits of the bee might elucidate distributional patterns. It may be that the bee is restricted to a particular nesting substrate. After three years, we still have located no nests. Where present, the Mojave Poppy Bee may be an important pollinator of the rare Bear Poppies due to its fidelity to these pollen sources. It may thus play a significant role in the maintenance of these plant populations. A previous study of the pollen collecting behavior of this bee indicates that individual foragers visit multiple flowers and often multiple plants on a single forageing bout and regularly make contact with the stigma (Griswold and Tepedino, unpub.)

Arctomecon californica
Susan Cochrane Levitsky, Nevada Natural Heritage Program

Argemone corymbosa
Gary A. Monroe @ USDA-NRCS PLANTS Database

References: Griswold 1993.

Perdita meconis



Perdita nevadiana
Valley of Fire Perdita

Distribution: Endemic to Clark County, Nevada. Known from only female specimen collected from Valley of Fire State Park. Surveys in 1998, 2004, and 2005 failed to produce additional material.

Habitat: Unknown.

Phenology: Based on only one specimen, determining the number of generations and the overall flight period is impossible. The single record is from the 17th of May.

Nesting Biology: It is presumed that this bee excavates nests in the soil, as do known species of *Perdita*.

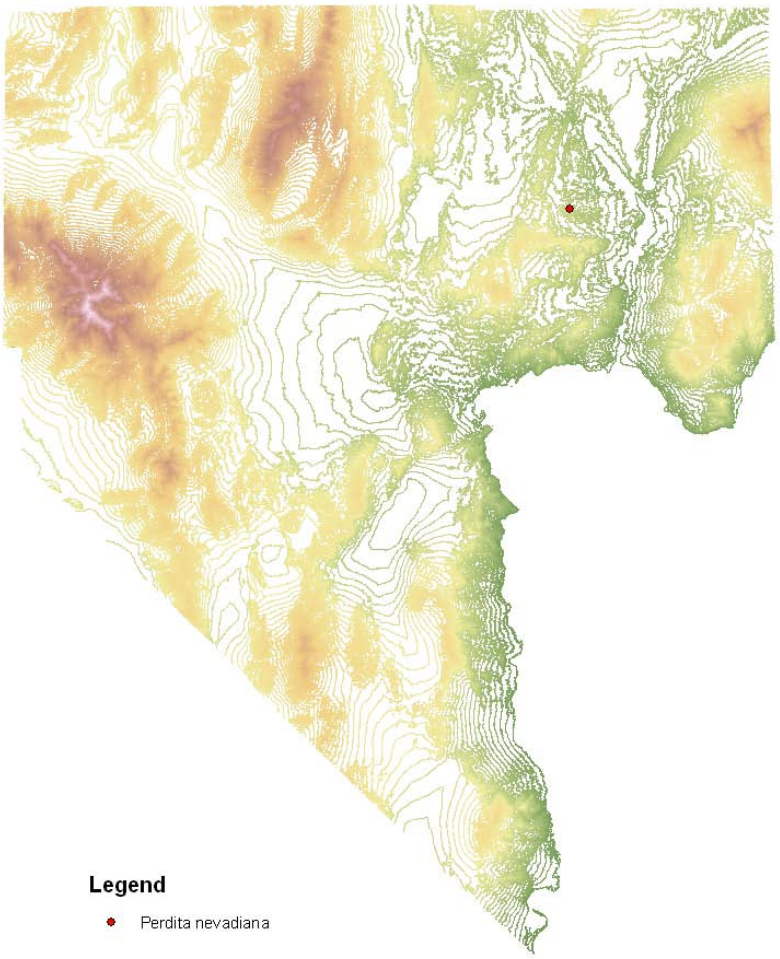
Floral Preferences: The single female was collected on Desert Marigold, *Baileya.* Whether this is a preferred pollen source is unknown. Other members of the subgenus to which it belongs consistently visit composites.

Taxonomic Status: From the descriptionit is clear that *P. nevadiana* Timberlake correctly placed in the subgenus *Pentaperdita*. It is possible, though very unlikely, that it is synonymous with *P. annexa* Timberlake known from 3 specimens from New Mexico and one from Texas. Comparison of the holotypes will be necessary to resolve this issue. The status of the species remains uncertain.

Comments: The failure to collect additional specimens of this species is puzzling. Over the course of three years, we collected at over 160 locations where *Baileya* was blooming. In all, more than 1300 specimens have been collected. Assuming that this plant is the host, the absence of this specimen suggests that something else is also limiting distributions. With no known nesting information, we can't assess how substrates are limiting this bee. Fifteen localities were collected repeatedly across the field season within Valley of Fire State Park but in none was the species found. An alternative explanation for its absence is that it is in fact only a variation of an already named species, and not new at all.

References: Timberlake 1980.

Perdita nevadiana



Perdita vespertina
Virgin River Twilight Bee

***Perdita vespertina* female**

Distribution: Endemic to Clark County, Nevada. Known only from a few scattered low elevation localities from the Las Vegas Dunes east to Mesquite. Extensive collecting in these regions in 2004 yielded no additional samples. In 2005 six individuals were found in three sites. Seven populations are now known.

Habitat: Washes and sand dunes in creosote-dominated basins.

Phenology: Single spring generation. Flight period from mid May to early June. Records range from 16 May to 7 June.

Nesting Biology: It is presumed that this bee excavates nests in the soil, as do most other species of *Perdita*.

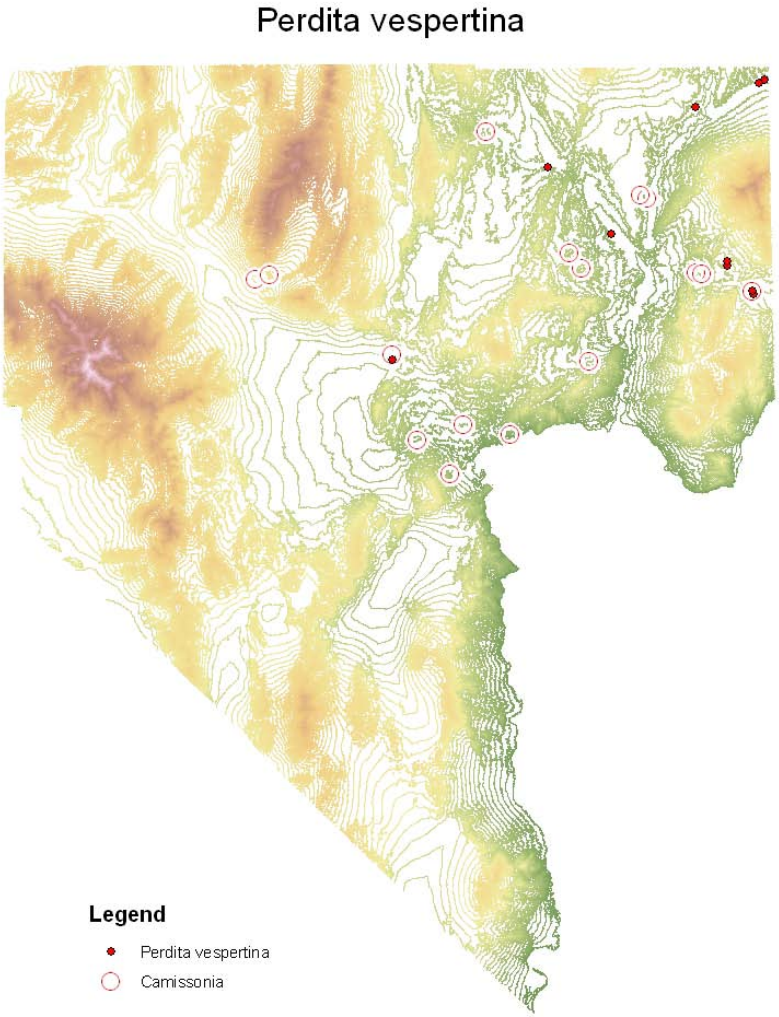
Floral Preferences: Specializes on *Camissonia*. All collections are from yellow-flowered evening primroses; it is unknown whether it also visits white-flowered species. The floral records from some specimens read "Oenothera", but according to the collector (F.D. Parker pers. comm.) bees were collected on plants now placed in the genus *Camissonia*. Both sexes are active only for a short period of time at dusk.

Taxonomic Status: This new species belongs to the subgenus *Xerophasma*. This subgenus was known only from two species, one in the Sonoran and one in the Chihuahuan deserts in 1954 when Timberlake revised the genus. He subsequently recognized this bee as a new species and gave it a manuscript name that did not get published before his death.

***Perdita vespertina* female**

Comments: Collections of this species were hampered by the restricted flight time of the bee and by confusion as to the identity of the host plant. Dedicated collecting in a year when *Camissonia* is in good bloom will be necessary to better understand the distribution and habitat requirements. See comments under the closely related *P. celadona*.

References: Timberlake 1954.



Perdita vicina
Mojave Mountain Perdita

***Perdita vicina* female**

Distribution: Endemic to Clark County, Nevada. Previously known only from a single collection in the Charleston Mountains. Common at mid elevations in the Spring Mountains, Sheep range, and Virgin Mountains where its pollen source, *Fallugia paradoxa,* is present. Not present in the McCullough Range.

Habitat: Dry washes in the flanks of mountain ranges.

Phenology: Single late spring generation. Flight period from May to July. Records range from 5 May to 20 July, coinciding almost entirely with its host plant. One seemingly anomalous record in 2004 of a male on September 7, but we have records of a second bloom on *F. paradoxa* from August 30 to September 19, suggesting a potential second generation in synchrony with *Fallugia*'s second bloom.

Nesting Biology: Nesting biology unknown. Presumed to excavate nests in the soil as do other *Perdita*.

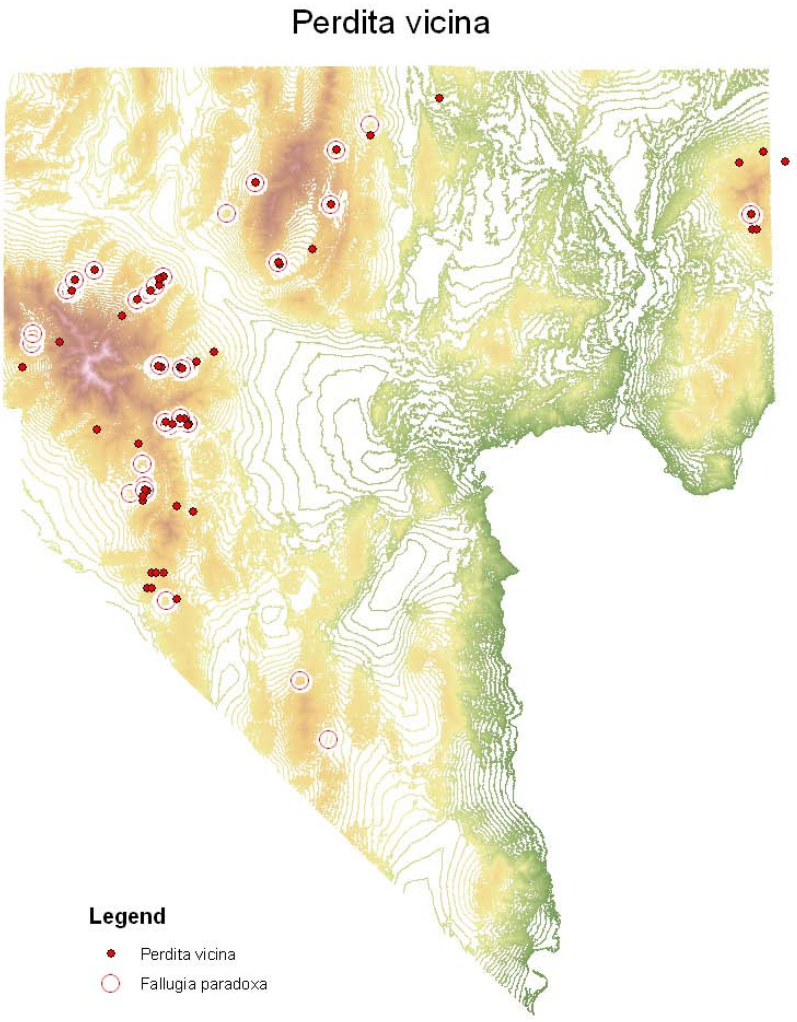
Floral Preferences: In contrast to *Perdita fallugiae*, *P. vicina* is a specialist on Apache Plume, *Fallugia paradoxa*. Females are consistently caught only on this shrub.

Taxonomic Status: *Perdita vicina* Timberlake belongs to the *ventralis* group, subgroup *ventralis* of the subgenus *Perdita*. Only the male was known prior to our study. Collections have resulted in numerous female and male specimens from the same collecting event—allowing us to associate them.

Comments: *Perdita vicina* is frequently found on Apache Plume in association with *Perdita fallugiae*, another species being evaluated. The Mojave Mountain Perdita is less common and not present at a number of sites where *P. fallugiae* occurs. The reason for this is unclear and

may relate to restriction to a single pollen source. *Perdita fallugiae* is polylectic, visitng a variety of flowering systematic sampling in the Newberry Mountains should be conducted to determine whether the range of *P. vicina* extends into this potential habitat.

References: Timberlake 1962.



Perdita xerophila discrepans
Desert-loving Perdita

***Perdita xerophila discrepans* male**

Distribution: Endemic to the eastern Mojave Desert. Extralimital records are Santa Clara, Washington Co., Utah; Mercury, Nye Co., Nevada; and Providence Mountains, San Bernardino Co., California. Collections in 2004 were minimal, but those in 2005 significantly increased the number of known populations of this bee. Populations are at mid elevations throughout Clark County.

Habitat: Creosote scrub, mixed desert scrub, and blackbrush.

Phenology: Apparently two generations. Flight period from late spring through summer. Records range from April 29 to June 17 and 10 August to 7 September.

Nesting Biology: Nesting biology is unknown. Presumably the bee nests in the ground, as do other *Perdita*. It appears to avoid sandy substrates—it was not present in any of the collections on its host plant, *Eriogonum*, in sandy areas.

Floral Preferences: Specialist on both annual and perennial buckwheats (*Eriogonum*).

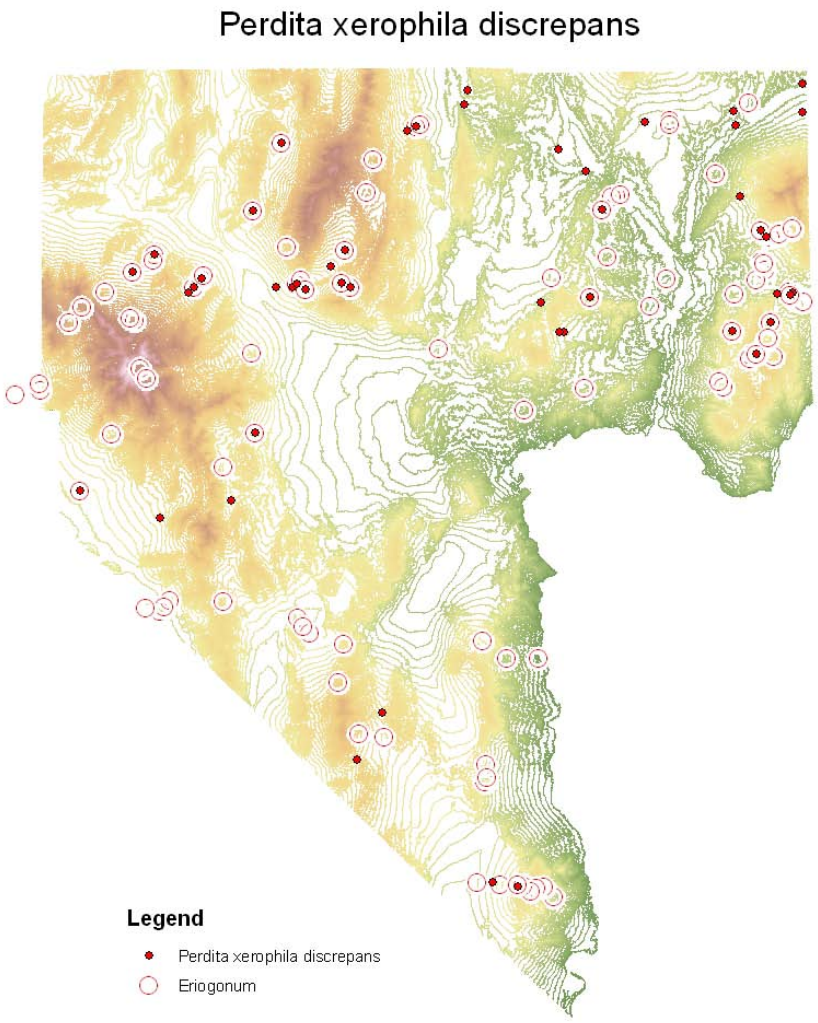
***Perdita xerophila discrepans* female**

Taxonomic Status: *Perdita xerophila discrepans* Timberlake is one of a complex of three subspecies of *P. xerophila*. *Perdita xerophila xerophila* is found in the lower Sonoran Desert (Imperial and Riverside Counties, California; Yuma County, Arizona). *Perdita xerophila fuscicornis* is from Inyo County, California. The status of these subspecies is unclear. Distinctive morphological features suggest that *P. xerophila discrepans* is in fact, a distinct species. Further taxonomic study is needed to answer this question.

Comments: *Perdita xerophila discrepans* appears to be only sporadically present on populations of its host plant. In 2005 we resampled sites where *P. xerophila discrepans* was present in 1998 and/or 2004. The bee was absent from many sites. This situation demonstrates that challenges to developing robust distributional data.

References: Timberlake 1962.

Eriogonum
G.A. Cooper @ USDA-NRCS PLANTS Database



Appendix B.

Locations for evaluation and watch bee species in Clark Co., Nevada (Geographic coordinates in UTM's)

Genus and Species	*Location Description*	*Easting*	*Northing*
Ancylandrena koebelei			
	Beehive Rock, W	717021	4031036
	Black Rdg, 4.16 mi NW	737607	4053379
	Blue Point Spring	731141	4031124
	Glendale, Nevada	716145	4058955
	Grand Gulch Road, 22 air mi S Mesquite	757807	4033081
	Las Vegas, 21 km NW	651540	4021628
	Overton Beach, W,	735737	4035968
	Riverside to Freeway	747904	4072346
	Rogers Spr., 0.55 mi S	729105	4027945
	Saint Thomas Gap	757807	4033081
	Sawmill Road	682115	4069080
	St. Thomas Gap	757807	4033081
	St. Thomas Road	732338	4038337
	Stewarts Point, NW	732329	4029213
Andrena balsamorhizae			
	Bitter Spring Valley	717493	4012175
	Bitter Spring Valley	718420	4011088
	Blue Point Spring	730535	4029165
	Blue Point Spring, 2 mi NE	731034	4031751
	Callville Bay Rd	701467	4005129
	East Las Vegas, 4.4 km NE	680916	3998020
	Echo Bay, 5 mi NW	729456	4028458
	Echo Wash, .5 mi from N shore road	725411	4019038
	Echo Wash, 1.2 mi from N shore road	725440	4017928
	Echo Wash, 1.5 mi from N shore road	724513	4019015
	Echo Wash, 1.9 mi from N shore road	724541	4017905
	Echo Wash, 10.1 mil from N shore road	715393	4024335
	Echo Wash, 2.8 mi W Echo Bay Road	726292	4020282
	Echo Wash, S	725411	4019038
	Government Wash	694345	4001638
	Government Wash, E	696145	4001678
	Government Wash, E	696120	4002787
	Gypsum Wash, E	689556	4014852
	Lake Mead		
	Las Vegas Bay, 1.5 mi W	689639	3998873
	Las Vegas Wash	689018	3998191
	Lime Ridge, E	745693	4032914
	Mud Wash	747360	4037403

Genus and Species	*Location Description*	*Easting*	*Northing*
Andrena balsamorhizae			
	Mud Wash	748288	4036319
	North Las Vegas, 18 km E	686104	4008118
	North Las Vegas, 7.6 mi E	681759	4008710
	Overton	728849	4047564
	Overton Beach	736381	4036109
	Overton Beach and North Shore Drive jct	732683	4036070
	Overton, 10 mi S	731299	4039734
	Overton, 12 mi S	730577	4036550
	Rainbow Garden, Las Vegas	680016	3998001
	Razorback Ridge, E	717521	4011065
	Rogers Spring	729251	4028669
	Rogers Spring	729936	4029168
	Rogers Spring	729667	4028032
	St. Thomas Road	732338	4038337
	Stewart Bay, .98 mi from North Shore Dr.	732827	4031299
	Stewart Point	732329	4029213
	Valley of Fire	721967	4038440
	Valley of Fire Wash, Lake Mead NRA	731375	4032218
	White Basin	715393	4024335
Atoposmia rufifemur			
	Black Mtn., 0.63 mi S	704107	3928867
	Boulder Dam, Nevada	704254	3988543
	Callville Bay, 2.5 km NW	703318	4002952
	Hidden Valley	662647	3963261
	Horse Spring Wash	756885	4027834
	Horse Spring, 0.7 mi WNW	756573	4026820
Megandrena mentzeliae			
	Arrow Cyn, 2.44 mi E	702726	4066437
	Baseline Mesa, 1.61 mi S	725764	4034618
	Beehive Rock, W	717021	4031036
	Bitter Spring Valley	713925	4010976
	Bitter Spring Valley	717493	4012175
	Black Mesa, SW	698845	4001739
	Blue Point Spr.	730553	4030209
	Boxcar Cove, N	698819	4002848
	Callville Bay, NW	700568	4005108
	Castle Rck, 3.75 mi NW	652313	4033877
	Coyote Springs Valley	683781	4074666
	Dead Man Wash	695457	4071595
	Echo Hills, S, 14.3 mi N Callville	721061	4013375
	Echo Wash	725411	4019038
	Elbow Canyon	678567	4067895

Genus and Species	*Location Description*	*Easting*	*Northing*
Megandrena mentzeliae			
	Elbow Canyon	680352	4067933
	Elbow Cyn., 0.5 mi NE	680390	4068581
	First Canyon, 2.19 mi S	652674	4033838
	Fossil Rdg, 2.39 mi NE	655963	4032590
	Fossil Ridge, S	656890	4031957
	Gale Hills, 3.23 mi S	703531	4007547
	Glendale, 1.8 mi NW	715374	4060971
	Glendale, 10 mi W	704335	4067695
	Glendale, 15 mi W	697445	4071662
	Glendale, 2.9 mi NW	713586	4060927
	Glendale, 20 mi W	689595	4073043
	Glendale, 8 mi W	705787	4064304
	Government Wash	694345	4001638
	Grassy Canyon, 5.37 mi SE	644745	4018702
	Harris Springs Canyon, N	644560	4018426
	Juanita Springs Ranch	747128	4059330
	Las Vegas, NW	652622	4019674
	Little Virgin Peak, 3.6 mi NW	744270	4058915
	McKay Wash, W	697242	4071636
	Meadow Valley Wash	711634	4067540
	Moapa, N	712637	4063124
	Mormon Mesa	730867	4050271
	Mud Wash	747360	4037403
	Mud Wash	748288	4036319
	Mud Wash, W	749185	4036345
	Muddy Peak, 3.4 mi NNE	708618	4024840
	Overton, NE	730957	4046942
	Riverside to Freeway	747904	4072346
	Riverside, Nevada	748282	4069235
	Rogers Spr., 0.55 mi S	729105	4027945
	Sawmill Road	683877	4070228
	Sawmill Road	681222	4069061
	Sheep Range	655953	4034159
	Spring Mountains, 13 mi NW Las Vegas	651225	4013916
	St. Thomas Road	732338	4038337
	Starvation Flat	686482	4073614
	State HWY 169 & Echo Bay Rd jct.	725769	4024265
	State HWY 169 & Echo Bay Rd jct.	726194	4023499
	Stewarts Point, NW	732329	4029213
	Table Mtn., 2.5 mi E	698428	4070835
	Table Mtn, 1.86 mi NE	696830	4071847
	The Narrows, 2.34 mi SE	723722	4054126

Genus and Species	Location Description	Easting	Northing
Megandrena mentzeliae			
	Tramp Rdg, 2.88 mi W	748184	4024844
	Valley of Fire	721967	4038440
	Wechech Basin, 2.16 mi SW	755235	4038290
	Wildcat Wash, E	692729	4073753
	Wildcat Wash, E	693621	4073773
	Yucca Gap	655953	4034159
	Yucca Gap, 0.6 mi E	657130	4034990
	Yucca Gap, 0.3 mi W	655140	4034566
Perdita bipicta			
	Fossil Ridge, 2.5 mi W	654057	4033634
Perdita celadona			
	Grand Gulch Road, 22 air mi S Mesquite	757807	4033081
	Mesquite	762647	4078550
	St. Thomas Gap	760974	4032251
Perdita cephalotes			
	Cow Spr., 6.06 mi ENE	688614	3941761
	Cow Spr., 6.33 mi NE	686541	3945319
	Cow Spr., 6.82 mi NNE	685079	3947359
	Elephant Rock, 1.61 mi WSW	725099	4033828
	Gale Hills, 3.37 mi SW	703622	4007230
	Goodsprings, SE	643634	3965151
	Juniper Mine, 8.58 mi NW	693217	3909650
	Piute Rng, 5.84 mi NE	689521	3905127
	Piute Rng, 6.99 mi NE	691254	3905410
	Red Rock Spr., 2.82 mi ENE	754124	4040249
	Yucca Gap	655953	4034159
	Yucca Gap	656850	4034176
Perdita cracens			
	Las Vegas, 5 mi S	664090	3994914
Perdita crotonis caerulea			
	Glendale, Nevada	716145	4058955
	Mesquite	762647	4078550
	Riverside to Freeway	747904	4072346
	Riverside, Nevada	748282	4069235
	St. Thomas Gap	757807	4033081
	Beehive Rck, 0.69 mi N	719578	4033280
	Black Ridge, S	740034	4042749
	Black Wash	762734	4033414
	Bowman Reservoir, E	726246	4055700
	Christmas Tree Pass, W	703773	3904177

Genus and Species	Location Description	Easting	Northing
	Mormon Mesa	734825	4069256
Perdita crotonis caerulea			
	Mormon Mtn, 8.28 mi SE	734217	4069366
	Overton, E	730957	4046942
	Riverside, NW	747264	4071828
	Riverside, SW	744839	4062873
	St. Thomas Gap	760974	4032251
	St. Thomas Gap, 0.4 mi E	760620	4032979
	Silica Dome, 0.65 mi WNW	723070	4037203
	Toquop Wsh, 0.27 mi NEN	751118	4073436
	Valley of Fire State Park	722289	4035611
	Valley of Fire	719628	4034433
Perdita euphorbiana			
	Black Wash, 35J	762734	4033414
	Mormon Mesa	734825	4069256
	St. Thomas Gap	757807	4033081
	St. Thomas Gap	760974	4032251
Perdita exusta			
	Beehive Rock, W	717021	4031036
	Blue Point Spr.	730553	4030209
	Glendale, 20 mi E	730670	4036263
	Glendale, 32 mi SE	725454	4023141
	Las Vegas Dunes	683220	4016936
	Las Vegas Dunes, 12	683220	4016936
	Logandale	724588	4055410
	Magnesite Wash, E	721250	4041136
	Mesquite, 14 mi SW	746447	4068318
	Overton, 8 mi S	729705	4036946
	Riverside to Freeway	747904	4072346
	St. Thomas Wash, 3	730387	4034713
	Valley of Fire State Park	722289	4035611
Perdita fallugiae			
	Ash Creek Spr., 1.2 mi W	639193	4002571
	Big Tiger Wash, 14 mi W Searchlight	668699	3930084
	Big Tiger Wash, NE	667813	3928958
	Bunkerville Ridge, NE	762715	4063403
	Bunkerville Ridge, NE	762749	4062293
	Bunkerville Ridge, NE	762715	4063403
	Cabin Canyon	760837	4060445
	Cabin Canyon Road, 12 mi S Mesquite	761052	4058780
	Calico Hills	639420	4002808
	Calico Hills, W, 6A	639438	4001699
	Cold Creek	613855	4031283

Genus and Species	Location Description	Easting	Northing
	Cottonwood Pass Road	640622	3983964
Perdita fallugiae			
	Crescent Peak, W, 27W	667854	3926739
	Deadman Cyn, 2.65 mi W	653085	4055075
	Fletcher Peak, 2.9 mi ESE	628177	4014924
	Fossil Ridge, 2.4 mi N	658211	4038051
	Fourth Of July Mtn., 1.3 mi ENE	696296	3926824
	Gass Spring, 0.71 mi ENE	665604	4033136
	Gold Butte, 4 mi NE	755305	4022333
	Grapevine Cyn, 3.26 mi S	637754	4014789
	Grapevine Spr., 2.4 mi SW	633426	4015059
	Harris Spr., 2.25 mi NW	629034	4014808
	Harris Sprs., 2.3 mi NNE	632098	4015132
	Harris Spr., 2.3 mi NNW	629426	4014918
	Harris Spr., 2.45 mi NNE	632578	4015114
	Hiko Spr., 0.2 mi W	711177	3894084
	Hidden Vly, 3.02 mi SW	660444	3966444
	Icebox Cyn., 0.4 mi E	636372	4001641
	Indian Ridge, 0.2 mi S	618671	4035772
	Indian Ridge, 0.9 mi E	622275	4037664
	Indian Ridge, 2.21 mi E	623096	4038447
	Kyle Canyon	637429	4014982
	Kyle Canyon	644560	4018426
	Kyle Canyon, 4500 ft.	639345	4015737
	Kyle Canyon, 5500 ft.	632504	4014850
	Kyle Canyon, 5600 ft.	632558	4015156
	Kyle Canyon, 6000 ft.	629870	4014555
	Kyle Canyon, 6200 ft.	629921	4016201
	Kyle Canyon, 6500 ft.	628253	4015942
	Kyle Canyon	634734	4014940
	Kyle Canyon	637429	4014982
	Kyle Canyon,	636831	4015250
	Lee Canyon	624693	4025885
	Lee Canyon	627889	4029580
	Lime Kiln Canyon	767253	4061322
	Lovell Cyn.	628364	3997252
	Lovell Summit, W	619646	4001405
	Lovell Wash	629624	3996000
	Lovell Wash	629640	3994891
	Lovell Wash, E	629657	3993781
	Lucky Strike Canyon	638994	4029432
	Mclanahan Spr., 2.2 mi S	664424	3947877
	Mormon Pass	669029	4053273

Genus and Species	Location Description	Easting	Northing
	Mormon Well	669857	4056619
Perdita fallugiae			
	Mormon Well Road	647905	4032908
	Mormon Well Road	670099	4044415
	Mormon Well Road	669029	4053273
	Mormon Well Road	670928	4047761
	Mormon Well Road	670099	4044415
	Mormon Well Road	670950	4046652
	Mormon Well, 2.21 mi N	653001	3962486
	Mormon Well, N, 38L	670685	4059965
	Mormon Well, N, 39E	670663	4061074
	Mountain Springs Summit, SE	636999	3985017
	Mountain Springs, NW	629755	3987126
	Mountain Springs, NW	630640	3988248
	Mountain Springs, W	629772	3986016
	Mule Spr., 0.6 mi SW	627114	3987732
	Mule Spr., 1.4 mi E	630161	3988389
	Mormon Well, 0.3 mi NW	669818	4057425
	Mormon Well, 1.8 mi N	670760	4059970
	Mule Spr., 2.0 mi NE	629712	3991381
	Peek a Boo Canyon	665686	4040999
	Peek a Boo Canyon	667456	4042143
	Peek a Boo Canyon, N	665686	4040999
	Potosi Mtn, 5.43 mi SE	641435	397607
	Potosi Mtn, 7.86 mi W	622035	3979933
	Red Rock Wash	635839	4001642
	Red Rock Wash, S	638556	4000575
	Sandstone Quarry, RRCNCA	639413	4003040
	Sawmill Cyn.	670454	4062603
	Sawmill Road	671534	4062202
	Sawmill Road	674192	4063365
	Sheep Range	655953	4034159
	South Spr., 1.1 mi W	629390	3995039
	Stateline Pass, SE	639395	3947331
	Telephone Canyon, S	630259	4013762
	Trout Cyn.	615048	4001558
	Trout Cyn.	616119	4002420
	Trout Cyn.	616594	4002789
	Trout Cyn.	618295	4004051
	Twin Buttes, 2.2 mi ENE	669456	4050627
	Twin Buttes, 2.4 mi NE	669070	4052132
	Wallace Canyon	607799	4013455
	Wheeler Wash, N	603294	4014509
	Wheeler Wash, W	601524	4012270

Genus and Species	Location Description	Easting	Northing
	Wheeler Pass, 3.7 mi NE	612805	4031210
Perdita fallugiae			
	White Rock Hills, E	638503	4003903
	White Rock Spring	637604	4003889
	White Rock Spr., 1.5 mi SW	635422	4002383
	Whitney Pass, W	761434	4046703
	Whitney Pass, 2.6 mi NW	760201	4049889
	Willow Spr., 3.5 mi NW	634565	4003103
	Willow Spring picnic area, Red Rock Wash	635822	4002751
	Wilson Pass, SE	635435	3969459
	Wilson Pass, W	631806	3970514
	Yucca Gap, 0.3 mi W	655140	4034566
	Wilson Pass, W	634515	3970555
Perdita flaviceps			
	Las Vegas	662657	4004659
Perdita fulvescens			
	Moapa	710759	4059716
	Riverside, 4.5 mi W		
Perdita inornata			
	Azure Ridge, S	759810	4011114
	Bootleg Spr., 2.6 mi WSW	630210	3989437
	Buck Spr., 1.5 mi SE	611079	4020632
	Cave Spr., 1.4 mi SE	635019	3970429
	Charleston Mountains, Willow Creek Camp	611948	4032337
	Gass Spring, 0.71 mi ENE	665604	4033136
	Keystone Wash	631856	3967186
	Lovell Cyn.	628556	3998391
	Lovell Cyn.	628918	3996056
	Lovell Summit, W	619646	4001405
	Lovell Wash	629640	3994891
	Mormon Mesa	733902	4070341
	Mormon Well Road	670099	4044415
	Mountain Springs, NW	629755	3987126
	Peek-A-Boo Cyn.	665535	4041295
	Peek-A-Boo Cyn.	667004	4042614
	Peek-A-Boo Cyn.	670024	4045949
	Spr Mtn, 2.02 mi NE	639170	3964866
	Wheeler Well, 2.5 mi S	605575	4021864
	White Rck Hills, 1.48 mi E	637801	4004143
	White Rck Spr, 0.27 mi ESE	636935	4004234
	Willow Creek Camp	611948	4032337
	Willow Peak, 2.6 mi N	610680	4031656
	Willow Spr., 3.5 mi NW	634565	4003103

Genus and Species	Location Description	Easting	Northing
	Wilson Pass, W	632709	3970527
Perdita meconis			
	Callville Wash	725370	4013689
	Callville Wash, W	705013	4007432
	Echo Bay		
	Echo Wash, S	725411	4019038
	Echo Wash, upper	725208	4019921
	Elbow Range, E	683805	4073556
	Fire Cove	733137	4032566
	Government Wash, W	693445	4001618
	Hidden Valley	662647	3963261
	Jean Lake, 2.24 mi ENE	662160	3964609
	Lake Mead, Hamblin Mountain	711639	4006326
	Las Vegas Blvd & Pabco Road	686276	3985924
	Lovell Wash, Lake Mead NRA	705794	4008287
	McKay Wash	698160	4070547
	Mud Wash	747360	4037403
	Overton Beach Road jct.	731946	4035680
	Red Bluff Spr., 2.0 mi SE	748525	4036683
	Red Bluff Spr., 2.7 mi ESE	749801	4036449
	Rogers Spring, N	729936	4029168
	Sandy, E	631939	3961640
	Sandy, NE	630953	3967173
	St. Thomas Road	732338	4038337
	Stewart Bay Junction	730928	4030317
	Stewart Point	732329	4029213
	Stewarts Bay	732880	4030986
Perdita nevadiana			
	Valley of Fire	721967	4038440
Perdita vespertina			
	Glendale, Nevada	716145	4058955
	Grand Gulch Road, 22 air mi S Mesquite	757807	4033081
	Las Vegas Dunes, 12	683220	4016936
	Mesquite	762647	4078550
	Mesquite, 30H	761380	4077802
	Overton, SE	730121	4044699
	Riverside to Freeway	747904	4072346
	St. Thomas Gap	760974	4032251
	St. Thomas Gap, 0.4 mi E St.	760620	4032979
	Wechech Basin, 2.16 mi SW	755235	4038290
	Whitney Pocket, 3.9 mi SSW	755045	4039308
Perdita vicina			
	Ash Creek Spr., 1.2 mi W	639193	4002571

Genus and Species	Location Description	Easting	Northing
	Bunkerville Ridge, NE	762715	4063403
Perdita vicina			
	Calico Hills	639420	4002808
	Clark Canyon	611308	4020156
	Cold Creek	613855	4031283
	Columbia Pass	637310	3965050
	Cottonwood Pass Road	640622	3983964
	Deadman Cyn, 2.65 mi W	653085	4055075
	Fossil Ridge, 2.4 mi N	658211	4038051
	Harris Spr., 2.45 mi NNE	632578	4015114
	Glendale, 18 mi W	692540	4073863
	Grapevine Spr., 2.4 mi SW	633426	4015059
	Grapevine Cyn, 3.26 mi S	637754	4014789
	Indian Ridge, 0.2 mi S	618671	4035772
	Indian Ridge, 2.9 mi SW	614397	4033524
	Keystone Wash	631856	3967186
	Kyle Canyon	641004	4016149
	Kyle Canyon	644560	4018426
	Kyle Canyon, 5600 ft.	632558	4015156
	Kyle Canyon	637429	4014982
	Lee Canyon	624693	4025885
	Lee Canyon	632665	4032661
	Lee Cyn.	627889	4029580
	Lee Cyn.	630739	4031576
	Lee Cyn.	632522	4034021
	Lee Cyn.	633555	4034629
	Lime Kiln Canyon	767253	4061322
	Lovell Cyn.	628556	3998391
	Lovell Summit	619646	4001405
	Mormon Well Road	658581	4037537
	Mormon Well Road	658581	4037537
	Mountain Springs Summit, SE	636999	3985017
	Mountain Springs, NW	629755	3987126
	Mountain Springs, NW	630640	3988248
	Mountain Springs, W	629772	3986016
	Mule Spr., 1.4 mi E	630161	3988389
	Peek a Boo Canyon, N Riverside, 24 mi S	665686	4040999
	Sandy, NE	630953	3967173
	Sawmill Cyn.	670454	4062603
	Sawmill Road	677720	4065658
	Twin Buttes, 2.2 mi ENE	669456	4050627
	Virgin Mountains	757523	4061042
	Wheeler Wash, N	603294	4014509

Genus and Species	Location Description	Easting	Northing
	White Rock Hills, E	638503	4003903
Perdita vicina			
	White Rock Spring	637604	4003889
	Whitney Pass, W	760538	4046676
	Whitney Pass, W	761434	4046703
	Whitney Pass, 2.6 mi NW	760201	4049889
	Willow Spring picnic area, Red Rock Wash	635822	4002751
	Willow Spr., 3.5 mi NW	634565	4003103
	Wilson Pass, W	631806	3970514
	Wilson Pass, W	632709	3970527
	Wilson Pass, W	634515	3970555
Perdita xerophila discrepans			
	Arden, 11 mi W	640605	3986615
	Beehive Rock, 1.36 mi W	717506	4031797
	Black Hills, 1.46 mi W	644491	4049337
	Browns Spring Dry, 4.42 mi E	607976	3988400
	Buffington Pockets, 0.86 mi NNW	706756	4030348
	Bullion Spring, NE, 27V	668678	3931193
	Christmas Tree Pass, W	698289	3905165
	Christmas Tree Pass, W	703773	3904177
	Corn Creek Springs, E	649698	4032939
	Elbow Cyn.	677589	4067196
	Elbow Cyn.	679310	4068151
	Fossil Rdge, 2.39 mi NE	655963	4032590
	Fossil Ridge, 2.5 mi W	654057	4033634
	Gass Pk, 2.47 mi S	663844	4034012
	Gass Spring, 0.71 mi ENE	665604	4033136
	Grassy Cyn, 6.79 mi NWN	631846	4032638
	Glendale, 20 mi W	689595	4073043
	Glendale, 5 mi W	710158	4063583
	Highland Range, W	673925	3941281
	Horse Spr., 0.7 mi WNW	756573	4026820
	Indian Ridge, 0.2 mi S	618671	4035772
	Indian Rdg, 2.43 mi E	623342	4039649
	Kyle Canyon Road, 23 mi NW Las Vegas		
	Lee Cyn.	630739	4031576
	Lee Cyn.	633555	4034629
	Little Virgin Peak, 0.7 mi ESE	749526	4054079
	Mormon Well Rd	653284	4033002
	Muddy Mountains	710905	4024224
	Peek a Boo Canyon, SW	661269	4037586
	Spring Mountains, W	625313	3982623
	St. Thomas Gap, 0.4 mi E	760620	4032979

	Tramp Rdg, 2.65 mi S	753500	4020138
Genus and Species	***Location Description***	***Easting***	***Northing***
Perdita xerophila discrepans			
	Tramp Rdg, 2.88 mi W	748184	4024844
	Turtlehead Mtn, 4.18 mi SE	645601	4001457
	Weiser Rdg, 1.47 mi E	719879	4050710
	White Basin	711802	4024246
	White Sage Flat, 2.93 mi E	650441	4064082
	Whitney Pocket	755198	4045405
	Whitney Pocket, 1.6 mi WNW	754030	4046640
	Yucca Forest, 2.04 mi S	664348	4041165

Appendix C.

The known bees of Clark County.

Family	*Genus and Species*	*Floral Specialist*	*Parasite*	*Social*
Andrenidae	Ancylandrena koebelei	x		
	Ancylandrena larreae	x		
	Ancylandrena timberlakei	x		
	Andrena balsamorhizae	x		
	Andrena capricornis	x		
	Andrena coracina			
	Andrena fracta			
	Andrena impolita			
	Andrena linsleyi	x		
	Andrena livida			
	Andrena olivacea	x		
	Andrena piperi			
	Andrena prima	x		
	Andrena primulifrons	x		
	Andrena prunorum			
	Andrena quadrilimbata			
	Andrena sphaeralceae	x		
	Andrena utahensis			
	Calliopsis anomoptera	x		
	Calliopsis callops	x		
	Calliopsis chlorops	x		
	Calliopsis foleyi	x		
	Calliopsis fracta	x		
	Calliopsis helianthi	x		
	Calliopsis larreae	x		
	Calliopsis nigromaculata	x		
	Calliopsis pectidis	x		
	Calliopsis puellae	x		
	Calliopsis subalpinus	x		
	Calliopsis timberlakei	x		
	Dieunomia heteropoda	x		
	Dieunomia nevadensis			
	Megandrena enceliae	x		
	Megandrena mentzeliae	x		
	Perdita (Epimacrotera) n.sp.			
	Perdita (Glossoperdita) n.sp.			
	Perdita (Heteroperdita) n.sp.			
	Perdita (Heteroperdita) n.sp. 9			
	Perdita (Perdita) sp. A			
	Perdita (Perdita) sp. B			
	Perdita (Perdita) sp. C			
	Perdita (Perdita) sp. E			
	Perdita (Perdita) sp. F			
	Perdita (Perdita) sp. G			
	Perdita abdominalis	x		
	Perdita aff. apacheorum			

Family	*Genus and Species*	*Floral Specialist*	*Parasite*	*Social*
Andrenidae	Perdita aff. bilobata			
	Perdita aff. claypolei			
	Perdita aff. coreopsidis			
	Perdita aff. crassula			
	Perdita aff. dispar			
	Perdita aff. duplonotata n.sp.			
	Perdita aff. exigua?			
	Perdita aff. fulvicauda n.sp.?			
	Perdita aff. labergei n.sp. 3			
	Perdita aff. lateralis			
	Perdita aff. lateralis n.sp.			
	Perdita aff. megapyga n.sp.			
	Perdita aff. melanochlora			
	Perdita aff. namatophila n.sp.			
	Perdita aff. rhodogastra n.sp. 7			
	Perdita aff. rhodogastra n.sp. 8			
	Perdita aff. trimaculata n.sp.			
	Perdita aff. xanthodes n.sp.			
	Perdita albihirta geraeae	x		
	Perdita albonotata	x		
	Perdita albovittata	x		
	Perdita apacheorum			
	Perdita arenaria	x		
	Perdita ashmeadi simulans	x		
	Perdita beatula			
	Perdita bellula	x		
	Perdita bipicta	x		
	Perdita butleri			
	Perdita callicerata	x		
	Perdita celadona	x		
	Perdita cephalotes	x		
	Perdita cladothricis	x		
	Perdita clypeata	x		
	Perdita clypeata clypeata	x		
	Perdita coldeniae	x		
	Perdita compta	x		
	Perdita covilleae	x		
	Perdita cracens	x		
	Perdita crotonis caerulea	x		
	Perdita cuspidata	x		
	Perdita dasylirii			
	Perdita dicksoni	x		
	Perdita difficilis	x		
	Perdita digressa			
	Perdita dubia parilis			
	Perdita duplonotata			
	Perdita elegans			
	Perdita eremica	x		
	Perdita eriastri fusciventris?	x		

Family	*Genus and Species*	*Floral Specialist*	*Parasite*	*Social*
Andrenidae	Perdita eucnides			
	Perdita euphorbiae	x		
	Perdita euphorbiana	x		
	Perdita exclamans	x		
	Perdita eximia	x		
	Perdita exusta	x		
	Perdita falcata			
	Perdita fallugiae	?		
	Perdita flavicauda			
	Perdita heliotropii heliotropii	x		
	Perdita hirticeps apicata	x		
	Perdita holoxantha			
	Perdita innotata	x		
	Perdita inornata			
	Perdita koebelei	x		
	Perdita koebelei koebelei	x		
	Perdita larreae	x		
	Perdita lucens	x		
	Perdita luciae decora	x		
	Perdita luculenta			
	Perdita maculosa	x		
	Perdita malacothricis	x		
	Perdita mandibularis	x		
	Perdita meconis	x		
	Perdita melanochlora	x		
	Perdita minima	x		
	Perdita mohavensis	x		
	Perdita mohavensis?			
	Perdita n.sp. 10			
	Perdita n.sp. aff. dasylirii			
	Perdita n.sp. aff. duplonotata			
	Perdita n.sp. aff. megapyga ?			
	Perdita n.sp. aff. portalis			
	Perdita nasuta	x		
	Perdita nasuta nasuta	x		
	Perdita nigridia	x		
	Perdita optiva	x		
	Perdita ovaliceps	x		
	Perdita pallida	x		
	Perdita pallidipes	x		
	Perdita pectidis			
	Perdita phymatae			
	Perdita plucheae	x		
	Perdita polycarpae	x		
	Perdita polytropica			
	Perdita prosopidis	x		
	Perdita punctosignata flava	x		
	Perdita punctosignata sulphurea	x		
	Perdita punctulata	x		

Family	*Genus and Species*	*Floral Specialist*	*Parasite*	*Social*
Andrenidae	Perdita rhodogastra	x		
	Perdita robustula	x		
	Perdita sexfasciata	x		
	Perdita sexmaculata			
	Perdita sexnotata			
	Perdita sonorensis	x		
	Perdita sphaeralceae group n.sp.			
	Perdita stathamae	x		
	Perdita stathamae eluta			
	Perdita stenopyga			
	Perdita stephanomeriae	x		
	Perdita subfasciata	x		
	Perdita thermophila trilobata	x		
	Perdita tortifoliae	x		
	Perdita triangulifera	x		
	Perdita turgiceps			
	Perdita utahensis	x		
	Perdita vespertina	x		
	Perdita vicina	x		
	Perdita xerophila	x		
	Perdita xerophila discrepans	x		
	Perdita zonalis group n.sp.			
	Protandrena aff. parvus n.sp.			
	Protandrena aff. townsendi n.sp.			
	Protandrena heteromorpha			
	Pseudopanurgus pectiphilus	x		
Apidae	Anthophora (Anthophoroides) n.sp.2			
	Anthophora aff. estebana			
	Anthophora aff. salazariae			
	Anthophora affabilis	x		
	Anthophora californica			
	Anthophora centriformis			
	Anthophora cinerula			
	Anthophora cinerula ms. n.			
	Anthophora coptognatha			
	Anthophora curta			
	Anthophora dammersi			
	Anthophora estebana			
	Anthophora fulvicauda			
	Anthophora hololeuca	x		
	Anthophora lesquerellae			
	Anthophora linsleyi			
	Anthophora mortuaria			
	Anthophora neglecta			
	Anthophora pachyodonta			
	Anthophora petrophila	x		
	Anthophora porterae	x		
	Anthophora salazariae			
	Anthophora signata			

Family	*Genus and Species*	*Floral Specialist*	*Parasite*	*Social*
Apidae	Anthophora squammulosa			
	Anthophora urbana			
	Anthophora ursina			
	Anthophora vannigera			
	Anthophorula aff. albata			
	Anthophorula aff. palmarum			
	Anthophorula aff. tricinctula n. sp.			
	Anthophorula albata			
	Anthophorula albovestita			
	Anthophorula compactula			
	Anthophorula deserticola			
	Anthophorula eriogoni			
	Anthophorula gutierreziae			
	Anthophorula palmarum			
	Anthophorula rufiventris			
	Apis mellifera			x
	Bombus crotchii			x
	Bombus edwardsii			x
	Bombus fervidus			x
	Bombus huntii			x
	Bombus morrisoni			x
	Bombus sonorus			x
	Bombus sonorus?			x
	Bombus vosnesenskii			x
	Centris atripes			
	Centris cockerelli			
	Centris hoffmanseggiae	x		
	Centris pallida	x		
	Centris rhodopus			
	Ceratina apacheorum			
	Ceratina arizonensis			
	Ceratina nanula			
	Ceratina pacifica			
	Diadasia australis	x		
	Diadasia australis australis	x		
	Diadasia diminuta	x		
	Diadasia diminuta/lutzi	x		
	Diadasia enavata	x		
	Diadasia lutzi	x		
	Diadasia martialis	x		
	Diadasia ochracea	x		
	Diadasia palmarum	x		
	Diadasia rinconis	x		
	Diadasia sphaeralcearum	x		
	Diadasia sphaeralcearum affinis	x		
	Diadasia tuberculifrons	x		
	Diadasia vallicola	x		
	Eucera actuosa			
	Eucera albescens			

Family	*Genus and Species*	*Floral Specialist*	*Parasite*	*Social*
Apidae	Eucera amsinckiae			
	Eucera fulvitarsis fulvitarsis			
	Eucera mohavensis			
	Eucera primaveris			
	Eucera quadricincta			
	Eucera territella			
	Eucera venusta venusta			
	Exomalopsis solidaginis	x		
	Habropoda cineraria			
	Habropoda pallida	x		
	Halictus farinosus			
	Halictus ligatus			
	Halictus rubicundus			
	Halictus tripartitus			
	Hexepeolus rhodogyne		x	
	Holcopasites arizonicus		x	
	Macrotera aff. portalis n.sp.			
	Macrotera arcuata	x		
	Macrotera latior	x		
	Macrotera mellea	x		
	Macrotera mortuaria	x		
	Martinapis occidentalis			
	Melecta pacifica		x	
	Melecta thoracica		x	
	Melissodes agilis	x		
	Melissodes bimatris	x		
	Melissodes brevipyga	x		
	Melissodes limbus			
	Melissodes ochraea	x		
	Melissodes opuntiella			
	Melissodes paroselae			
	Melissodes semilupina	x		
	Melissodes tepida yumensis			
	Melissodes tristis	x		
	Melissodes utahensis	x		
	Melissodes verbesinarum	x		
	Melissodes vernalis	x		
	Neolarra aff. batrae		x	
	Neolarra aff. linsleyi		x	
	Neolarra aff. vigilans		x	
	Neolarra californica		x	
	Neolarra cockerelli		x	
	Neolarra verbesinae		x	
	Nomada (Holonomada) n. sp. 2		x	
	Nomada (Nomada) sp. 2		x	
	Nomada (Nomada) sp. 3		x	
	Nomada (Nomada) sp. 4		x	
	Nomada crotchii		x	
	Nomada edwardsii		x	

Family	*Genus and Species*	*Floral Specialist*	*Parasite*	*Social*
Apidae	Nomada suavis		x	
	Nomada texana		x	
	Nomia tetrazonata tetrazonata		x	
	Oreopasites arizonica		x	
	Peponapis pruinosa	x		
	Svastra helianthelli?	x		
	Svastra machaerantherae			
	Svastra obliqua expurgata	x		
	Tetraloniella eriocarpi			
	Townsendiella pulchra		x	
	Triopasites penniger		x	
	Xeralictus bicuspidariae		x	
	Xeromelecta californica		x	
	Xeromelecta larreae		x	
	Xylocopa californica californica			
	Xylocopa tabaniformis androleuca			
	Xylocopa tabaniformis orpifex			
	Xylocopa varipuncta			
	Zacosmia maculata		x	
Colletidae	Colletes aff. algarobiae			
	Colletes aff. perileucus			
	Colletes aff. petalostemonis			
	Colletes algarobiae			
	Colletes cercidii			
	Colletes clypeonitens	x		
	Colletes covilleae			
	Colletes daleae	x		
	Colletes daleae group sp. 1			
	Colletes deserticola	x		
	Colletes kincaidii			
	Colletes larreae	x		
	Colletes louisae	x		
	Colletes phaceliae			
	Colletes prosopidis	x		
	Colletes salicicola			
	Colletes scopiventer			
	Colletes slevini			
	Colletes sphaeralceae	x		
	Colletes tectiventris	x		
	Hylaeus (Paraprosopis) n.sp.			
	Hylaeus asininus			
	Hylaeus episcopalis coquilletti			
	Hylaeus mesillae cressoni			
	Hylaeus sejunctus			
	Hylaeus verticalis			
	Hylaeus wootoni			
Halictidae	Agapostemon angelicus			
	Agapostemon angelicus/texanus			
	Agapostemon femoratus			

Family	*Genus and Species*	*Floral Specialist*	*Parasite*	*Social*
Halictidae	Agapostemon melliventris			
	Agapostemon texanus			
	Augochlorella pomoniella			
	Conanthalictus aff. mentzeliae n.sp.			
	Conanthalictus bakeri	x		
	Conanthalictus caerulescens	x		
	Conanthalictus minor	x		
	Dufourea desertorum	x		
	Dufourea longiceps	x		
	Dufourea nudicornis	x		
	Dufourea sandhouseae	x		
	Dufourea vandykei	x		
	Dufourea vernalis	x		
	Lasioglossum aff. petrellus			
	Lasioglossum argemonis			
	Lasioglossum clarissimus			
	Lasioglossum egregium			
	Lasioglossum hudsoniellus			
	Lasioglossum hunteri			
	Lasioglossum hyalinus			
	Lasioglossum impavidus			
	Lasioglossum incompletus			
	Lasioglossum kunzei			
	Lasioglossum lampronotum			
	Lasioglossum lusoria			
	Lasioglossum microlepoides			
	Lasioglossum sp. M3			
	Lasioglossum sp. M4			
	Lasioglossum nevadensis			
	Lasioglossum ovaliceps			
	Lasioglossum pectoraloides			
	Lasioglossum perparvus			
	Lasioglossum pruinosiformis			
	Lasioglossum pulveris			
	Lasioglossum sisymbrii			
	Lasioglossum sp. 19			
	Lasioglossum sp. 24			
	Lasioglossum sp. M1			
	Lasioglossum sp. M12			
	Lasioglossum sp. M13			
	Lasioglossum sp. M15			
	Lasioglossum sp. M16			
	Lasioglossum sp. M17			
	Lasioglossum sp. M18			
	Lasioglossum sp. M19			
	Lasioglossum sp. M2			
	Lasioglossum sp. M20			
	Lasioglossum sp. M3			
	Lasioglossum sp. M4			

Family	*Genus and Species*	*Floral Specialist*	*Parasite*	*Social*
	Lasioglossum sp. M5			
	Lasioglossum sp. M6			
	Lasioglossum sp. M7			
	Lasioglossum sp. M9			
	Lasioglossum tegulariformis			
	Protodufourea eickworti	x		
	Sphecodes sp. 1		x	
	Sphecodes sp. 2		x	
	Sphecodes sp. 3		x	
	Sphecodes sp. 4		x	
Megachilidae	Anthidiellum ehrhorni			
	Anthidiellum notatum notatum			
	Anthidiellum notatum robertsoni			
	Anthidium atripes	x		
	Anthidium cockerelli			
	Anthidium collectum	x		
	Anthidium emarginatum	x		
	Anthidium formosum			
	Anthidium illustre	x		
	Anthidium jocosum			
	Anthidium maculosum			
	Anthidium mormonum	x		
	Anthidium pallidiclypeum			
	Anthidium palmarum	x		
	Anthidium paroselae			
	Anthidium tenuiflorae	x		
	Ashmeadiella (Arogochila) sp.			
	Ashmeadiella aff. rubrella			
	Ashmeadiella aff. salviae n.sp.			
	Ashmeadiella aridula	x		
	Ashmeadiella australis	x		
	Ashmeadiella barberi			
	Ashmeadiella bigeloviae			
	Ashmeadiella breviceps			
	Ashmeadiella bucconis	x		
	Ashmeadiella cactorum			
	Ashmeadiella cactorum basalis			
	Ashmeadiella cactorum cactorum			
	Ashmeadiella californica	x		
	Ashmeadiella cazieri	x		
	Ashmeadiella cubiceps clypeata	x		
	Ashmeadiella difugita			
	Ashmeadiella erema			
	Ashmeadiella eurynorhyncha			
	Ashmeadiella femorata			
	Ashmeadiella foveata			
	Ashmeadiella gillettei			
	Ashmeadiella holtii			
	Ashmeadiella hurdiana			

Family	*Genus and Species*	*Floral Specialist*	*Parasite*	*Social*
Megachilidae	Ashmeadiella leachi			
	Ashmeadiella leucozona	x		
	Ashmeadiella meliloti			
	Ashmeadiella opuntiae			
	Ashmeadiella prosopidis	x		
	Ashmeadiella rhodognatha	x		
	Ashmeadiella rubrella	x		
	Ashmeadiella rufipes			
	Ashmeadiella rufitarsis	x		
	Ashmeadiella salviae	x		
	Ashmeadiella sonora			
	Ashmeadiella timberlakei	x		
	Ashmeadiella xenomastax	x		
	Atoposmia (Atoposmia) n.sp. 3			
	Atoposmia aff. triodonta			
	Atoposmia arizonensis	x		
	Atoposmia copelandica	x		
	Atoposmia daleae	x		
	Atoposmia enceliae	x		
	Atoposmia hypostomalis	x		
	Atoposmia mirifica	x		
	Atoposmia namatophila			
	Atoposmia nitidivitta	x		
	Atoposmia pycnognatha	x		
	Atoposmia pycnognatha solata	x		
	Atoposmia robustula	x		
	Atoposmia rufifemur			
	Atoposmia rupestris	x		
	Atoposmia segregata			
	Atoposmia timberlakei			
	Atoposmia triodonta	x		
	Atoposmia viguierae	x		
	Chelostoma cockerelli	x		
	Chelostoma marginatum marginatum	x		
	Coelioxys edita		x	
	Coelioxys hirsutissima		x	
	Coelioxys mitchelli		x	
	Coelioxys novomexicana		x	
	Dianthidium arizonicum			
	Dianthidium heterulkei	x		
	Dianthidium implicatum	x		
	Dianthidium marshi			
	Dianthidium parvum parvum			
	Dianthidium platyurum platyurum	x		
	Dianthidium pudicum consimile			
	Dianthidium pudicum pudicum	x		
	Dianthidium singulare	x		
	Dianthidium ulkei	x		
	Dioxys pacificus pacificus		x	

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Megachilidae	Dioxys pomonae timberlakei		x	
	Dioxys productus subruber		x	
	Doeringiella sp. 17		x	
	Doeringiella sp. 40		x	
	Doeringiella sp. 42		x	
	Doeringiella sp. A		x	
	Doeringiella sp. B		x	
	Doeringiella sp. C		x	
	Epeolus mesillae		x	
	Ericrocis lata		x	
	Heriades cressoni	x		
	Heriades timberlakei			
	Hoplitis (Proteriades) n.sp.			
	Hoplitis (Proteriades) sp.			
	Hoplitis aff. pygmaea			
	Hoplitis biscutellae	x		
	Hoplitis deserticola	x		
	Hoplitis grinnelli			
	Hoplitis hamulicornis	x		
	Hoplitis incanescens	x		
	Hoplitis mojavensis			
	Hoplitis paroselae	x		
	Hoplitis producta complex			
	Hoplitis producta gracilis			
	Hoplitis producta panamintana			
	Hoplitis pygmaea	x		
	Hoplitis remotula	x		
	Hoplitis torchioi			
	Hoplitis xerophila	x		
	Hoplitis zuni	x		
	Lithurge apicalis	x		
	Lithurge echinocacti	x		
	Lithurge listrota	x		
	Megachile aff. umatillensis n.sp.			
	Megachile angelarum			
	Megachile astragali	x		
	Megachile brevis onobrychidis	x		
	Megachile browni			
	Megachile bruneri			
	Megachile casadae			
	Megachile chilopsidis			
	Megachile concinna	x		
	Megachile coquilletti			
	Megachile discorhina			
	Megachile frugalis pseudofrugalis			
	Megachile fucata			
	Megachile gentilis			
	Megachile legalis			
	Megachile lobatifrons			

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Megachilidae	Megachile mellitarsis	x		
	Megachile mojavensis			
	Megachile montivaga			
	Megachile newberryae			
	Megachile odontostoma			
	Megachile palmensis			
	Megachile policaris			
	Megachile prosopidis			
	Megachile rossi			
	Megachile sabinensis			
	Megachile sidalceae			
	Megachile soledadensis	x		
	Megachile spinotulata			
	Megachile subanograe			
	Megachile texana			
	Megachile townsendiana	x		
	Megachile xerophila			
	Osmia aff. giffardi n.sp.			
	Osmia aff. crassa n.sp.			
	Osmia calla	x		
	Osmia clarescens	x		
	Osmia densa	x		
	Osmia gaudiosa	x		
	Osmia grinnelli	x		
	Osmia kincaidii	x		
	Osmia lignaria propinqua			
	Osmia liogastra	x		
	Osmia marginata	x		
	Osmia pikei	x		
	Osmia ribifloris ribifloris			
	Osmia subfasciata			
	Osmia titusi	x		
	Osmia trevoris			
	Osmia unca			
	Protosmia rubifloris			
	Stelis aff. hemiroda?		x	
	Stelis aff. semirubra		x	
	Stelis anthocopae		x	
	Stelis anthracina		x	
	Stelis cockerelli?		x	
	Stelis hemiroda		x	
	Stelis joanae		x	
	Stelis lateralis		x	
	Stelis laticincta		x	
	Stelis mojave?		x	
	Stelis occidentalis		x	
	Stelis palmarum		x	
	Stelis perpulchra		x	
	Stelis xerophilae		x	

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Megachilidae	Trachusa bequaerti	x		
	Trachusa larreae	x		
Melittidae	Hesperapis (Carinapis) n.sp. 1			
	Hesperapis (Panurgomia) sp.			
	Hesperapis aff. elegantula n.sp.			
	Hesperapis aff. kayella n.sp.			
	Hesperapis fulvipes	x		
	Hesperapis hurdi	x		
	Hesperapis larreae	x		
	Hesperapis laticeps rufiventris	x		
	Hesperapis palpalis	x		
	Hesperapis parva			
	Hesperapis timberlakei			