

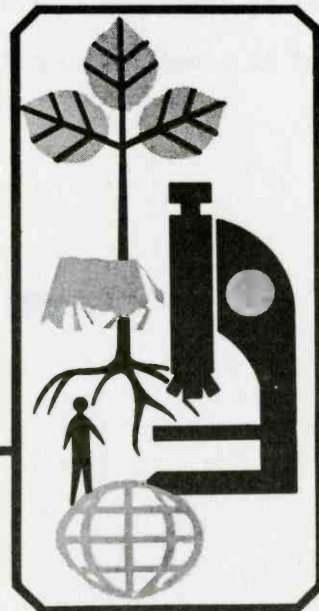
FILE COPY
DO NOT REMOVE

Mosquitoes of Arizona

Technical Bulletin 205



Agricultural Experiment Station
The University of Arizona
Tucson



MOSQUITOES OF ARIZONA

by

John L. McDonald,¹ Thomas P. Sluss,²
James D. Lang,³ C.C. Roan⁴

¹ Graduate Student, Department of Entomology

² Graduate Associate in Teaching, Department of Entomology

³ Graduate Associate in Teaching, Department of Entomology

⁴ Professor of Entomology

5 M June 1973

TABLE OF CONTENTS

	Page
Introduction.....	1
List of Mosquitoes of Arizona.....	2
Key to Genera.....	3
Key to Species.....	5
Species Discussions.....	8
County records of Arizona Mosquitoes (Table I).....	17
Mosquitoes and their Control.....	19
Literature Cited.....	21

INTRODUCTION

The purpose of this bulletin is to provide an up to date summary, with keys, of the female mosquitoes of Arizona. The bulletin provides simplified, illustrated keys to genera and species of known Arizona mosquitoes along with brief diagnostic descriptions of the species. Also included are county distributions, summaries of known life cycles, and a discussion of some control strategies of pest and vector mosquitoes. This is not intended to be a taxonomic work and males have not been included in the keys. We feel, however, that the Arizona mosquitoes can, for the most part, be identified to species with females and these are, after all, the pests of concern. The identification of immature stages is a specialized taxonomic area that is beyond the scope of this bulletin.

The major mosquito-borne disease found in Arizona is encephalitis. Encephalitis, literally meaning inflammation of the brain, is commonly and erroneously referred to as sleeping sickness. There are several types of mosquito-borne encephalitis found in the United States but only Western Equine Encephalitis (WEE) and Venequelean Equine Encephalitis (VEE) appear to be of major concern in Arizona. Several outbreaks of WEE have occurred in Arizona in the past but the recent outbreaks of VEE in Texas and Mexico have caused increased, if not renewed, interest in Arizona's mosquitoes from a public health point of view. The primary vector of WEE, Culex tarsalis, and the vectors of Texas' recent VEE epidemic are probably also found in Arizona. Abnormal and unusual rainfall in Arizona may cause explosive increases in the numbers of these mosquitoes at any time in the future.

In general, man's activities have created many additional breeding sites for mosquitoes, thus increasing his mosquito problems. Fortunately, for the most part mosquitoes are important to the people of Arizona as pests rather than as vectors. Seventy-nine percent of the people in Arizona live in urban areas and eighty-five percent of these people live in either Phoenix or Tucson. Since both of these cities have a great deal of irrigation nearby, the potential and actual degree of pest mosquito breeding near cities is quite significant. Other omnipresent mosquito breeding sites are horse and cattle watering troughs and pools in both urban and rural areas.

Although about half of the mosquitoes around a breeding site should be males, as one moves farther from the site, an increasingly larger percentage are females. The males, which emerge before the females, tend to remain near the breeding sites in order to mate with the females as they emerge from the water. Females of many species require a blood meal before they can lay fertile eggs and, partially for this reason, tend to travel farther and live longer than the males.

The average flight range of all mosquitoes generally is about one mile. Some, such as Aedes aegypti, may fly only a few yards from their breeding site during their entire life span while others, such as Aedes sollicitans, may fly or be carried by winds over a hundred miles. The life span of the adult mosquito is variable. In the summer months the adult may live a month or more although this period can be greatly reduced during adverse weather conditions. The mosquitoes that live the longest, six months or more, are those that overwinter as adults in a state of hibernation.

The feeding behavior of adult mosquitoes is variable. The males of all species do not bite but feed exclusively upon nectar or plant juices. Only the females are bloodsuckers. Some female mosquitoes are zoophilic (animal lovers) and feed exclusively on animals. Others are anthropophilic (man lovers) and preferentially feed upon man. A few, in the larval stage, such as members of the genus Toxorhynchites and Psorophora, prey upon other mosquito larvae. The adult female Toxorhynchites do not feed upon man or animals as do Psorophora.

Probably the most puzzling behavior of mosquitoes concerns their biting. Why they bite one person and not another is not understood. Mosquitoes are attracted to concentrations of carbon dioxide exhaled by man and animals, but what other attractants may be involved is still a mystery. Some mosquitoes bite only in the daytime, others only at night, and still a few others bite both during the day and the night.

Arizona county mosquito records cited in this report have been compiled mainly from C. S. Richards et al. (1956). Additional records were obtained from the collection of the Entomology Department, University of Arizona. This source was especially useful due to the previous work of J. F. Burger.

Recent man bite and light trap collections from various localities in the state also were used. Sources cited other than Richards et al. (1956) are indicated as follows: Belkin and McDonald (B & Mc); Burger (B); McDonald and Belkin (Mc & B); Sixth Army Medical Laboratory (6th); University of Arizona collection (UA); and Zavortink (Z). We are aware that these records probably are not complete and caution the reader to remember that because a species fails to be recorded from a given locality does not necessarily mean that it does not exist in that area.

Certain taxonomic considerations, such as synonymies and true identities, are not firmly established for some of the species listed in this report. In consideration of this we have followed, where possible, Stone (1965) and have treated certain material as follows:

Aedes kompi Vargas and Downs (Burger, 1965) as Aedes sp. nr. kompi (Zavortink, 1969);

Anopheles franciscanus as Anopheles pseudo-punctipennis franciscanus McCracken;

Culex stigmatosoma Dyar as Culex peus Speiser;

Culiseta maccrackenae Dyar and Knab as Culiseta particeps (Adams).

Because we are basing our identification only upon adult females, certain species are very difficult or impossible to separate in the key. Out of necessity, therefore, in the key we are treating Aedes varipalpus (Coquillett) and Aedes monticola Belkin and McDonald as the single species Aedes varipalpus. An asterisk (*) after a name in either the key to genera or the species keys indicates a rare group or one not commonly encountered. The reader is cautioned that this report is not a taxonomic work, but rather a guide to Arizona mosquitoes. Carpenter and LaCasse (1955) provides excellent keys and discussions of most North American mosquitoes should the reader desire a more comprehensive work. In the case of medically important species, a population sample of both males and females should be collected and sent to a taxonomist for positive identification.

Acknowledgements

The authors wish to express their appreciation to members of the Sixth U. S. Army

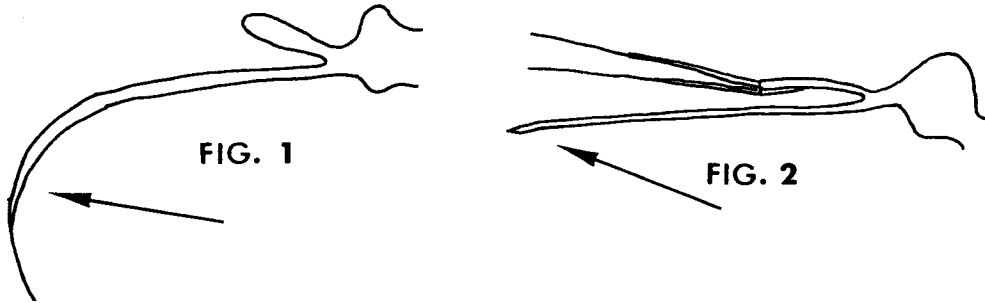
Medical Laboratory for their pre-publication criticisms and suggestions. We are especially grateful to Captain L. W. Teller, U. S. Navy, and the entire Military Entomology Information Service (MEIS) for assistance in retrieval of literature for this bulletin.

Mosquitoes of Arizona

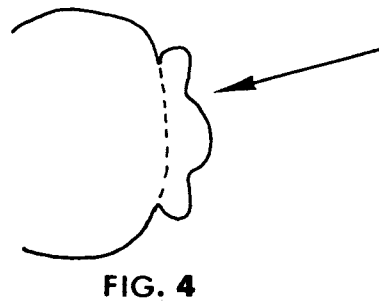
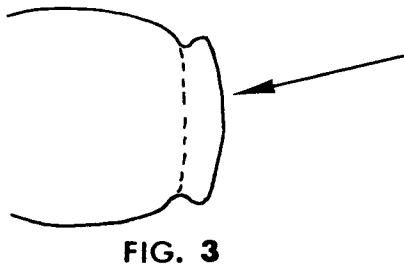
	<u>Aedes</u>
1	<u>atropalpus</u>
2	<u>cataphylla</u>
3	<u>dorsalis</u>
4	<u>fitchii</u>
5	<u>infirmatus</u>
6	sp. nr. <u>kompi</u>
7	<u>monticola</u>
8	<u>muelleri</u>
9	<u>nigromaculis</u>
10	<u>papago</u>
11	<u>purpureipes</u>
12	<u>sollicitans</u>
13	<u>taeniorhynchus</u>
14	<u>trivittatus</u>
15	<u>varipalpus</u>
16	<u>ventrovittis</u>
17	<u>vexans</u>
18	<u>Anopheles barberi</u>
19	<u>freeborni</u>
20	<u>judithea</u>
21	<u>pseudopunctipennis franciscanus</u>
22	<u>Culex apicalis</u>
23	<u>arizonensis</u>
24	<u>coronator</u>
25	<u>nigripalpus</u>
26	<u>erythrothorax</u>
27	<u>peus</u>
28	<u>piplens quinquefasciatus</u>
29	<u>restuans</u>
30	<u>tarsalis</u>
31	<u>territans</u>
32	<u>thriambus</u>
33	<u>Culiseta incidens</u>
34	<u>inornata</u>
35	<u>particeps</u>
36	<u>Orthopodomyia kummi</u>
37	<u>signifera</u>
38	<u>Psorophora confinnis</u>
39	<u>discolor</u>
40	<u>howardii</u>
41	<u>signipennis</u>
42	<u>Toxorhynchites</u> sp.
43	<u>Uranotaenia anhydor</u>

Key to the Genera

1. Proboscis distinctly curves downward (Fig. 1)..... Toxorhynchites*
 1'. Proboscis not distinctly curved downward (Fig. 2)..... 2



- 2(1'). Palpi nearly as long as proboscis (Fig. 2); scutellum rounded (Fig. 3)..... Anopheles
 2'. Palpi much shorter than proboscis; scutellum trilobed (Fig. 4)..... 3



- 3(2'). Mesonotum with prominent longitudinal white lines (Fig. 9); fourth segment of front tarsi as long as wide..... Orthopodomyia*
 3'. Mesonotum without prominent longitudinal white lines 4

- 4(3'). Second marginal cell shorter than its petiole (Fig. 5)..... Uranotaenia*
 4'. Second marginal cell as long as or longer than its petiole (Fig. 6)..... 5



FIG. 5



FIG. 6

- 5(4'). Tip of female abdomen blunt (Fig. 7)..... 6
 5'. Tip of female abdomen pointed (Fig. 8)..... 7

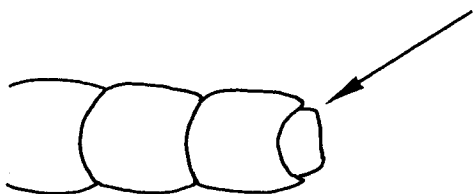


FIG. 7

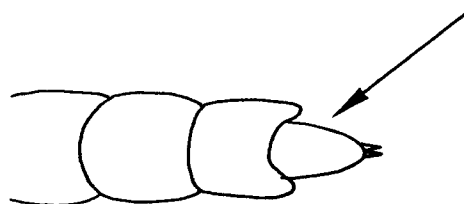


FIG. 8

- 6(5). Base of subcostal vein with tuft of setae on underside of wing; spiracular
 bristles present (Fig. 10)..... Culiseta
 6'. Base of subcostal vein without tuft of setae on underside of wing;
 spiracular bristles absent..... Culex

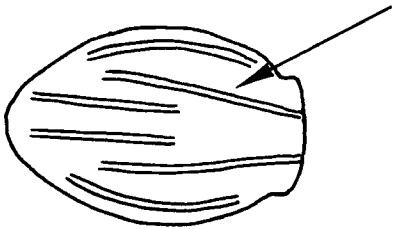


FIG. 9

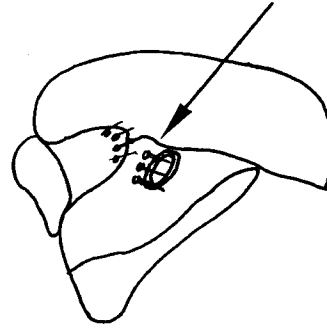


FIG. 10

- 7(5'). Spiracular bristles present..... Psorophora
 7'. Spiracular bristles absent..... Aedes

Key to the species of Aedes

1. Proboscis with distinct medial white band..... 2.
 1'. Proboscis without distinct medial white band..... 4.
 2(1). Abdomen with longitudinal line of pale scales..... 3.
 2'. Abdomen without longitudinal line of pale scales; wing scales entirely dark..taeniorhynchus
 3(2). Palpi white tipped; abdominal longitudinal line of pale scales narrow;
 last segment of hind tarsus mostly white..... sollicitans*
 3'. Palpi completely dark; abdominal longitudinal line of pale scales wide..... nigromaculis
 4(1'). Proboscis speckled with a few pale scales..... 5.
 4'. Proboscis entirely dark..... 8.
 5(4). Body light brown..... 6.
 5'. Body dark brown or black..... 7.
 6(5). Last segment of hind tarsus entirely white or yellowish-white..... dorsalis
 6'. Last segment of hind tarsus with apical one-half dark and basal one-half pale..... fitchii*
 7(5'). Hind legs with white bands and pale knee spots; scutum with white
 lyre-shaped marking..... papago*
 7'. Hind legs without bands or knee spots.....cataphylla
 8(4'). Abdomen with notched "B"-or "V"-shaped patches of basal scales..... vexans

- 8'. Abdomen without "B"-or "V"-shaped patches of basal scales..... 9.
- 9(8'). Wings with both dark and pale scales; all femora speckled with pale scales.... ventrovittis
- 9'. Wings, except base of costa, without mixed scales, all dark..... 10.
- 10(9'). Hind tarsi entirely dark..... 11.
- 10'. Hind tarsi with band of pale scales..... 16.
- 11(10). Scutum with wide lateral golden lines..... trivittatus
- 11'. Scutum without wide lateral golden lines, but may have white or pale lines..... 12.
- 12(11'). Scutum with white or pale median stripe..... 13.
- 12'. Scutum without pale median stripe..... 15.
- 13(12). Scutum with very wide white or pale stripe extending just beyond midline..... infirmatus
- 13'. Scutum with narrow white stripe dividing posteriorly into two lines..... 14.
- 14(13'). Abdominal tergites with basal band of pale scales..... muelleri*
- 14'. Abdominal tergites without basal band of pale scales..... Sp.nr. kompi*
- 15(12'). Legs with metallic purple iridescence..... purpureipes
- 15'. Legs without metallic purple iridescence, dark brown..... ventrovittis
- 16(10'). Abdominal segments with basal pale bands widening laterally..... atropalpus*
- 16'. Abdominal segments with basal pale bands narrowing laterally..... varipalpus or monticola*

Key to the species of Anopheles

- 1. Anterior edge of wing with pale spots..... pseudopunctipennis franciscanus
- 1'. Anterior edge of wing uniformly dark scaled..... 2.
- 2(1'). Wing with some scales forming four darker spots..... freeborni
- 2'. Wing without four dark spots..... 3.
- 3(2'). Mesonotum brown and mostly shiny..... barberi* or judithea*

Key to the species of Culex

- 1. Proboscis with bands, at least ventrally..... 2.
- 1'. Proboscis without bands, uniformly dark 4.
- 2(1). Proboscis with distinct median band ventrally, occasionally extending around sides but never completely banded..... thriambus
- 2'. Proboscis with a distinct, complete band..... 3.

- 3(2'). Abdomen ventrally with V-shaped dark marking; anterior surface of front femur usually with narrow line of pale scales..... tarsalis
- 3'. Each abdominal segment ventrally with an oval dark spot; anterior surface of front femur usually without narrow line of pale scales..... peus
- 4(1'). Hind tarsi basally and apically with distinct, pale bands..... coronator*
- 4'. Hind tarsi without or only with basal distinct, pale bands..... 5.
- 5(4'). Palpi with ring of pale scales; tergites with apical pale bands..... apicalis*
- 5'. Palpi without ring of pale scales..... 6.
- 6(5'). Scutum with pair of small-scaled, submedian spots..... restuans
- 6'. Scutum without pair of pale spots..... 7.
- 7(6'). Abdominal pale bands widened laterally..... 8.
- 7'. Abdominal pale bands even or narrower laterally..... 9.
- 8(7). Abdomen with basal pale bands, bands greatly widened laterally..... nigripalpus
- 8'. Abdomen with apical pale bands, bands slightly widened laterally..... territans*
- 9(7'). Abdomen with narrow apical line of pale scales..... arizonensis*
- 9'. Abdomen with basal band of pale scales..... 10.
- 10(9'). Scutum with reddish brown integument and clothed with narrow golden scales..... erythrothorax*
- 10'. Scutum with brown integument and clothed with narrow golden brown scales..... pipens quinquefasciatus

Key to the species Culiseta

1. All femora with subapical pale bands..... particeps
- 1'. All femora without subapical pale bands..... 2.
- 2(1'). Fore and mid tibiae with narrow apical and basal pale bands; knee spots present..... incidens
- 2'. Fore and mid tibiae without apical and basal bands; knee spots indistinct..... inornata

Key to the species of Orthopodomyia

1. Abdominal tergites banded; wing scales mixed..... signifera*
- 1'. Abdominal tergites not banded; wing scales mostly black..... kummi*

Key to the species of Psorophora

1. Proboscis brown and slightly darker apically..... howardii
- 1'. Proboscis banded or speckled..... 2.
- 2(1'). Fringe on posterior wing margin with distinct pale areas..... signipennis
- 2'. Fringe on the posterior wing margin without distinct pale areas..... 3.
- 3(2'). Abdominal tergites mostly pale scaled..... discolor
- 3'. Abdominal tergites mostly dark scaled but with some pale scales..... confinnis

The Genus Aedes Meigen

The genus Aedes is represented by more than 500 species of mosquitoes which can be found from the far north polar regions to the tropical areas along the equator. Aedes is the largest genus of mosquitoes found in North America. Members of the genus are extremely important because they are pest mosquitoes as well as vectors of disease.

All species of Aedes lay their eggs singly on the ground or just above the water line in tree holes and artificial containers. The eggs hatch only after they have been dry for a time and then come in contact with water after flooding. Certain of the flood water mosquitoes, such as Ae. sollicitans and Ae. vexans, follow that is referred to as synchronized development where they are essentially all eggs at the same time, then all larvae, etc. Species such as Ae. aegypti are considered as asynchronous since the various life stages (egg, larva, pupa, and adult) are commonly found together.

The breeding sites utilized by Aedes are quite variable and range from intermittently flooded coastal marshes to tree holes, rock holes and artificial containers. The infamous clouds of mosquitoes in Alaska and northern Canada emerge from breeding sites formed by melting snow.

Aedes atropalpus (Coquillett)

DESCRIPTION: This is a medium to small mosquito. Proboscis dark scaled. Scutum with broad dark stripe down the middle becoming wider at posterior end. The strip of dark scales is enclosed on both sides, particularly along the fore-portion of the scutum, by pale or light yellow scales. Legs with distinct pale knee-spots. Hind tarsal segment five

almost entirely white.

BIONOMICS: Eggs are attached firmly to the sides of rock pools and rock holes usually along or near mountain streams. Although eggs begin hatching within 24 hours after flooding, the larvae are very slow in developing. During the daytime, the adults rest near their breeding sites under rock ledges. The adult females are never found far from their breeding sites and are persistent biters near rocky streams. Their highly selective larval habitat renders them of minor importance.

ARIZONA DISTRIBUTION: Pima, Santa Cruz

Aedes cataphylla cataphylla Dyar

DESCRIPTION: This species is easily recognized by its rather dusty gray appearance over the brownish background of its mesonotum and wings. Palpi short, dark and speckled with grayish scales. Knee spots pale, legs speckled with light scales.

BIONOMICS: This mosquito produces only one generation per year. It overwinters in the egg stage with the larvae developing in open or shaded grassy ground pools of meadows. Typically found in mountainous wooded areas, they are avid feeders on man and therefore pose a severe pest problem in some areas.

ARIZONA DISTRIBUTION: Coconino and Apache (UA)

Aedes dorsalis (Meigen)

DESCRIPTION: This is a medium-sized pale yellow to dark brown mosquito. Although the striping pattern is inconsistent, many of the specimens show a long stripe of pale scales on the dorsal surface of the abdomen. Hind tarsal segments with pale bands at both ends. Wings bearing bi-colored scales. All femora, tibiae and first tarsal segments bearing pale scales.

BIONOMICS: This mosquito overwinters in the egg stage, hatches early in the spring and produces several broods through the year. Breed-

ing sites are quite varied, ranging from Pacific coast salt marshes to strongly alkaline pools to fresh waters. However, the favored water of this mosquito for breeding appears to be temporary open grassy ground pools in close association with irrigation and intermittent flooding. The adult females are very aggressive biters which will attack during the day or night but especially at evening twilight. They are long range fliers and are commonly found ten miles from their breeding sites. ARIZONA DISTRIBUTION: Apache, Navajo, Pima, Santa Cruz (6th), Yuma

Aedes fitchii (Felt & Young)

DESCRIPTION: A medium-sized mosquito. Proboscis dark and bearing scattered pale scales. Palpi with indistinct pale basal rings on segments three and four, last palpal segment pale at tip. Hind tarsal segments with broad basal pale bands. Wings bearing a mixture of dark and pale scales. BIONOMICS: This species overwinters in the egg stage and hatches very early in the spring. Breeding sites are quite varied, from open marshes to lateral overflow pools, to melting snows along streams, and ground pools. The females are aggressive biters and can be a severe pest in forested areas. ARIZONA DISTRIBUTION: Coconino

Aedes infirmatus Dyar & Knab

DESCRIPTION: A medium-sized mosquito. Proboscis and palpi dark scaled without markings. Anterior half of scutum bearing a broad pale white median stripe. Scutellar hind lobe bearing a small cluster of pale scales. Pleura with scattered small clusters of pale scales. Tergites without bands but with small lateral basal triangular spots. Tibiae and tarsi unbanded. Wings uniformly dark. BIONOMICS: This mosquito is commonly found breeding in temporary woodland pools or open grassy pools following rains. The adult females readily attack during the daytime in or near wooded areas but will also bite at night near dwellings, although they seldom enter houses. ARIZONA DISTRIBUTION: Cochise

Aedes sp. nr. kompi Vargas & Downs

DESCRIPTION: A medium-sized mosquito. Proboscis and palpi dark and unbanded. Pleura with thick clusters of pale scales. Scutum anteriorly bearing a single narrow line of pale scales which divides into two lines

posteriorly at the pre-scutellar area. Legs with hind femora entirely white, fore and mid femora mostly white, all tibiae dark, hind tarsi dark. Tergites mostly dark except for lateral pale scales on segment five, six and seven; segment eight with a basal white band. Wing scales dark and narrow. BIONOMICS: This species came from a single tree hole in a willow tree. The water was dark and contained leaf debris. Nothing is known of the habits of the adults. ARIZONA DISTRIBUTION: Santa Cruz (Z. 1969)

Aedes monticola Belkin & McDonald

DESCRIPTION: A small to medium-sized dark mosquito. Proboscis dark. Palpi dark scaled except for two white bands and white scales at the apices. Scutum with a wide stripe of golden scales on the anterior half. Scutellum with clusters of white scales. Pleura with dense clusters of white scales, a large tuft of scales on the post coxal area. Legs with white knee spots, hind tarsal segment one with broad basal and apical white bands, segments two and three with broad apical white bands, four unbanded, five white. Wings uniformly dark scaled except for a small cluster of white scales at the base of costa. BIONOMICS: This species has been found breeding in rotting tree holes in mountainous area. The adult females have been observed to bite man in late afternoon. ARIZONA DISTRIBUTION: Cochise, Graham, Pima, Santa Cruz (all B & McD 1957)

Aedes muelleri Dyar

DESCRIPTION: A medium-sized mosquito. Proboscis and palpi dark. Pleura bearing a thick cluster of pale scales. Legs dark and metallic appearing except for white knee spots. BIONOMICS: Because this is such a rare species, little is known of its habits except that it is found in mountainous regions. ARIZONA DISTRIBUTION: Cochise, Pima (UA), Santa Cruz

Aedes nigromaculis (Ludlow)

DESCRIPTION: A medium-sized mosquito. Proboscis with a pale band in the middle. Palpi completely dark. Pleura with indistinct clusters of pale scales. Abdominal tergites bearing a broad longitudinal line of pale scales. Fore femora and fore tibiae speckled. Hind tarsal segments one through four with broad basal white bands; segment five entirely white. Wings with a mixture of dark and pale scales. Fore femora

Aedes sollicitans (Walker)

and fore tibiae speckled. Hind tarsal segments one through four with broad basal white bands; segment five entirely white. Wings with a mixture of dark and pale scales.

BIONOMICS: This highly successful mosquito overwinters in the egg stage. Originally coming from the arid western plains, it has adapted to such breeding sites as irrigated meadows and other sites of intermittent water. This mosquito can successfully compete with, and rapidly replace, Ae. dorsalis in the same ecological niche. The rapid hatching of eggs after deposition, two to six days, as compared to dorsalis' long delay in hatching after egg deposition, enhances the success of this mosquito. The female attacks both animals and man with a painful bite. Biting is common in the evening hours but will also occur during daylight hours. Because it is a strong flier, this mosquito has spread rapidly. Migrating several miles from its breeding site with each generation, of which there may be 20 per year, has likewise increased dispersal of this mosquito.

ARIZONA DISTRIBUTION: Apache (UA), Coconino (6th), Navajo, Yavapai, Yuma (6th)

Aedes papago Zavortink

DESCRIPTION: A medium-sized mosquito. Proboscis black scaled, appearing metallic, median area speckled with white. Palpi mostly black scaled, segment four and the basal portion of segment three white. Mesonotum dark and bearing distinct narrow white lines. Femora and tibiae dark scaled and metallic; hind tarsal segment one with subbasal pale band, basal bands on tarsal segments two-five. Wing dark scaled except for a short white line on the costal vein.

BIONOMICS: Larvae are probably found exclusively in rotting tree holes.

ARIZONA DISTRIBUTION: Pima (Z. 1970b)

Aedes purpureipes Aitken

DESCRIPTION: A medium-sized mosquito. Proboscis dark and appearing metallic. Scutum orangish with a midline strip of yellow scales. Middle lobe of the scutellum bearing large flat white scales. Legs with white knee spots, the remainder of the legs dark and metallic looking.

BIONOMICS: This rather uncommon species of mosquito is rarely collected. It is a tree hole breeder in mountain areas. Adult females are known to bite man during the daytime.

ARIZONA DISTRIBUTION: Cochise (UA), Pima, Santa Cruz

DESCRIPTION: A large mosquito. Proboscis bearing a wide pale band. Abdominal tergites with a longitudinal line of pale scales. Mesonotum golden. Wing scales mixed brown and white. Tarsi with wide pale bands.

BIONOMICS: Of all the salt marsh mosquitoes, this is easily one of the most severe pest mosquitoes to plague man. The eggs are laid on the mud of marshes or brackish water pools where they remain until high tides, rains or flooding take place. The eggs, which must stay dry for at least 24 hours before they will hatch, begin hatching almost instantly when they are covered by water. Under ideal conditions, adults begin to emerge as little as seven to ten days following egg hatching. These are probably the strongest fliers of all known mosquitoes, often flying in huge swarms from swamps to urban areas several miles away. They are extremely fierce biters at twilight but, if disturbed in the grassy resting sites during the daytime, they will readily attack and viciously bite even in full sunlight.

ARIZONA DISTRIBUTION: Yuma

Aedes taeniorhynchus (Wiedemann)

DESCRIPTION: This is a medium to small mosquito. Proboscis dark scaled with distinct white band in the middle. Palpi dark scaled except for white scales at tip. Scutum dark brown, scutellar lobes with pale white scales. Pleura with clusters of pale white scales. Legs with white knee spots. Hind tarsal segments one through four with broad basal white bands, fifth tarsal segment entirely white. Wing scales narrow and dark.

BIONOMICS: This species typically breeds in salt marshes but occasionally can be found breeding in brackish waters inland, particularly in oil fields. On rare occasions they have even been taken in fresh water pools not far from the sea coast. The eggs are laid on the mud of marshes or brackish water pools where they remain until high tides, rains or flooding take place. The eggs hatch after they are covered by water and the larval stages last five to seven days under ideal conditions in the warm summer months. The adult females are strong fliers and may be a severe pest problem several miles from their breeding sites. They are fierce biters especially at sundown but are common biters during the daytime in shaded areas or in open sunlit grassy areas where the adults may be resting.

ARIZONA DISTRIBUTION: Yuma (Rigby et al. 1963)

Aedes trivittatus (Coquillett)

DESCRIPTION: This is a medium-sized mosquito with dark proboscis and dark palpi. Scutum covered with pale scales surrounding a wide brown stripe down the middle. Distinct patches of scales on pleura. Legs with dark scales. Wings bearing uniform dark brown scales.

BIONOMICS: This species overwinters in the egg stage. Larvae occur in flood water and rain pools especially near wooded areas. Advanced instars which stay most of the time hidden in vegetation in the bottom of the pool are seldom detected in routine mosquito breeding site inspections. Under ideal weather conditions, adults emerge from breeding sites only eight days after the eggs hatch. During the daytime the adults can be found resting on grasses and other vegetation. The females, aggressive and painful biters, usually attack at sundown but will attack during the daytime in woody shaded areas.

ARIZONA DISTRIBUTION: Apache, Cochise, Coconino (6th), Gila, Greenlee, Navajo (UA), Pima (UA), Santa Cruz

Aedes varipalpus (Coquillett)

DESCRIPTION: A small to medium-sized dark mosquito. Proboscis and palpi dark scaled except for pale scales on apices of palpi, giving them a white-tipped appearance. Scutum with indistinct lines of yellowish or golden scales. Pleura with dense clusters of pale scales, no scale tuft in the postcoxal area. Legs with white knee spots, hind tarsal segments one through four with broad apical bands, segment five entirely white. Wings uniformly dark scaled except for a small cluster of white scales at base of the costa

BIONOMICS: Although normally found breeding in tree holes, this species may also occur in rain barrels containing a heavy sediment of decaying leaves. The adults are very small and can pass through ordinary window screen but are not a serious problem in dwellings as they prefer to bite outdoors.

ARIZONA DISTRIBUTION: Cochise, Coconino, Graham, Pima

Aedes ventrovittis Dyar

DESCRIPTION: A small-sized mosquito. Palpi and proboscis dark. Scutellum bearing yellowish scales. Pleura with clusters of pale scales. First tergite with a few scattered pale scales, remainder of the tergites with pale basal bands. Dark scales of tergites with a definite brownish-black metallic sheen.

BIONOMICS: These mosquitoes are found only in mountainous regions at elevations above 7,000 feet. The rapidly developing larvae are found in snow melt pools which are often frozen around the edge or surrounded by snow.

ARIZONA DISTRIBUTION: Greenlee (UA)

Aedes vexans (Meigen)

DESCRIPTION: A medium-sized brown mosquito. Proboscis dark scaled. Palpi dark scaled except for their white tipped apices. Hind tarsi with narrow basal pale bands. A distinct "B" or "V" notch of white scales in the middle portion of each tergite.

BIONOMICS: This species is widespread in Arizona. It breeds in all types of temporary pools of fresh water such as rain pools, flood waters, and roadside ditches, and is even found in the same pools with Ae. dorsalis and Ae. nigromaculis. The eggs are laid on the ground and hatch almost immediately following flooding. Depending on temperatures, the aquatic stages of this mosquito may require 10 to 21 days before the adults emerge. They normally rest on grass and other types of vegetation during the daytime and emerge on their hunt for blood at dusk. Adult vexans are well known for their bloodthirsty biting habits.

ARIZONA DISTRIBUTION: Apache, Cochise, Graham, Greenlee, Maricopa, Navajo (UA), Pima, Pinal, Yavapai, Yuma

The Genus Anopheles Meigen

The genus Anopheles is widespread throughout the state of Arizona. Anopheline eggs are laid individually in groups of about 100 eggs on the surface of the water and each egg is kept on the surface by lateral floats. Eggs hatch within one to three days following deposition. The larvae are equipped with very short siphons on the upper surface of their tail section and, therefore, are found parallel to the surface of the water rather than hanging down at an angle to the water surface as in the case of culicines. The females are readily distinguished from other mosquitoes by the palpi, which are about as long as the proboscis, and by their rounded rather than trilobed scutellum. In the resting position, the adult's head, thorax and abdomen are in a straight line which forms an angle of 40° to 90° with the surface they are standing on.

Anopheline mosquitoes become active at nighttime. The morning and evening twilight hours are usually their hours of peak activity. Apparently all anophelines require a blood meal for fertile egg production. Fortunately most are zoophilic rather than anthropophilic.

However, they do bite man and when they do, their approach is quiet and their biting itself typically painless.

Anopheles barberi Coquillett

DESCRIPTION: A small black mosquito. Proboscis, palpi and legs dark. Wing scales uniformly dark.

BIONOMICS: The breeding sites for this mosquito are usually tree stumps, tree holes and artificial containers close to wooded areas. Artificial containers used as breeding sites always have a high content of organic matter, such as leaves, mixed in. Larvae develop quickly with warming spring temperatures and may be found throughout the summer due to continuous breeding. During daytime, adults may be found resting in shacks in the woods or under bridges near the woods. Adult females are commonly known to take a blood meal indoors.

ARIZONA DISTRIBUTION: Cochise (Rigby et al. 1963), Pima (UA), Santa Cruz, Yuma (6th)

Anopheles freeborni Aitken

DESCRIPTION: A medium-sized black mosquito. Proboscis and palpi dark. Apical tips of femora and tibiae pale scaled. Four dark spots on the wings formed by clusters of dark scales.

BIONOMICS: The adult females overwinter by hibernating in out-buildings, cellars, caves and other protected areas. In spring they emerge from their hibernation site, seek a blood meal, then lay eggs for the first generation of offspring. Breeding sites are usually open sunlit ground pools which contain algae or emergent vegetation. However, they will breed in water that is polluted with organic sewage matter. Larvae may be taken occasionally from slightly brackish water in desert ground pools. Mid-season flight range of this mosquito is about two and one half miles although the last generation in late fall may migrate 10-12 miles to reach overwinter sites. ARIZONA DISTRIBUTION: Apache, Cochise, Mohave, Navajo, Pima, Yavapai, Yuma (6th)

Anopheles judithae Zavortink

DESCRIPTION: A medium-sized mosquito. Palpi dark scaled. Mesonotum brown and mostly shiny. Legs dark scaled without bands. Wings uniformly dark scaled.

BIONOMICS: Typically found in permanent rather than temporary tree holes.

ARIZONA DISTRIBUTION: Cochise, Maricopa, Pima, Santa Cruz, Yavapai (All Z. 1970a)

Anopheles pseudopunctipennis

franciscanus McCracken

DESCRIPTION: A medium-sized mosquito. Proboscis long and dark. Palpi white banded. Scutum with pale yellowish-white scales and hairs forming a median strip giving it a "frosted" appearance. Legs uniformly dark except for the white tipped femora and tibiae.

BIONOMICS: Breeding sites for this mosquito include ground pools, stock ponds, receding streams or artificial containers such as large water tanks. Breeding sites are usually warm to the touch, contain abundant growth of green algae and are always in full sunlight. Feeding and biting behavior are unknown. The flight range is approximately one mile.

ARIZONA DISTRIBUTION: All counties except Apache

The Genus Culex Linnaeus

Culex mosquitoes breed in almost every type of still, fresh water. They prefer water with a high degree of organic matter such as sewage. As a result, the aquatic stages can be found breeding in almost any artificial container, ditches, ponds, and even larger bodies of water. The eggs are deposited in rafts of about one hundred eggs. Within two to three days, the eggs start to hatch and under favorable weather conditions adults are found emerging within five to seven days. The adult females are for the most part inactive during the daytime, resting in grasses and cool, dark, damp places. The Culex mosquitoes typically overwinter as adults in protected areas such as outbuildings, basements, cellars and caves.

Because C. tarsalis is a proven vector of WEE, this genus of mosquitoes is considered the most important in Arizona.

Culex apicalis Adams

DESCRIPTION: A relatively small mosquito. Proboscis dark. Palpi indistinctly banded. Pleura with clusters of whitish scales. Dark scales on the legs give a metallic sheen under light; narrow knee spots present. Wings are uniformly dark.

BIONOMICS: The typical breeding sites for this mosquito are woodland and stream pools. Because the adults are apparently unable to bite humans, they are considered unimportant as pests.

ARIZONA DISTRIBUTION: Apache, Cochise (UA), Coconino, Maricopa, Navajo, Pima, Yavapai

Culex arizonensis Bohart

DESCRIPTION: A relatively small mosquito. Proboscis dark, palpi dark. Pleura with clusters of white scales. Abdomen with a metallic appearance due to dark scales on all tergites except the first. All tergites except the first with a narrow apical pale band. Legs metallic appearing except for the narrow knee spots. Wings dark.

BIONOMICS: Larvae of this relatively rare species have been taken from a creek bed pool. Breeding is apparently continuous throughout the season. Adult female biting behavior is unknown.

ARIZONA DISTRIBUTION: Pima, Santa Cruz, Yavapai

Culex coronator Dyar & Knab

DESCRIPTION: A small to medium sized mosquito. Proboscis and palpi dark scaled. Scutellar lobes with yellow-gold scales. Pleura with clusters of white scales. First tergite with a mid-cluster of brownish scales; a basal band of pale scales on the remaining tergites. Basal and apical rings on all tarsi. Wings dark scaled.

BIONOMICS: Larvae are commonly found in flood-water, ground pools and artificial containers. Adult females are not known to feed on man.

ARIZONA DISTRIBUTION: Cochise, Pima

Culex nigripalpus Theobald

DESCRIPTION: A medium-sized mosquito. Proboscis and palpi unbanded and dark scaled. Scutum bearing dark brown scales, scutellar lobes with brown scales. Pleural scales, if present, in very small clusters. Tergites occasionally bearing narrow white basal bands, tergal dark scales appearing metallic. Legs without bands. Wing scales narrow and dark.

BIONOMICS: The larvae of this species may be found in a wide variety of sites. They commonly inhabit artificial containers, ditches, wheel ruts, ground pools, leaf axils of plants, and marshes. The females typically take a blood meal outdoors but will occasionally be found indoors as well.

ARIZONA DISTRIBUTION: Santa Cruz (UA)

Culex erythrothorax Dyar

DESCRIPTION: This mosquito is commonly confused with pipiens quinquefasciatus. It is a medium-sized mosquito. Proboscis and palpi dark scaled. Legs medium brown giving a bronze-like appearance. Bands on abdomen

yellowish and rather indistinct. Wing scales dark brown.

BIONOMICS: This mosquito breeds in shallow pools with rather dense vegetation. The adult females prefer to feed on birds but will avidly feed on man if he enters their breeding areas during sunlight as well as darkness.

ARIZONA DISTRIBUTION: Cochise, Santa Cruz (6th), Yuma

Culex peus Speiser

DESCRIPTION: A medium-sized dark mosquito. Proboscis with a pale midband. Palpi white tipped. This mosquito is often confused with tarsalis. However, it is readily separated by its lack of a line or row of white scales on the outer surface of the femora and tibiae. Pleura with small clusters of white scales. All tergites except first with a narrow basal band which widens near the sides. Hind tarsi with basal and apical pale bands.

BIONOMICS: This mosquito can be found breeding in all types of ground pools and oxidation ponds, as well as artificial containers. The WEE virus has been isolated from this species but C. peus seldom if ever bites man.

ARIZONA DISTRIBUTION: Cochise, Pima, Pinal, Santa Cruz, Yuma (6th)

Culex pipiens quinquefasciatus Say

DESCRIPTION: A medium-sized mosquito. Palpi and proboscis dark scaled. Mesonotum coated with narrow golden brown scales. Abdominal tergites with narrow pale basal bands. Dark scales on legs give a metallic appearance; legs without rings or bands.

BIONOMICS: This is one of the most common mosquitoes in southern Arizona. Larvae may readily be found breeding in almost any water containing organic matter. Some of their more typical breeding sites include catch basins, rain barrels, tanks, tin cans, storm drains, septic tanks, waste waters from food processing plants, standing ditch water, etc. Breeding is continuous throughout warm weather and therefore egg rafts and all stages may be found at the same breeding site. Some of these mosquitoes apparently can produce fertile eggs without first having taken a blood meal. The adults are active only at night and are readily found resting in buildings and caves near the breeding sites during the daytime.

ARIZONA DISTRIBUTION: Cochise, Coconino (6th), Graham, Maricopa, Pima, Pinal, Santa Cruz, Yuma

Culex restuans Theobald

DESCRIPTION: A medium-sized mosquito. Palpi and proboscis dark scaled. Mesonotum with narrow light brown scales except for a pair of whitish humeral spots. Tergites with pale basal bands, remainder of the scales dark and metallic appearing. Legs dark except for narrow white apical tips of the femora and tibiae. Wing scales dark.

BIONOMICS: This species prefers to breed in very stagnant waters polluted with sewage or decaying organic matter. Some of the typical breeding sites are ponds, side pools in streams, ditches, ground pools and almost any type of artificial container.

ARIZONA DISTRIBUTION: Santa Cruz

Culex tarsalis Coquillett

DESCRIPTION: A medium-sized dark mosquito. Proboscis with a pale midband. Palpi white-tipped. Pleura with a small cluster of gray-white scales. Abdomen ventrally with V-shaped dark marking. Femora and tibiae usually with a line or row of white scales on the outer surface. All tergites except first with a narrow basal band. Hind tarsi with wide basal and apical pale bands.

BIONOMICS: Adult females of this species deposit at least two rafts of eggs. The eggs hatch within two days. The aquatic stages are passed very quickly in a great variety of breeding sites. Semi-permanent pools of water near irrigation are often occupied by C. tarsalis. However, they readily breed in ground pools, sewage waters, ditches and almost any artificial container which holds polluted waters.

During the day the adults rest in buildings, caves, culverts, grasses, brush and stream banks. They are most active from sundown to sunup. The female apparently needs a blood meal to produce fertile eggs. The adults overwinter in caves, mines, cellars, and protected outbuildings.

ARIZONA DISTRIBUTION: All counties

Culex territans Walker

DESCRIPTION: A rather small mosquito. Proboscis and palpi dark. Pleura bearing clusters of white scales. Scutum grayish to dark brown, scutellum bearing grayish scales. Tergites, except the first, with a narrow apical pale band becoming wider in the lateral portion. Legs, with the exception of indistinct knee spots, dark scaled and metallic appearing. Wing scales dark and narrow.

BIONOMICS: The typical breeding sites for this mosquito are stream pools, ponds, and swamps. Because the adults do not bite man, they are considered unimportant.

ARIZONA DISTRIBUTION: Cochise

Culex thriambus Dyar

DESCRIPTION: A medium-sized dark mosquito. Proboscis with an indistinct pale mid-band. Palpi dark scaled. Scutellar lobes with narrow yellow scales and brownish setae. All abdominal tergites except first with a narrow basal band. Legs with white knee spots; hind tarsi with basal and apical pale bands except segment five which may be all white. Wing scales dark.

BIONOMICS: Although these mosquitoes are quite abundant throughout much of Arizona, very little is known about this species. Where or what the adults feed upon is unknown. Larvae have been found in rock pools along streams. ARIZONA DISTRIBUTION: Apache, Cochise, Coconino, Gila, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma (6th)

The Genus Culiseta Felt

Culiseta are very similar in habits and appearance to Culex. Larvae are commonly found breeding in marshy areas, side pools along streams, snow water pools in mountain areas and occasionally grassland flood water pools. Adult females overwinter in protected areas and emerge with the first warm weather in spring.

Culiseta incidens (Thomson)

DESCRIPTION: A large mosquito. Proboscis and palpi dark scaled, but lightly sprinkled with white scales. Scutellar lobes with clusters of pale white scales. First abdominal tergite with a small mid-cluster of pale white scales, the remaining tergites with basal pale bands. Legs with knee spots; narrow basal pale bands on the hind tarsi. Crossveins on wings without scales.

BIONOMICS: This adaptable species is widespread throughout Arizona. It is found at almost any altitude up to 10,000 feet and can be found in a great variety of breeding sites such as pools from melting snow, reservoirs, polluted waters, side pools in stream beds, hoof prints, tire casings and rain barrels. In many areas the females appear to be timid biters of man while in other areas they are quite aggressive biters.

ARIZONA DISTRIBUTION: All counties except Graham and Pinal

Culiseta inornata (Williston)

DESCRIPTION: A large mosquito. Proboscis and palpi dark scaled, but heavily speckled. Scutum bearing yellowish-brown scales. Pleura with clusters of whitish-gray scales. Fore femora and tibiae heavily speckled. Wings with light and dark scales intermixed on costa and subcosta; crossveins without scales. BIONOMICS: Larvae of this mosquito are commonly found in cool water, though not as cold as that preferred by incidens. They may be found in seepage pools from irrigation, flood waters, and occasionally artificial containers. They overwinter as adult females which emerge during warm days of winter and spring. The adult females are fortunately zoophilic and seldom pose as problem to man as a pest mosquito.

ARIZONA DISTRIBUTION: All counties except Gila, Graham and Greenlee

Culiseta particeps (Adams)

DESCRIPTION: A large mosquito. Proboscis speckled. Palpi banded and white-tipped. Scutellum bearing pale white scales. Pleura with clusters of pale white scales. First abdominal tergite with a small mid-cluster of pale scales, the remaining tergites with basal pale bands. Femora and tibiae speckled, hind tarsal segments banded basally. Wing crossveins heavily scaled.

BIONOMICS: Breeding sites are typically cool, clear shaded pools containing a considerable amount of organic matter, particularly leaves and debris. Bottom breeding larvae are difficult to find because of their habit of living and hiding in bottom debris when disturbed. Breeding is continuous throughout the season. Adult females will attack man any time during the day but become more active at sundown.

ARIZONA DISTRIBUTION: Cochise (UA), Pima, Santa Cruz

The Genus Orthopodomyia Theobald

Members of this genus are found breeding in tree holes and occasionally in artificial containers. None are known to bite man.

Orthopodomyia kummi Edwards

DESCRIPTION: A medium-sized mosquito. Proboscis and palpi dark, with scattered white scales.

Thorax black, mesonotum with six narrow lines of white scales. Pleuron with white scales forming three distinct lines. Abdominal tergites not banded. Wing scales narrower than O. signifera, mostly black; vein R with line of white scales; no concentration of white scales over crossveins.

BIONOMICS: Unknown, but probably similar to O. signifera.

ARIZONA DISTRIBUTION: Santa Cruz (UA)

Orthopodomyia signifera (Coquillett)

DESCRIPTION: A medium-sized mosquito. Proboscis and palpi dark, both with white scales forming dorsal longitudinal lines. Thorax brown to black, mesonotum with six narrow lines of white scales. Pleuron with numerous white scales forming less distinct lines than in O. kummi. Abdominal tergites with basal band of pale scales. Wing scales broad, intermixed dark brown and white; white scales forming patch over crossveins; no white line on vein R. BIONOMICS: The larvae of this species are usually found breeding in water of a high pH in tree holes, tree stumps, wooden containers and rarely in artificial containers. Eggs are deposited near the water line and the newly emerged larvae move down into the water after hatching. Larvae develop very slowly. Adults are most commonly found resting in the tree hole where the larvae are breeding.

ARIZONA DISTRIBUTION: Pima (UA) and Santa Cruz (UA)

The Genus Psorophora Robineau-Desvoidy

This genus has only recently been implicated as a vector of human disease in the United States. Its breeding habits are very similar to some of the Aedes group. Eggs are deposited on the ground and may remain dormant for long periods of time. When flooding of the breeding site takes place, larvae develop quite rapidly. Late instar larvae are commonly predaceous on other mosquito larvae.

Psorophora confinnis (Lynch Arribalzaga)

DESCRIPTION: A rather large mosquito. Proboscis dark scaled and indistinctly banded. Palpi dark except for the tips of the last segments. Pleura with clusters of white scales. All abdominal tergites except the first bearing apical groups of pale ring. First hind tarsal segment bearing a wide median white band; all hind tarsal segments with basal white bands. BIONOMICS: This mosquito is probably the most

widespread and important member of the Psorophora group in the United States. It overwinters in the egg stage. The eggs are laid on the ground in areas subject to flood water from irrigation canals, streams, or where rain water accumulates. Eggs, if covered with water, hatch within four to five days after flooding. The adult females are particularly noxious pests because they are extremely large mosquitoes, are very aggressive biters during the daytime or evening, and will fly one to ten miles from their breeding site in search of a blood meal.

ARIZONA DISTRIBUTION: Cochise, Graham, Greenlee, Maricopa, Pima, Pinal, Santa Cruz (UA), Yavapai, Yuma

Psorophora discolor (Coquillett)

DESCRIPTION: A medium-sized mosquito. Proboscis with a wide, dark scaled band. Palpi dark scaled and speckled except for white last segment. Scutum covered with narrow yellowish scales. All but first tergite almost completely covered with pale white scales. Femora and tibiae speckled. An indistinct subapical ring appears on each femur. Wing scales brown and white arranged more or less in clusters.

BIONOMICS: These mosquitoes breed in ground pools caused by rain or side pools along streams and irrigation canals. Larvae are usually down in the depths of the water and do not rise and hang suspended from below the water surface until just before pupation. The aquatic stages normally last 10-14 days. Although primarily zoophilic, the adult females are active feeders on humans in the evening. ARIZONA DISTRIBUTION: Cochise, Santa Cruz

Psorophora howardii Coquillett

DESCRIPTION: A very large mosquito. Proboscis long and brown, and darkest at the apex. Palpi are very long and brown. Scutum with pale scales on the sides surrounding a shiny black mid-scutum. Scutellar lobes bearing clusters of pale white scales. Femora clothed with yellowish scales except at the apices where the scales gradually become dark and erect or semi-erect. Second tarsal segment with a basal pale band.

BIONOMICS: The most common breeding site for this species is open or partly shaded ground pools where rain or irrigation water has accumulated. The adult females typically stay near their breeding sites but will aggressively attack man day or night if he comes near. ARIZONA DISTRIBUTION: Pinal

Psorophora signipennis (Coquillett)

DESCRIPTION: This is a medium-sized mosquito. Proboscis with a very wide speckled band. Palpi short, dark and speckled with pale scales. Scutum covered with yellowish-brown scales. Pleura with clusters of pale-white scales. All but first tergite white scaled and speckled with some black scales. Femora and tibiae heavily speckled. Legs with pale knee spots. Hind tarsi pale scaled basally and dark scaled apically on segments two through five.

BIONOMICS: This mosquito is widespread in Arizona. It is particularly well adapted to the temporary ground pools of the desert where, under ideal conditions, it may pass from egg to adult in as little as five days. Larvae are often found in temporary standing water of roadside ditches and partly dried up stream beds, as well as ground pools.

ARIZONA DISTRIBUTION: Cochise, Coconino, Graham, Greenlee, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai, Yuma (6th)

The Genus Toxorhynchites Theobald

Toxorhynchites are very large, colorful mosquitoes ordinarily found only in tropical areas. At least one species, however, is known from the southeast United States. Breeding sites are usually in tree holes and artificial containers. Like many species of Psorophora, the larvae of the genus are predaceous on the larvae of other mosquitoes found in the same breeding site. The adult males and females are active during the daytime, feeding on plant juices, but are totally unknown to take a blood meal from any animal. These mosquitoes are often imported to assist in a natural or biological control program of other mosquitoes.

Toxorhynchites sp. (Z. 1969)

DESCRIPTION: A very large, beautiful mosquito. Proboscis and palpi dark blue to black. White to pale yellow scales located on the sides of the second and third palpal segments. Scutum covered with yellowish and purplish-brown scales. Legs iridescent and bearing white knee spots. Wings with scattered purple scales.

BIONOMICS: Members of this genus are usually found breeding in tree holes, rock holes and several types of artificial containers. Eggs are deposited on the surface of the water by the adult female. The larval period usually lasts a few weeks but under adverse conditions, it may extend up to six months. The pupal stage may extend from four days under ideal conditions to 23 days under unfavorable condi-

tions. Adults often rest on trees or vegetation near the breeding sites. This mosquito overwinters as an adult.

ARIZONA DISTRIBUTION: Cochise (UA)

The Genus Uranotaenia Lynch Arribalzaga

Members of the genus Uranotaenia are among the most beautiful mosquitoes encountered anywhere. Although they are of little economic importance to man (they seldom bite humans), they are fine collector's items. Their breeding sites are typically ground pools, grassy edges of ponds, tree stumps and tree holes. The larvae at rest are almost parallel with the surface of the water and are often mistaken

for Anopheles.

Uranotaenia anhydor anhydor Dyar

DESCRIPTION: A very small mosquito. Proboscis long and dark, and swollen at the apex. Palpi dark, very short without rings or speckling. Scutum with two rows of bluish iridescent scales along the sides. Pleura with some iridescent bluish scales. Fore tibiae dark scaled, mid-tibiae pale scaled, hind tibiae mostly dark scaled, hind tarsi dark.

BIONOMICS: Almost nothing is known of this species except that it probably breeds in swamp areas.

ARIZONA DISTRIBUTION: Cochise

TABLE I County Records of Arizona Mosquitoes

SPECIES OF MOSQUITO	Apache	Cochise	Coconino	Gila	Graham	Greenlee	Maricopa	Mohave	Navajo	Pima	Pinal	Santa Cruz	Yavapai	Yuma
<u>Aedes atropalpus</u>										X		X		
<u>cataphylla</u>	X		X											
<u>dorsalis</u>	X								X	X		X	X	X
<u>fitchii</u>			X											
<u>infirmatus</u>		X												
sp. nr. <u>kompi</u>												X		
<u>monticola</u>		X			X					X		X		
<u>muelleri</u>		X								X		X		
<u>nigromaculis</u>	X		X						X				X	X
<u>papago</u>										X				
<u>purpureipes</u>		X								X		X		
<u>sollicitans</u>														X
<u>taeniorhynchus</u>														X
<u>trivittatus</u>	X	X	X	X		X			X	X		X		
<u>varipalpus</u>		X	X		X					X				
<u>ventrovittis</u>						X								
<u>vexans</u>	X	X			X	X	X		X	X	X		X	X

	Apache	Cochise	Coconino	Gila	Graham	Greenlee	Maricopa	Mohave	Nava jo	Pima	Pinal	Santa Cruz	Yavapai	Yuma
<u>Anopheles barberi</u>		X								X		X		X
<u>freeborni</u>	X	X						X	X	X			X	X
<u>judithea</u>		X					X			X		X	X	
<u>pseudopunctipennis</u> <u>franciscanus</u>		X	X	X	X	X	X	X	X	X	X	X	X	X
<u>Culex apicalis</u>	X	X	X				X		X	X			X	
<u>arizonensis</u>										X		X	X	
<u>coronator</u>		X								X				
<u>nigripalpus</u>												X		
<u>erythrothorax</u>		X										X		X
<u>peus</u>		X								X	X	X		X
<u>pipiens</u> <u>quinquefasciatus</u>		X	X		X		X			X	X	X		X
<u>restuans</u>												X		
<u>tarsalis</u>	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<u>territans</u>		X												
<u>thriambus</u>	X	X	X	X		X	X	X	X	X	X	X	X	X
<u>Culiseta incidens</u>	X	X	X	X		X	X	X	X	X		X	X	X
<u>inornata</u>	X	X	X				X	X	X	X	X	X	X	X
<u>particeps</u>		X								X		X		
<u>Orthopodomyia kummi</u>												X		
<u>signifera</u>										X		X		
<u>Psorophora confinnis</u>		X			X	X	X			X	X	X	X	X
<u>discolor</u>		X										X		
<u>howardii</u>											X			
<u>signipennis</u>		X	X		X	X	X			X	X	X	X	X
<u>Toxorhynchites sp.</u>		X												
<u>Uranotaenia anhydor</u>		X												

Mosquitoes and Their Control

It is not possible to prescribe specific remedies for all possible situations regarding mosquito control. We can, however, establish some principles to assist individuals or groups in reaching decisions as to how they may cope with their specific situation whether it involves pestiferous behavior or the capability of mosquitoes to transmit diseases of man and his animals. Regarding mosquitoes at the present time there are three basic options more or less available to man as an individual or as a part of an increasingly complex social structure. These are Avoidance, Exclusion and Population Suppression.

Man could, but rarely does, confine his occupancy and activities to areas outside of the mosquitoes' natural or home range. The second option is for man to exert his territorial prerogatives and exclude the mosquito from man's domain. These first two options are quite simple, reasonably inexpensive, usually consistent with environmental and ecological steady states but both ultimately restrict man's mobility and freedom.

The third option, population suppression, requires that in some manner or other man modify his and/or the mosquitoes' chosen or required ecological niche so as to provide an optimum advantage to man while rendering the environment hostile or at least minimally capable of supporting mosquitoes. Unfortunately such environmental manipulation involving either biological, physical and/or chemical changes, runs afoul of the classical Newtonian Law, specifically that for every action there is an equal and opposite reaction. In our more detailed discussion we do not propose to attempt circumvention of this Law but advise the reader that they are there.

Four population subsets may make use of various combinations of the options we have proposed:

1. Individuals
2. Families and other Small Units
3. Communities
4. Governing Bodies concerned with Large Geographical Areas.

Avoidance

Very little more can be said concerning this option for coping with mosquitoes. It has been used historically in Arizona. Barnes (1960) states, "Camp Goodwin was extremely

unhealthy. Malaria-carrying mosquitoes swarmed and the soldiers sickened. This necessitated the abandonment of the post. Old Camp Goodwin was vacated permanently on March 14, 1871." The other options were apparently unknown or unavailable at that time. Resort owners are and have been very well aware of this option.

Exclusion

One of the earlier examples of the application of this principle is found in Mauli (1880) where he discusses the use of window screens as a prophylactic for malaria poisoning. Exclusion may be accomplished by:

1. Mechanical barriers such as screens, mosquito nets, etc.
2. Personal chemical barriers such as insect repellents.
3. Area chemical barriers such as residues on foliage surrounding the protected area.

Specific recommendations regarding which chemicals are available, effective and permitted for these purposes are impractical because of: (1) The unstable state of various government regulations and (2) The ability of most insects in general, and mosquitoes in particular, to develop a tolerance, if not an outright resistance, to many insecticides. At best the principle of exclusion is available only to individuals and small groups or very small areas such as yards and patios.

Population Suppression

Man tends to react to immediate stimuli and rarely seeks a more fundamental site or time of reaction that might be more rewarding. Although the habits and ecological niches of mosquitoes are extremely varied in their details, all larval and pupal stages of mosquitoes are completely dependent on bodies of water of varying sizes and compositions. This characteristic opens up two points of action for population suppression: (1) The Adult stage, and (2) The Immature (larval and pupal) stages.

It is in the area of population suppression that it becomes essential to have some knowledge of which species of mosquitoes are involved. If the species is known it is possible to go to the information on bionomics previously presented and discover just when and where it might be breeding and its flight and feeding habits. Without this biological information it is senseless to make any attempts

at population suppression!

Adult Suppression

There are several methods of adult population suppression that are employed to provide varying degrees of relief from mosquito problems:

1. Space sprays, aerosols, vapors, etc. introduced into residential or other buildings.
2. Space sprays, etc. used in yards, patios and picnic areas.
3. Residual applications in buildings frequently or continuously occupied by man or in and around mosquito resting sites.
4. Fogging or spraying of communities or larger areas to reduce temporarily, adult populations.

With the possible exception of the residual applications (if they were permissible) all of these actions will provide only a very temporary relief and may require very frequent repetition.

Immature Suppression

It is quite important to know just which species of mosquito constitutes the pest problem and the details of its bionomics before attempting to suppress immature populations.

A mosquito such as Aedes aegypti which breeds in and around men's dwellings in artificial containers can be approached on a household or neighborhood basis. Such common breeding sites as old tires, flower urns, roof gutters, bird baths, tin cans etc. can be eliminated.

Aedes dorsalis prefers temporary open grassy ground pools in close association with irrigation or other intermittent flooding. Since this species is a strong flier and may commonly be found ten miles from its breeding site the local neighborhood approach is not applicable.

These examples may demonstrate that, although eliminating those bodies of water suitable for larval and pupal stages is an academic ideal, this approach is not always practical.

If the bodies of water are more or less permanent and of adequate size they may be

stocked with a mosquito fish such as Gambusia affinis. This fish thrives in a wide variety of water types including fresh or brackish, clear or muddy, shallow or deep waters. Gambusia can tolerate water moderately polluted with sewage. It prefers shallow water where it is protected from predators and where food and vegetation are more abundant. This fish can tolerate wide ranges in water temperature and, although essentially a warm water fish, it has been reported to successfully overwinter under ice (Sholdt et al. 1972).

Some mosquitoes can thrive in dense vegetation that may protect them from Gambusia. It may therefore be necessary to remove such vegetation mechanically. The use of herbicides may be necessary in the management of vegetation in large areas. This complicates the situation and clearly requires consultation with experts in this area.

For some species of mosquitoes it may be sufficient to manage the vegetation in and around the breeding site without the use of the mosquito fish. This assumes of course, that you know where the mosquitoes are breeding, that changing the vegetation, if the site is reasonably accessible, will not so change the ecological niche as to displace some other life form of great value.

It is frequently necessary to employ not only water management - get rid of it - but also biological controls such as mosquito fish - plant management by mechanical or chemical means - and larvicidal chemicals to reduce mosquito populations to a tolerable level. The degree of control obtained with larvicide applications often depends on the amount of pollution and the type and amount of vegetation cover present. Oil applications continue to be a suitable means of killing mosquito larvae.

Larvicidal treatments may, and in all probability will, have some adverse effect on some other forms of aquatic life. Applications of oils are not consistent with the basic purpose of sewage oxidation ponds. The success of oil applications depends on vegetation density and weather, and may require rather frequent repetition. Oil applications could also be phytotoxic and may have other adverse environmental consequences, as do all other available options.

The best source of current information on mosquito control is the report on Public Health

Pesticides from the Technical Development Laboratories, CDC, which appears annually in

Pest Control, a monthly trade magazine published in cooperation with the National Pest Control Association.

L I T E R A T U R E C I T E D

1. Barnes, Will C. 1960. Arizona Place Names, University of Arizona Press, Tucson. 519 pp.
2. Belkin, John N. and W. A. McDonald. 1957. A new species of Aedes (Ochlerotatus) from tree holes in southern Arizona and a discussion of the varipalpus complex (Diptera: Culicidae). Ann. Entomol. Soc. Amer. 50(2):179-191.
3. Burger, J. F. 1965. Aedes kompi Vargas and Downs 1950, new to the United States. Mosquito News 25(4):396-398.
4. Carpenter, S. J. and W. J. LaCasse. 1955. Mosquitoes of North America (north of Mexico). Univ. of California Press, Berkeley and Los Angeles. 360 pp.
5. Maull, W. C. 1880. Window screens as a prophylactic of malarial poisoning. Mich. Med. News: 1880: 266-267.
6. McDonald, W. A. and J. N. Belkin. 1960. Orthopodomyia kummi new to the United States. Proc. Entomol. Soc. Wash. 62(4):249-250.
7. Richards, C. S., L. T. Nielsen, and D. M. Rees. 1956. Mosquito records from the Great Basin and the drainage of the lower Colorado River. Mosquito News. 16(1):10-17.
8. Rigby, P. T., T. E. Blakeslee, and C. E. Forehand. 1963. The occurrence of Aedes taeniorhynchus (Wiedmann), Anopheles barberi (Coquillett), and Culex thriambus (Dyar) in Arizona. Mosquito News 23(1):50.
9. Rigby, P. T. 1968. Occurrence of Aedes infirmatus D.&K. in Arizona. Mosquito News 28(2):239.
10. Sholdt, L. Lance, Douglas A. Ehrhardt, and Andrew G. Michael. 1972. A guide to the use of the mosquito fish, Gambusia affinis, for mosquito control. Navy Environmental and Preventive Medicine Unit No. 2. Norfolk, Va. 23511.
11. Stone, A. 1965. Family Culicidae, pp. 105-120. In A. Stone et al., eds. A Catalog of the Diptera of America North of Mexico. U.S.D.A. Agric. Handbook 276, 1696 pp.
12. Zavortink, T. J. 1969. New species and records of treehole mosquitoes from the southwestern United States. Mosq. Syst. Newsletter 1(2):22.
13. ----- 1970a. Mosquito Studies (Diptera, Culicidae) XIX. The treehole Anopheles of the New World. Contrib. Amer. Entomol. Inst. 5(2):10-12.
14. ----- 1970b. Mosquito Studies (Diptera, Culicidae) XXII. A new subgenus and species of Aedes from Arizona. Contrib. Amer. Entomol. Instit. 7(1):2-9.