SURVEY OF LEPIDOPTERA INHABITING THREE
DUNE SYSTEMS IN THE CALIFORNIA DESERT

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BACKGROUND INFORMATION

Lepidoptera represent a major group of insects that is dependent upon plants owing to the larval feeding habits. Therefore species which are specific to certain host plants can serve as an index of community diversity and of endemism. In general there are few examples of Lepidoptera that are highly modified for sand-dwelling, but some species or genera do specialize in this niche in the larval stage or they feed on above ground portions of plants that may be restricted to sand dunes. A survey of these kinds of Lepidoptera should provide data that could be useful in defining land-use policies.

Western Nearctic sand dune communities in general have survived a curious paradox in their relationship with man; in early colonization by European society, the 18th and 19th centuries in California, the dune systems were largely spared because they were undesirable for man's activities, especially agriculture. Thus, in most cases these habitats survived until they could be sampled by biologists (unlike some communities such as grasslands which were essentially gone before entomologists were around). However, with population pressure in recent years the dune communities are being eliminated because they are considered "wasteland" of no practical value; and their destruction has been accelerated beyond that of urban sprawl by the unbelievable popularity of off-road vehicles (ORV). Even at the appalling rate of population growth in California, it would be a long time before the extensive dune systems in the desert were encompassed by industrialization and urban spread, but unless preventative measures are taken, it will be only a few years until all available dunes are so disturbed by ORV activities that their communities are affected to an extent precluding interpretation of their native interrelationships. When sufficient surface disruption occurs to upset the delicate balance between loose sand and stabilizing plant elements, the dunes again begin to move with the winds and remaining portions of the stabilized community are buried (1, 2, 3).

With the exception of the butterflies (about 5% of the Lepidoptera in any given area of North America), Lepidoptera in these communities have not been adequately sampled. During a 20-year period I have devoted a sporadic effort to surveying the fauna of coastal sand dunes (4, 5, 6, 7) with special emphasis on the smaller moths (the so-called Microlepidoptera). Standardizing sampling procedures poses difficulties, and to date seasonal distribution of sampling is not uniform at all sites, so only tentative conclusions are possible.

As would be predicted by theories of island biogeography and by the plant diversity (8), the largest dunes and the central coast region support the greatest diversity of insects. Excluding species known to be general feeders on weedy plants or to specialize on non-dune plants, about

100 species of small moths have been differentiated. The largest dune system, near Santa Maria, has the largest number, including a highly modified, jumping, flightless moth (6), as well as other insect endemics: several beetles, flies, and a grasshopper. Among small moths there are about 10 narrow endemics, species limited to one or two adjacent dune systems, and these occur at localities which originally were the five largest dune systems (7).

RESEARCH PROPOSED

Primarily on the basis of previous experience with the insect fauna of coastal dunes in California, it was proposed to concentrate efforts in this project on certain taxa at a few large dune systems of the interior deserts. Thus selected genera in four lepidopterous families, Noctuidae, Pyralidae, Gelechiidae, and Scythrididae, were enumerated as potentially representative of the sand-based moth fauna. Three dune systems, the Algodones dunes in the area of Glamis, The Rice dunes, and Kelso dunes of the eastern Mojave, were selected as representative of an elevational sequence and differing physiographic forms, from which to compare faunas.

It was proposed to evaluate these representative faunas through literature search, assessment of specimens in museums and by field survey at various times of year, employing diurnal and nocturnal sampling of adults and rearing the moths from field collected larvae.

RESEARCH CONDUCTED

Field work. - Field survey was conducted on 21 days, with blacklight traps run on 17 nights, in March, April, June, and December. More than 3000 adult specimens were processed, mainly from light trap collections. The majority of these are either widespread species associated with a wide diversity of plants in the dune "apron" community, or are in taxa for which sources of reliable identifications are not available. Thus most are not enumerated in this report. Field work was conducted as follows:

a) Two-day visit to Glamis area early April, 1977; b) one-day (2) and two-day (1) visits to Kelso dunes April 21-26, 1977, with assistance from 3 other staff and student personnel from U.C. (Several days were also spent in survey of nearby, smaller sand habitats, Afton Road and south of Zzyzx Springs, during this period); c) Two-day visit to Kelso dunes and Zzyzx Springs dunes December 17-18, 1977; d) Three-day visit to Glamis area, one day to Rice dunes, and two days to Kelso dunes and Zzyzx Springs, in late March-early April, 1978; e) Three-day visit to Glamis area, one day Parker area (Arizona near Colorado River), and two days at Kelso dunes and Zzyzx Springs in late June, 1978.

Laboratory study. a) Rearing of larval collections. About 40 biological collections were processed, consisting primarily of late instar larvae, involving about 17 species of Lepidoptera in 24 rearing records; b) preparation and sorting of specimens resulting from field collections and rearing, and of material borrowed from other institutions; c) Exemplar dissections from each population completed and compared for Pyralidae, Tortricidae, Scythrididae, and Plutellidae.

Museum study. - Preliminary collections at U.C. Berkeley made by J. T. Doyen and Powell during 1974-1977, mainly from Glamis (January, July, November) and Kelso (January, July) were assessed along with field collections

listed above. These were compared with relevant material for identifications and additional geographical data at the American Museum of Natural History, New York (survey of collections, October, 1978), California Academy of Sciences, California State Department of Food and Agriculture, National Museum of Natural History (December, 1977), Los Angeles County Museum of Natural History (March, 1978).

DESCRIPTION OF AREAS SAMPLED

Three large dune systems were selected: a) Algodones dunes, in the vicinity of Glamis, Imperial Co.; b) Rice dunes, Riverside-San Bernardino Cos.; and c) Kelso dunes, San Bernardino Co. A fourth locality was added for comparative purposes, a small, stabilized dune habitat at the west margin of Soda dry Lake, near Zzyzx Springs, San Bernardino Co. (Map 1).

In general, the larger dune systems consist of a central massif of active, unstabilized sand, subtended by an "apron" of stabilized vegetation interspersed with open sand. For purposes of this report, the "apron" is defined as the area of peripheral, low sand dunes bordered on the upper margin by the highest extent of Larrea tridentata and on the lower margin by lowest extent of loose sand with typical dune plants including Coldenia plicata, Oenothera deltoides, Abronia villosa, and Palafoxia arida. Thus the apron is an ecotone between the sparsely vegetated high dunes and the Larrea scrub of the desert floor. Diurnal sampling was performed along transects from the lower portion of the apron to the highest limits of vegetation on the dunes. Nocturnal sampling usually was confined to the apron.

a) Glamis. - Situated near sea level, the Algodones dunes comprise the largest dune system in the southwestern deserts, consisting of NW-SE oriented, linear barchan dunes, vegetated mostly along the peripheral margins, with a large, central mass of unstabilized sand. All sampling was carried out on the eastern portion, where washes characterized by non-dune specialized plants dissect the apron of low dunes. Sites sampled were: 1.5 km SE Glamis P.O. (III-78); 2 km W Glamis, (diurnal only, III-77, III-78); 1-3 km NW Glamis (XI-74, III-77); 22 and 27 km NW Glamis (III, VI-78).

A transect at 27 km NW Glamis yielded 21 species of flowering plants, 11 on the higher dunes and 14 on the apron. Numerous additional species grew along the washes S and NW of Glamis, where blacklight sampling took place. Special effort was made to sample Croton wigginsii, Palafoxia arida var. gigantea, and Helianthus niveus ssp. tephrodes, the only three dicotyledenous plants listed by Westermeyer and Beauchamp (9) which are endemic to the Algodones dunes according to Munz & Keck (10).

b) Rice. - The Rice dunes extend in a long, NW-SE oriented band, SE from Danby Dry Lake across the San Bernardino - Riverside County line, at about 300 m elevation. They consist of a large area of relatively flat sand with extensive, scattered vegetation. There is no central massif of

unstabilized sand, so that the entire system is analagous to the stabilized apron at Glamis and Kelso. Dominance of Ephedra ("Mormon tea") is a distinctive feature of the Rice dunes relative to other areas sampled. In 1978 annual vegetation was sparse due to low rainfall, with Ephedra, Coldenia, and Croton comprising the stabilized community. Only 14 species of dicotyledenous plants were counted at the sampling sites: 3 km S Rice (diurnal only, II-77, IV-78); 9 km W Rice (IV-78).

c) Kelso. - The Kelso dunes are similar to the large dune systems of the Great Basin and are the highest dunes sampled. Situated at about 650 m elevation at the lowest point, near Kelso, they rise 100m or more above the valley floor to the SW. A central massif with sparse vegetation, primarily perennial grasses and Chilopsis linearis ("Desert willow"), is surrounded by a broad apron of stabilized, low dunes. Sites sampled were: 3 km S Kelso (diurnal only) and 15-16 air km SW Kelso (IV-77, XII-77, IV-78, VI-78). Light traps were placed at the upper margin of the apron. At the latter locality a transect in early April yielded 25 species of flowering plants, 7 in the upper dunes, increasing to 12 in the lower dunes, and about 17 in the apron.

d) Zzyzx. - This locality is situated about 14 air km south of Baker, San Bernardino Co., at about 300 m elevation. Two areas of fairly extensive sand accumulation were discovered, about 1 and 2 km South of the Zzyzx Springs Biological Station operated by a consortium of California State Universities on lease from BLM. The sand source appears to be primarily wind-blown debris from Soda Dry Lake which accumulates in talus slope-like formations along the margin of the rocky Soda Mountains. A remarkably rich community of arenicolous plants occurs here, with 40 species of flowering plants inventoried on a N-S transect across the width of the site in April 1977. The community at this site resembles the apron formation of larger dunes, but large accumulations of unstable sand are lacking. In 1977, there were many areas of open sand, while in 1978, a wetter year, open areas were covered by a mantle of annuals, especially grasses and Camissonia claviformis. Most of the sampling occurred at the northern of the two dunes, which has more diverse vegetation.

ASSESSMENT OF SAND-DWELLING AND ARENOPHILOUS PLANT ASSOCIATED TAXA

Noctuidae. -

1) Protophygia polingi (Barnes & Benjamin, 1922). This species was reared from sand-dwelling larvae collected in December at Saline Valley, Inyo County, and was one of the most characteristic moths in light trap samples in late March and early April (Table 1). Originally described from Dixieland, Imperial County, it has been collected otherwise only in the Palm Springs - La Quinta area, late February to mid April, according to collections examined (AMNH, NMNH, UCB). Thus P. polingi appears to be

endemic to sand dune areas of California deserts.

2) Species of Copablepharon have been reared from sand-dwelling larvae elsewhere in North America (11). Possible correlation with interior dune systems was postulated, but data do not indicate restriction to large dune systems. There are 13 described species in the western U.S., of which 3 were originally described from California. Two of these appear to be restricted to coastal areas in dune and riverine habitats. Two widespread species, alba and grandis, are widely distributed in California desert areas. One species, serrata McDunnough, 1932, which was described from Indio, appears to be the species represented in our samples only from the Glamis dunes. It flies in October and November and has been collected in the vicinity of Indio, Palm Springs, Glamis and Yermo, according to available records (NMNH, AMNH, LACM, UCB). This species is thus possibly restricted to sand dune areas of the lower desert and Mojave River drainage and is the only Copablepharon which may be endemic in the area. There is one old record for Lake Elsinore (1928, LACM), but the genus is in need of taxonomic review, and this record needs confirmation.

3) Species of Euxoa are diverse, with a large number described (100+ in North America) from all kinds of habitats. Two species have been reared from sand-dwelling larvae on coastal dunes in California, but none was encountered in the present survey. The incomplete state of taxonomic knowledge of species prevents satisfactory assessment of literature and museum records, but it appears there are no Euxoa restricted to interior dune areas in California.

Pyralidae. -

1) Ancyloleptini: Pseudoschoenobius opalescalis Hulst, 1886, was described from Arizona on the basis of winged males. Collections from California show this species to have a flightless female (Glamis dunes, Eureka Valley dunes) which is active in winter (January-March). Specimens which appear to be conspecific have been collected at lights at Baker, Salton Sea, and in southern Utah. Others with slightly different structural details are represented from northern Utah, Colorado, and Nebraska. These include winged females and were collected from April to September. Because examples of geographic variation of this extreme in female biology and phenology are unknown in Lepidoptera, it is concluded that the California populations represent an undescribed species, which will be formally described elsewhere. Males were taken at light at several sites, including large dune habitats (Table 1) and at Baker, remote from major dunes.

2) Crambinae: Members of this group generally are grass-feeders in the larval stage (including lawn moths). Two species were taken in light trap samples at large and small dunes in spring (Table 1). Loxocrambus mohaviellus (Forbes, 1920) was described from Victorville, San Bernardino County, and appears to have been known only from the original collection

(AMNH on loan from Cornell). The present survey detected this species only at Zzyzx Springs and Acton Road, and it therefore appears to be endemic to the Mojave River Drainage and adjacent dune systems.

Loxocrambus n. sp. (A. B. Klots ms name, AMNH). This species was characteristic in all light trap samples of the high desert in March-April during this survey. Klots had tentatively included phenotypically diverse samples, mostly represented by single or few specimens, from many localities, Dixieland, Imperial Co., Borrego, north to Yermo, San Bernardino Co., and east to the Colorado River area in Mohave Co., Arizona. The records suggest this species may be tied to one or more of the perennial grasses of riverine and dune situations.

3) Chrysauginae: Satole ligniperdalis Dyar, 1908, a widespread species (W. Texas to California) has been reared from seed capsules of desert willow (Chilopsis linearis) growing on the Kelso dunes. This population appears to possess greater phenotypic variability (possibly polymorphism) than any other. Individuals exhibited prolonged diapause, the ability to wait 1, 2, or 3 years before completion of development to the adult stage.

4) Odontiinae: This subfamily contains several genera that are characteristic of desert areas and includes at least 7 species known only from the California deserts (12). Species sampled during the present survey were relatively widespread ones, mostly detected at two or more of the stations (Table 1). Larval biologies of desert odontiines are mostly unknown. All were taken at lights in dune apron associations.

Tortricidae. -

1) Epiblema is a moderately large genus (about 40 described species in N.A.) with members occurring in diverse ecological areas. Known larvae in most cases are stem borers in Compositae, sometimes causing gall formation by the host plant (13). E. sosana (Kft. 1907) was taken at all sites sampled. This species is known to feed on Ambrosia (14) and probably is not tied to sand habitats. A related, undescribed species appears to be restricted to Ambrosia on coastal dunes in southern California, as it was not detected in the present survey.

2) Suleima is a small genus closely related to Epiblema, members of which also feed as larvae in stems of Compositae. An apparently undescribed species was reared from Helianthus niveus at the north end of the Algodones dunes (Table 2). Larvae were collected in March and June (17 mi NW Glamis) and one male was taken at light (14 mi NW Glamis). Structurally this moth is similar to S. helianthana Riley, a widespread species well known as a minor pest of sunflowers. The distinctive color pattern, isolated distribution and host plant, and minor structural differences indicate the Algodones population is a genetically distinct one, and formal description of it will occur elsewhere. This is the only example of an apparent narrow endemic encountered in Lepidoptera during this

survey. It is probable that the species extends into northern Mexico, with its host plant.

3) Platynota stultana (Wlsm., 1880). This species was originally described from Sonora, Mexico, and early collection records indicate it may have been native in Arizona. Although P. stultana, a highly polyphagous plant feeder in the larval stage, has become widespread in California in man-made habitats, this is the first record of a possible native population in the state.

Gelechiidae. -

1) Species of Lita have been reared from various woody compositae, with larval feeding in spring and adult emergence in fall. L. puertella (Busck, 1916) was abundant at Glamis in November. This species was described from La Puerta Valley, San Diego County and ranges widely in desert areas aside from major dune systems according to present taxonomic concepts (15). The host plant is unknown.

2) Several species of Chionodes were collected at lights in Glamis and Kelso dune apron habitats and at Zzyzx Springs. As species of this genus characteristically are host specific, investigation of endemic plants for larvae should be carried out. Probably most of the species sampled are associated with widespread plants, but the preliminary state of taxonomy in this group limits conclusions, and only a few distinctive species were identified (Table 1).

Ethmiidae. -

1) Pseudethmia protuberans Clarke, 1950. Described from Dixieland, Imperial Co., this species was known from relatively few collections, ranging north to the vicinity of Essex, San Bernardino Co. (16). The adults are active in early spring, and only males are attracted to lights. Owing to its unique taxonomic status, knowledge of the biology and larvae would be of considerable interest. The situation at the Rice dunes together with foodplant associations known for other ethmiids (16) strongly suggest that Coldenia plicata is the host plant, and therefore the distribution of this California endemic is limited to sand habitats occupied by C. plicata. Populations were detected at Rice, Kelso and Zzyzx Springs (Table 1).

2) Ethmia n. sp. A single female was taken in a light trap in mid-December at the Zzyzx Springs dunes.

Scythrididae. -

Areniscythris brachypteris Powell, 1976, is a flightless species (both sexes) which occurs on coastal dunes in San Luis Obispo County (6). The larvae are highly modified for life in moving sand dunes. Survey of interior dunes in Oregon, California and Baja California during 1973-1977 revealed that there are at least 4 winged species which occupy the same

niche. Two of these occur in Oregon and by structural detail are closely related to A. brachypteris. Of the remaining two, one is also closely related, while the other is morphologically distinct, yet superficially similar. Larvae of both live in sand-covered silken tubes attached to buried plants in active sand areas and are morphologically modified as in A. brachypteris. On the larger dunes (Glamis, Kelso) there is ecological separation of the two, but on lower, less diverse dunes (Rice), they occur together.

1) Areniscythris n. sp. A (Powell ms). This is a tan moth which has been collected at Diablo Dry Lake, Baja California Norte (April), Glamis area (January-April and June), Kelso dunes (east-end) (April), and southern edge (June), and Saline Valley dunes (April). Larvae were collected from several different plants at the Glamis dunes in January and April (Table 2). Adults are diurnal early in the year (January-early April) when night time temperatures are cool but are nocturnal in warmer situations (Glamis, Kelso in June, Saline Valley in mid April). Adults feed at Composite flowers (Baileya) in mid day.

2) New genus, n. sp. B (Powell, ms). This moth has mottled, gray forewings, dark in early spring, pale in early summer, and adults were diurnal in all situations. They were taken at Diablo Dry Lake, Baja California (April), Glamis area (March, June), Rice dunes (early February to early April), and Kelso dunes (mid southern edge, April, June). Larvae were collected from Coldenia plicata in December (Kelso) and March (Glamis, Rice), (Table 2), and adults were in close association with this plant at all sites. At Rice, they visited flowers (Palafoxia) but were not observed to do so elsewhere.

At the larger dunes (Glamis, Kelso) the latter species occupied areas in or at the upper margin of the apron, distinctly below the open sand situations where sp. A was found. The two species are of interest because morphologically and behaviorally, they are the most highly modified dune inhabiting lepidoptera encountered in the survey. Adults as well as larvae are structurally adapted for dune life. These were the only Lepidoptera which occurred only on larger dune systems and were absent from smaller sand dunes (e.g. Zzyzx Springs) and riverine habitats, according to available records.

Plutellidae. -

Ypsolopha n. sp. (Powell ms). A series of this moth was taken April 1/2, 1978 at the dunes 6 mi W of Rice, San Bernardino Co. Adults were collected at light and from Ephedra along with those of Y. delicatella (Busck, 1903), a widespread species. A collection of larvae produced only the latter species. Additional specimens of the undescribed species had been collected in 1922 at Dixieland, Imperial Co. (NMNH). Thus the species is not endemic to, and its host is not characteristic of larger sand dune systems.

SUMMARY

- 1) Survey of Lepidoptera was carried out on 21 days during March, April, June, and December, 1977-78 at three large dune systems, and one small sand dune habitat. Together with previous collections (January, July, November) from two of the large dunes, available samples totalled more than 3,000 specimens representing an estimated 150 species. The majority of these are widespread species because the larvae feed on weedy plants, generally distributed desert plants, or are polyphagous. Many others are members of taxa for which specific identification sources are not available and no conclusions about their distributions can be drawn at present.
- 2) Only one species was discovered which appears to be endemic to a single dune system: Suleima n. sp. (Powell ms) (Tortricidae). The larvae feed in stems of Helianthus niveus ssp. tephrodes, an endemic plant.
- 3) Two species of Scythrididae, both undescribed, are restricted to large or moderately large dune systems. Both occur on all larger dunes sampled, from northern Baja California to Kelso (sp. B) and Saline Valley (sp. A).
- 4) Including the preceding endemics, about 15 species of moths were discovered which occur at one or more of the major dune systems sampled during this survey and are endemic to the California deserts, and in some cases adjacent areas in Arizona or Baja California. These are not restricted to large dunes, but occur in sandy alluvial and/or riverine situations as well.

Included are 5 Noctuidae, 4 Pyralidae, 1 Ethmiidae, 1 Gelechiidae, and 1 Plutellidae (Table 1).

5. Preliminary survey and assessment of the Lepidoptera suggests that for plant-feeding insects, preservation of a few larger and small dune systems, such as are tentatively set aside by BLM policies at present, would be sufficient for maintenance of the dune community. During this study, sites that seemed particularly well suited as representative of diverse dune habitats were: North end of Algodones dunes, Kelso dune system, and Zzyzx Springs, all of which are presently treated as off-limits to ORV activity. More diffuse, flat dune formations, such as at Rice contain unique aspects but seem to be in no imminent danger from ORV or other human activities.

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Table 1. Selected Lepidoptera species sampled at four desert dune localities,
by months of capture
(*designates probably endemic to California and Baja Calif. desert)

<u>Name</u>	<u>Glamis</u>	<u>Rice</u>	<u>Kelso</u>	<u>Zzyzx</u>	<u>Known distribution ecological assoc.</u>
NOCTUIDAE:					
<u>Copablepharon alba</u> Harv.:	VI		IV, VI, VII	IV	Widespr. desert
<u>C. serrata</u> McD.:	XI				*Calif. low desert
<u>Protopygia polingi</u> (B. & B.)	III	IV	IV	IV	*Inyo to Imperial larva in dunes
<u>Plagiomimicus hilli</u> (B. & Bsk)	XI				*Coachella-Imperial Valleys
<u>Basilodes consuelus</u> (Stkr)	III			IV	Calif. Ariz. deserts
<u>Schinia felicitata</u> Sm.	III	IV	IV	IV	Widespr. deserts <u>Oenathera de'toides</u>
<u>S. niveicosta</u> Sm.	III	IV	IV	IV	Widespr. deserts <u>Palafoxia arida</u>
<u>S. cupes deserticola</u> (B. & McD.)			IV	IV	Widespr. deserts <u>Camissonia claviformis</u>
<u>S. biundulata</u> Sm.			IV	IV	*Calif. deserts
<u>S. citrinellus</u> G. & R.	III	IV	IV	IV	Widespr. deserts <u>Croton</u>
<u>S. pallicincta</u> Sm.	III				*Calif. deserts <u>Baileya multiradiata</u>
<u>Heliolonche pictipennis</u> Grt.			IV		deserts, Great Basin <u>Malacothrix</u> , <u>Rafinesquia</u>
<u>Hemigrotella argenteostriata</u> (B. & McD.)		IV			Widespr. deserts
<u>Euaontia clarki</u> (B. & McD.)	III	IV			Widespr. deserts
<u>Neotarache deserticola</u> B & B	III, VII	IV	IV	IV	Widespr. deserts
<u>Ponometia macdunnoughi</u> B & B	III, VI, VII		VI, VII	IV	Widespr. deserts

Table 1 (Cont'd.).

<u>Name</u>	<u>Glamis</u>	<u>Rice</u>	<u>Kelso</u>	<u>Zyzyx</u>	<u>Known distribution ecological assoc.</u>
<u>Triocnemis saporis</u> Art.	III			IV	Widespr. deserts
GEOMETRIDAE:					
<u>Euphyia implicata</u> Am.	III		IV	IV, XII	Coastal & desert dunes; larva under <u>Abronia</u>
PYRALIDAE:					
<u>Pseudoschoenobius</u> n. sp.	I		IV		*Glamis to Eureka Vly.
<u>Loxocrambus mohaviellus</u> Fbs.				IV	*Mojave Riv. basin
<u>Loxocrambus</u> n. sp.		IV	IV, VI	IV	*Calif. deserts
<u>Heterographis morrisonella</u> Rag.	III	IV	IV	IV	Coastal & desert dunes larva in sand tubes under <u>Ambrosia</u> (coastal)
<u>Homeosoma electellum</u> (Hlst.)	III				Widespr. larva in flower heads Compositae
<u>Honora mellinella</u> Grt.	III				Widespr., <u>Palafoxia</u> <u>arida</u>
<u>Ragonotia dotalis</u> (Hlst.)				IV, VI	Widespr. deserts
<u>Frechinia laetalis</u>	VI		VI		Widespr. deserts, Great Basin, <u>Ambrosia</u>
<u>Noctueliopsis virula</u> (B. & McD.)	III		IV	IV	*Calif. deserts
<u>N. palmalis</u> (B. & McD.)	III			IV	Widespr. deserts
<u>N. aridalis</u> (B. & McD.)				IV	Calif.-Ariz. deserts
<u>N. puertalis</u> (B. & McD.)	III				Widespr. deserts,
<u>N. bububattalis</u> (Hlst.)	III			IV	Widespr. deserts Great Basin
<u>Loxostege oburthuralis</u> Fern.			IV		Calif.-Ariz. deserts
<u>Arenochroa flavalis</u> (Fern)	III	IV			Calif.-Ariz. deserts

Table 1 (Cont'd.)

<u>Name</u>	<u>Glamis</u>	<u>Rice</u>	<u>Kelso</u>	<u>Zzyzx</u>	<u>Known distribution ecological assoc.</u>
TORTRICIDAE:					
<u>Epiblema sosana</u> Kft.	III,VI	IV	IV,VI		Widespr. arid W. U.S.; larva in stems <u>Ambrosia</u>
<u>Phaneta stramineana</u> (Wlsm)				IV	Widespr. deserts Great Basin; <u>Haplo- pappus</u>
<u>Suleima</u> n. sp.	III,VI				*Algodones dunes; <u>Helianthus niveus</u>
<u>Platynota stultana</u> (Wlsm.)	III				Widespr. southwest polyphagous
<u>P. yumana</u> Kft.			IV		Calif.-Ariz. deserts
GELECHIIDAE:					
<u>Nealdya bifidella</u> Dietz				IV	Calif.-Ariz. deserts
<u>Lita puertella</u> (Bsk)	XI				*Calif. deserts
<u>Chionodes lacteusochrella</u> (Chamb.)			VI		Widespr. desert, coastal dunes; <u>Croton</u>
<u>Chionodes xanthophilella</u> (B. & Bsk.)				IV	Calif.-Ariz. deserts
<u>C. sistrella</u> (Bsk.)	III			IV	desert & coastal dunes
<u>Aristotelia bifasciella</u> (Bsk.)				IV	Widespr. deserts
ETHMIIDAE:					
<u>Pseudethmia protuberans</u> Clarke		IV	IV	IV	*Callexico to Zzyzx
<u>Ethmia</u> n. sp.				XII	*Zzyzx Spr.
SCYTHRIDIDAE:					
<u>Colinita sponsella</u> Bsk.			VI		Calif.-Ariz. deserts
<u>Areniscythris</u> n. sp. A	I,III, VI	IV	IV,VI		*Baja Calif. to Saline Vly. polypha- gous on active dune p
n. genus, n. sp. B	III,VI	IV	IV,VI		*Baja Calif to Kelso <u>Coldenia plicata</u>

Table 1 (Cont'd.).

<u>Name</u>	<u>Glamis</u>	<u>Rice</u>	<u>Kelso</u>	<u>Zzyzx</u>	<u>Known distribution ecological assoc.</u>
PLUTELLIDAE:					
<u>Ypsolopha delicatella</u> (Bsk)		IV			Widespr. deserts, <u>Ephedra</u>
<u>Ypsolopha</u> n. sp.		IV			*Dixieland-Rice, <u>Ephedra</u>

Table 2. List of Lepidoptera reared from field-collected larvae or pupae.

<u>Name</u>	<u>JAP lot #</u>	<u>Locality</u>	<u>Date</u>	<u>Association</u>
Lycaenidae				
<u>Hemiargus isola</u> (Reak.)	77D102	Zzyzx Spr.	IV-26-77	larva on <u>Prosopis</u>
Nymphalidae:				
<u>Vanessa cardui</u> (L.)	78C15	14 mi NW Glamis	III-31-78	larvae on <u>Cryptantha</u>
Noctuidae:				
<u>Protophygia polingi</u> (B. & B.)	77M2	Saline Valley	XII-16-77	larva ex open sand
<u>Spodoptera exigua</u> (Hbn.)	77M3	2 mi S. Kelso	XII-18-77	larva under <u>Rumex</u>
Geometridae:				
<u>Glaucina erroraria</u> Dyar	77M 3.1	2 mi S. Kelso	XII-18-77	pupa ex sand under <u>Larrea</u>
Pyralidae:				
<u>Hellula rogatalis</u> (Hlst.)	77D95	Zzyzx Spr.	IV-23-77	larvae on <u>Cleomella obtusifolia</u>
<u>Homeosoma electellum</u> (Hlst.)	78C9	1 mi W. Glamis	III-30-78	larvae in flowers <u>Palafoxia arida</u> var. <u>gigantea</u>
	78C11	1 mi W. Glamis	III-30-78	larvae in flowers <u>Baileya</u>
<u>Honora mellinella</u> Grt.	78C8	1 mi W. Glamis	III-30-78	larvae in external webs in <u>Palafoxia arida</u> var. <u>gigantea</u>
undet. Pyraustinae	77M3.2	2 mi S. Kelso	XII-18-78	Cocoon in sand under <u>Larrea</u>
<u>Satole ligniperdalis</u> Dyar	74G9	10 mi SW Kelso (emgd. VII-74, IX-75, VI-76, X-77)	VII-14-74	larvae in seed capsules <u>Chilopsis linearis</u>
Tortricidae:				
<u>Suleima</u> n. sp.	78D2	17 mi NW Glamis	IV-1-78	larvae in stems <u>Helianthus niveus</u>
	78F12	17 mi NW Glamis	VI-27-78	larvae in stems <u>Helianthus niveus</u>

Table 2 (Cont'd.)

<u>Name</u>	<u>JAP lot #</u>	<u>Locality</u>	<u>Date</u>	<u>Association</u>
Scythrididae:				
Areniscythris n. sp. A	77A17	Glamis, 2mi NW	I-27-77	Larvae in sand tubes, various annuals.
	77A18	Glamis, 2mi NW	I-28-77	Larva in sand tubes, <u>Palafoxia arida</u>
	77C156	1 mi W. Glamis	III-30-77	Sand tubes, <u>Larrea</u> & undet. annual
n. genus, n. sp. B	77M4	9 mi SW Kelso	XII-18-77	larvae in sand tubes under <u>Coldenia plicata</u>
	78C7	1 mi W. Glamis	III-30-78	"
	78D5	6 mi W. Rice	IV-2-78	"
Coleophoridae:				
<u>Coleophora</u> species	77D97	Zzyzx Spr.	IV-25-77	larvae cases on <u>Aster intricatus</u>
Plutellidae:				
<u>Ypsolopha delicatella</u> (Bsk)	78D6	6 mi W. Rice	IV-2-78	larvae on <u>Ephedra trifurca</u>
Heliodinidae:				
<u>Lithariapteryx abroniaella</u> (Chamb.)	77D100	Zzyzx Spr.	IV-27-77	larvae on <u>Abronia villosa</u>
Psychidae:				
<u>Thrydopteryx meadi</u> H. Edw.	78F13	9 mi SW Kelso	VI-29-78	larvae cases on <u>Larrea</u>

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GREEN LINES PARALLEL WITH
THE HIGHWAYS

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trafficking emergency call
where there are no
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CROSSING THE BORDER