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MONITORING MACNEILL'S SOOTYWING IN HABITAT CREATION SITES 2010 ANNUAL REPORT

Prepared by: Bill Wiesenborn, Wildlife Group
ABSTRACT

Habitat created in part for MacNeill's sootywing was surveyed for adult sootywings during April-September 2010. The objective of surveys was to determine if sootywings are established at restoration plots. Five plots at Cibola Valley Conservation Area (CVCA), totaling 232 acres, and three plots at Palo Verde Ecological Reserve (PVER), totaling 35 acres, were sampled. Sootywings were most abundant in the 58-acre plot at CVCA Phase 4-west, planted in March 2009, with > 200 adults counted per date during April to July along a dirt road bisecting the plot. Sootywings were absent at the near-dead, 8-acre Phase 2 plot, and low numbers of sootywings (< 8 per date) were counted at the remaining 3 CVCA quail brush plots. Sootywing populations at PVER were very low or absent. The deep-furrow irrigation used at CVCA Phase 4-west appears very effective in growing *Atriplex lentiformis* shrubs suitable as hosts for MacNeill's sootywings. We suggest deep-furrows should be used at all future plots constructed for the species. Although adult sootywings typically occur during April-September, populations in 2010 disappeared after July. This disappearance was due to drought that eliminated the skipper's perennial nectar-source, heliotrope. The population decline emphasizes the importance of maintaining adequate soil moisture during periods of low rainfall when adults are active.

INTRODUCTION

MacNeill's sootywing, *Hesperopsis gracielae* (MacNeill), is a small (wingspread = 23 mm) dark-brown butterfly (Lepidoptera: Hesperiidae; Pyrginae) found along the lower Colorado River and near the river along its tributaries in southeastern California, western Arizona, southern Nevada, and southern Utah (MacNeill 1970, Austin and Austin 1980, Scott 1986, Nelson and Anderson 1999). The species is State listed as S1 (critically imperiled) in Nevada and S2 (imperiled) or S3 (rare or uncommon but not imperiled) in Arizona and California. Flights of *H. gracielae* occur from April to October with three generations in southern Nevada (Austin & Austin 1980) and two flights in southeastern California (April & July to October, Emmel & Emmel 1973). MacNeill's sootywing appears to require shade to tolerate the high temperatures where it lives (Wiesenborn 1999).

Larvae of sootywings feed only on quail brush, *Atriplex lentiformis* (Torrey) (Chenopodiaceae), a shrub found in dense clumps along lower Colorado River drainages (Emmel & Emmel 1973). Quail brush fixes atmospheric nitrogen (Malik et al. 1991). Female sootywings oviposit on large (radius > 1.6 m) host plants with high concentrations of water (> 64%) in branches and nitrogen (> 3.2% of dry-mass) in leaves (Wiesenborn and Pratt 2008). Sources of nectar for butterflies may limit the sootywing's distribution, because *A. lentiformis* is wind pollinated and does not produce nectar. Other plant species therefore are needed by the skipper for nectar. We have observed sootywings nectar-feeding (Figs. 1-2) on eight plant species (Pratt and Wiesenborn 2009):

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Family</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heliotrope</td>
<td>Heliotropium curassavicum</td>
<td>Boraginaceae</td>
</tr>
<tr>
<td>Western purslane</td>
<td>Sesuvium verrucosum</td>
<td>Aizoaceae</td>
</tr>
<tr>
<td>Arrowweed</td>
<td>Pluchea sericea</td>
<td>Asteraceae</td>
</tr>
<tr>
<td>Alkali mallow</td>
<td>Malvella leprosa</td>
<td>Malvaceae</td>
</tr>
<tr>
<td>Screwbean mesquite</td>
<td>Prosopis pubescens</td>
<td>Fabaceae</td>
</tr>
</tbody>
</table>
Honey mesquite  *Prosopis glandulosa*  Fabaceae  yellow flowers
Tamarisk  *Tamarix ramosissima*  Tamaricaceae  white-pink flowers
Common purslane  *Portulaca oleracea*  Portulacaceae  yellow flowers

Heliotrope, and to a lesser extent western-purslane, is the plant most-used by MacNeill's sootywings as a source of nectar (Wiesenborn and Pratt 2010, Wiesenborn 2010). Sootywings visit flowers on heliotrope so frequently that the plant serves as a monitoring tool for the skipper.

Fig. 1. Adult MacNeill's sootywing visiting a flower on naturalized, common purslane (*Portulaca oleracea*) at CVCA Phase 4-west during 2009.

Fig. 2. Adult MacNeill's sootywing visiting a flower on tamarisk, *Tamarix ramosissima*, alongside the Colorado River near Blythe during 2008.
The objectives of this work task are to (1) survey MacNeill’s sootywings at MSCP restoration sites and (2) determine if new or existing sites need to be altered to ensure sootywing establishment. This work task is integrated with three other MSCP work tasks:

- C7: Survey and Habitat Characterization for MacNeill’s Sootywing
- E4: Palo Verde Ecological Reserve (PVER)
- E5: Cibola Valley Conservation Area (CVCA)

**STUDY AREAS**

Five restoration plots supporting *A. lentiformis* alone or together with *Prosopis* sp. (mesquite) were surveyed during 2010. Five plots were at CVCA and three plots were at PVER:

<table>
<thead>
<tr>
<th>Restoration Plot</th>
<th>Planted</th>
<th>Acres</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVCA Phase 2</td>
<td>2007</td>
<td>8</td>
<td>entirely quail brush, flood irrigated</td>
</tr>
<tr>
<td>CVCA Phase 3</td>
<td>2008</td>
<td>6</td>
<td>quail brush and mesquite in deep furrows</td>
</tr>
<tr>
<td>CVCA Phase 4 west</td>
<td>2009</td>
<td>58</td>
<td>quail brush and mesquite in deep furrows</td>
</tr>
<tr>
<td>CVCA Phase 4 east</td>
<td>2009</td>
<td>90</td>
<td>quail brush and mesquite in deep furrows</td>
</tr>
<tr>
<td>CVCA Phase 5</td>
<td>2010</td>
<td>70</td>
<td>quail brush and mesquite in deep furrows</td>
</tr>
<tr>
<td>PVER Phase 3</td>
<td>2008</td>
<td>6</td>
<td>quail in 4 strips within alfalfa plot, flood irrigated</td>
</tr>
<tr>
<td>PVER Phase 4</td>
<td>2009</td>
<td>11</td>
<td>mixture of quail brush, mesquite, and native grasses, flood irrigated</td>
</tr>
<tr>
<td>PVER Phase 5</td>
<td>2010</td>
<td>18</td>
<td>quail brush, mesquite, and native grasses in shallow-furrows (2 plots, north and south, separated by a dirt road)</td>
</tr>
</tbody>
</table>

**METHODS**

MacNeill’s sootywings were sampled to determine if they are absent, rare (< 10 per sampling date), or abundant at the different restoration plots. We sampled transects along *A. lentiformis* plots at CVCA 7-8 times and those at PVER 7 times during April-September 2010. Surveys for adult sootywings took place primarily on plants with nectar-producing flowers, especially heliotrope. Sampling efficiency is improved by sampling flowers, because sootywings aggregate on flowers other than *Atriplex* to obtain nectar. Transects along roads (Fig. 3) were sampled, because heliotrope and other nectar-producing plants are more abundant in disturbed areas such as along roads. Adult sootywings were sampled on quail brush along transects if nectar-producing flowers were absent. Repeated sampling of the same transects allows examining population trends through time.
Sampled transects were:

<table>
<thead>
<tr>
<th>Restoration Plot</th>
<th>Transect Sampled</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVCA Phase 2</td>
<td>entire west edge along road</td>
</tr>
<tr>
<td>CVCA Phase 3</td>
<td>entire west, south, and east edges</td>
</tr>
<tr>
<td>CVCA Phase 4 west</td>
<td>entire east-west dirt-road bisecting plot</td>
</tr>
<tr>
<td>CVCA Phase 4 east</td>
<td>entire south and east edges along roads</td>
</tr>
<tr>
<td>CVCA Phase 5</td>
<td>entire south edge along road</td>
</tr>
<tr>
<td>PVER Phase 3</td>
<td>entire west edge along drainage canal</td>
</tr>
<tr>
<td>PVER Phase 4</td>
<td>entire east edge along berm</td>
</tr>
<tr>
<td>PVER Phase 5</td>
<td>entire west edge along dirt road bordering quail brush</td>
</tr>
</tbody>
</table>

Plots were sampled during 0830-1500 PDT when air temperature was 26-38 °C and relative humidity was 20-24%. All plots were walked to locate adult and larval sootywing. Numbers of adult sootywing located were recorded, and any larval sootywings were noted.

Fig. 3. CVCA Phase 4-west viewed from west in 2010. Rows are planted quail brush and mesquite. Tamarisk, bordering the north and west edges, is spreading into the restoration plot. MacNeill's sootywing were sampled along dirt road extending eastwards through center of plot.
RESULTS

Cibola Valley Conservation Area

CVCA Phase 4-west (Fig. 4) is the only plot at either CVCA or PVER where sootywings have become well established. Adult sootywings were abundant in this plot during late April to mid-July (Fig. 5). Drought during the summer (Fig. 6) caused the sootywing's primary source of nectar, heliotrope, to die above-ground after July. This resulted in a disappearance of adult sootywings. The skipper's host plant, quail brush, remained well-watered during the drought due to irrigation.

Fig. 4. CVCA Phase 4-west during late 2010. *Atriplex lentiformis* shrubs are planted in 2-foot deep furrows.
Fig. 5. Counts of adult MacNeill’s sootywings along transect bisecting the CVCA Phase 4-west plot during 2010.

Fig. 6. Rainfall in inches at Blythe, California, during January through September 2010. Data from CIMIS station operated by California Department of Water Resources.
Low populations of adult sootywings (< 8 per date) were detected at the other CVCA quail-brush plots (Fig. 7). Sootywings were absent at Phase 2, a site containing mostly dead *A. lentiformis*. We observed a late-season upswing in sootywings at the newly-planted Phase 5. Similar to Phase 4-west, this plot contains quail brush and mesquite planted in deep furrows. Its vegetation is developing similar to Phase 4-west during 2009.

Fig. 7. Counts of MacNeill’s sootywings along transects at CVCA plots containing *Atriplex lentiformis*. 
Palo Verde Ecological Reserve

Very-low populations of MacNeill's sootywings (< 3 per date) were observed at PVER (Fig. 8). Sootywings were sparse at Phase 4 (Fig. 9) and absent at Phase 3 and the newly-planted Phase 5 (Figs. 10).

Fig. 8. Counts of adult MacNeill’s sootywings along transects at PVER plots containing *Atriplex lentiformis* during 2010. Phase 5 is divided into north and south plots, separated by a dirt road.

Fig. 9. *Atriplex lentiformis* Phase 4 plot at PVER during late 2010.
Fig. 10. Quail brush, mesquite, and native grass at PVER Phase 5, planted in spring 2010.

I terminated sampling at Phase 3 after May, because the quail brush had become swamped by alfalfa and weeds. Sootywings at Phase 4 were observed flying amongst the *A. lentiformis* shrubs growing along the north edge of the plot.

**DISCUSSION**

The quail brush plot at CVCA Phase 4-west remains the most successful restoration site for MacNeill's sootywings. The plot produces a large stand of host plants that are adequately watered. Volunteer heliotrope within the plot provides ample nectar for adult skippers. The drought during summer 2010 eliminated the heliotrope, and dependent sootywings, but did not affect the quality of host shrubs. The return of rainfall during winter 2010-2011 should enable heliotrope, a perennial, to regrow. Long-term affects to the sootywing population are not anticipated.

The likelihood of drought at the site emphasizes the importance of irrigation at the site. Quail brush is a riparian plant that we have planted in a non-riparian agricultural field. Irrigation will be needed to maintain adequate plant moisture-contents. *Atriplex lentiformis* that is not watered, as can be seen in a volunteer plot south of Phase 5, supports little or no butterflies.

The deep furrows at CVCA Phase 4-west have proven very successful. This same approach was used at CVCA Phase 5, and sootywings were colonizing this plot late during 2010 similar to their colonization of CVCA Phase 4-west during 2009. Deep furrows provide adequate water to the intended plants, quail brush and mesquite, while minimizing the water supply to weeds. Adequate watering of quail brush provides the plant water-content needed to produce shrubs suitable for sootywings (Wiesenborn and Pratt 2008). We suggest all future construction of *A. lentiformis* and *Prosopis* spp. plots use deep-furrow irrigation.
*Atriplex* plots at PVER continue to support little or no sootywings. This is most likely due to the absence of nectar-providing plants such as heliotrope. Sootywings may become more abundant if heliotrope volunteers within the plots. Planting narrow strips of quail brush within other plants, as at PVER Phase 3, also has not been successful, because the *Atriplex* has been crowded out.

Populations of sootywings are likely to change at each of the fields as they mature. For example, quail brush grows faster than mesquite due to its C₄ physiology. As plots mature, mesquite will eventually overtop the *A. lentiformis* plants, changing the vegetation structure. This likely will not decrease sootywing populations, because mesquite provides shade needed by the sootywing to control body temperature (Wiesenborn 1999).

Of interest continues to be the low populations of sootywings at CVCA Phase 3. This field appears to be suitable for *H. gracielae*. Additional work may be needed to clarify why sootywings are not colonizing the plot. Possible problems may include inadequate host-plant water and nitrogen contents, low nectar production by flowering plants, field isolation, or small field size.
LITERATURE CITED


Wiesenborn, W. D. 1999. Sunlight avoidance compared between Hesperopsis gracielae (MacNeill) (Lepidoptera: Hesperiidae) and Brephidium exilis (Boisduval) (Lepidoptera: Lycaenidae). Pan-Pacific Entomologist 75(3):147-152.

