Systematics of the spider genera *Mallos* and *Mexitilia*

(Araneae: Dictynidae)

by

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SYSTEMATICS OF THE SPIDER GENERA MALLOS AND MEXITILIA

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(ABSTRACT)

This systematic study recognizes 15 species of the genus Mallos Pickard-Cambridge and three species of the genus Mexitilia Lehtinen. Three species of Mallos and one species of Mexitilia are newly described. Two species are placed in synonymy and two species are transferred to Mallos. The males of two Mallos species are described for the first time. A cladistic analysis based on 22 morphological produced a cladogram that supports the monophyly of Mallos and the validity of Mexitilia. For five species of Mallos and one species of Mexitilia mitochondrial and nuclear DNA sequences were analyzed by restriction digest. The seventeen resulting restriction sites produced a cladogram that agreed with the one based on the morphology of these six species. When morphological and molecular characters were combined they produced a single tree that was identical to that based on molecular data alone. These molecular and morphological characters present the same picture of Mallos and Mexitilia phylogeny.
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# TABLE OF CONTENTS

I. Revisionary Study and Morphological Phylogeny:

- Introduction ......................................................... 1
- Materials and Methods ........................................ 11
- Phylogenetic Analysis ........................................... 13
- Discussion and Conclusion ....................................... 18
- Key to Genera and Species ....................................... 19
- *Mallos* Taxonomy .................................................. 23
- *Mexitilia* Taxonomy ............................................... 118

II. Molecular Phylogeny

- Introduction ......................................................... 159
- Methods ............................................................... 162
- Results ............................................................... 170
- Discussion ............................................................ 172

III. Literature Cited ................................................... 183

IV. Vita .......................................................................... 188
List of Figures

Figure 1. Distribution of Mallos and Mexitilia species........................................5

Figures 2 - 4. Webs .................................................................................................9

Figure 5. Cladistic relationships of Mallos and Mexitilia species.......................15

Figure 6. Social behavior of Mallos and Mexitilia species imposed on their phylogeny.................................................................21

Figures 7, 8. Mallos dugesi; cribellum and calimistrum.......................................31

Figures 9, 10. Cribella.........................................................................................33

Figure 11 - 13. Internal ducts of epigyna...............................................................35

Figure 14. Left palp, Mallos grandis....................................................................39

Figures 15 - 18. DiTA terminus.............................................................................41

Figures 19 - 89. Mallos species illustrations.......................................................43 - 134

Figures 90, 91. Embolus of male pedipalp..........................................................136

Figures 92 - 107. Mexitilia species illustrations................................................140 - 157

Figure 108. Cladistic relationships of Mallos and Mexitilia species................163

Figures 109, 110. DNA sequences used in this study.......................................167

Figure 111. Cladistic relationships of Mallos and Mexitilia species based on molecular data only.................................................................175

Figure 112. Cladistic relationships based on morphological characters only......177

Figure 113. Tree comparison.............................................................................179

Figure 114. Cladogram based on combined data sets.....................................181
List of Tables

Table 1. Approximate times of maturation and elevational distribution based on information from collection labels ................................................................. 4

Table 2. Character data matrix .............................................................................................................. 14

Tables 3 - 16. Leg article measurements, *Mallos* species ................................................... 43 - 134

Tables 17 - 19. Leg article measurements, *Mexitilia* species ........................................... 140 - 157

Table 20. Restriction site data for species of *Mallos* and *Mexitilia trivittata* .......... 165

Table 21. Molecular character data matrix .......................................................................................... 174

Table 22. Morphological character data matrix .................................................................................. 174

Table 23. Morphological and molecular character data matrix ...................................................... 174
Chapter 1: Revisionary study and morphological phylogeny.

Introduction

The family Dictynidae belongs to the "RTA" clade of the Araneomorphae, a group distinguished by the presence of a retrolateral tibial apophysis on the male palpal tibia (Coddington and Levi, 1991). These typically small cribellate spiders are characterized by a uniseral calimistrum, a cribellum that is usually undivided, terminal leg segments with a reduced number of trichobothria, and a male palp that lacks a medium apophysis (Chamberlin and Gertsch, 1958). Lehtinen (1967) redefined Dictynidae to include a number of ecribellate spiders, and divided it into six subfamilies. The subfamilies Tricholathysinae and Dictyninae contain the largest number of genera and include those traditionally considered to be dictynids.

The family Dictynidae has a cosmopolitan distribution and contains 45 genera and more than 400 species. As a member of the RTA clade, it is a potential sister group of the Orbiculariae, a clade that includes the orb weaving spiders (Coddington, 1990 and Coddington and Levi, 1991). However, since Chamberlin and Gertsch's (1958) thorough revision of the North American Dictynidae, the group's systematics has received little attention. The primary objectives of this study are: 1) to revise the species of the dictynid genera Mallos Pickard-Cambridge and Mexitilia Lehtinen, 2) assess the validity of the genus Mexitilia, and 3) reconstruct the phylogeny of these genera.

The genus Mallos belongs to Lehtinen's subfamily Dictyninae and was first established by Pickard-Cambridge in 1902. Four generic synonyms were subsequently
used for one or more of its species (Pickard-Cambridge 1902, Banks 1904, Simon 1909, Chamberlin 1919). Pickard-Cambridge (1902) placed the genus *Mallos* in the family Dictynidae, subfamily Amaurobiinae. A number of *Mallos* species were described between 1902 and 1946 when Gertsch studied its taxonomy for the first time. This review included 10 species, 4 newly described. In their revision of the North American Dictynidae, Chamberlin and Gertsch (1958) described two new species and divided the genus into two species groups, the *niveus* group and the *trivittatus* group. This separation was based primarily on spider size and cephalothorax coloration.

Lehtinen (1967) split the genus *Mallos* into two genera, *Mallos* and *Mexitilia*, along the lines of Chamberlin and Gertsch's (1958) two species groups. *Mexitilia* is composed of those species belonging originally to the *trivittatus* species group. Although based on spider size, reproductive features and cephalothorax coloration, this split has gained little acceptance. Lehtinen (1967) pointed out that the putative monophyly of *Mallos*, and that of a number of other dictynid genera, is probably based on practical characteristics, as opposed to true synapomorphy.

The genera *Mallos* and *Mexitilia* contain small spiders (body length 2.0-7.0 mm) that have an oval cribellum and rely on irregular cribellate webs for prey capture. At the onset of this revision, *Mallos* contained 15 species that range from the Pacific Northwest and Southwest of North America into South America, and *Mexitilia* contained two species found in southwestern North America and southern Mexico. Little is known of the natural history of most species of *Mallos* and *Mexitilia*. The
exception, the quasisocial species, *Mallos gregalis* and the communal species *Mexitilia trivittata*, have been extensively studied (Jackson 1977, 1978, 1979; Burgess 1979; Tietjen 1982, 1983, 1986). This investigation will be the first to propose a phylogeny for a spider group that contains quasisocial and communal species.

**Natural History**

Chamberlin and Gertsch (1958) briefly describe the dictynid web, locations of these webs, and summarize what is known of dictynid mating and maturation. However, little is known of the ecology and behavior of most *Mallos* and *Mexitilia* species. This section describes the general habitats of *Mallos* and *Mexitilia* species, summarizes their times of maturation, geographic distributions, and characterizes the webs and web locations of *Mallos* and *Mexitilia* species from Southwestern Arizona.

The genera *Mallos* and *Mexitilia* have a more limited distribution than their cosmopolitan sister genera *Dictyna* and *Embyna*. *Mallos hesperius*, *M. margaretae*, *M. gregalis*, and *M. kraussi* are found exclusively in the American tropics, whereas, the remainder of the species are found in northern Mexico and the American Pacific and Southwest (Fig. 1). *Mallos pallidus* is found at low elevations on the Southern coast of California, but other *Mallos* and *Mexitilia* appear to be restricted to the higher elevations (Table 1).

Temperate zone species reach maturity in early fall, with the exception of the spiders in the subclade to which *Mallos niveus* belongs. These are mature either year round or during the late winter to early summer months. In contrast, tropical species
Table 1. Approximate times of maturation and elevational distribution based on information from collection labels.

<table>
<thead>
<tr>
<th>Mallos species</th>
<th>Months in which adults were collected</th>
<th>Elevation (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>margaretae</td>
<td>February</td>
<td>900</td>
</tr>
<tr>
<td>hesperius</td>
<td>January-November</td>
<td>600-2000</td>
</tr>
<tr>
<td>gregalis</td>
<td>July</td>
<td>1000-3000</td>
</tr>
<tr>
<td>bryanti</td>
<td>September-October</td>
<td>700-3000</td>
</tr>
<tr>
<td>dugesi</td>
<td>August-November</td>
<td>700-2000</td>
</tr>
<tr>
<td>kruassii</td>
<td>November-January</td>
<td>1300-2000</td>
</tr>
<tr>
<td>blandus</td>
<td>September-October</td>
<td>1200-2000</td>
</tr>
<tr>
<td>new species C</td>
<td>(?)</td>
<td>1300</td>
</tr>
<tr>
<td>new species B</td>
<td>July</td>
<td>1300</td>
</tr>
<tr>
<td>new species A</td>
<td>September-November</td>
<td>1300-1600</td>
</tr>
<tr>
<td>niveus</td>
<td>March-December</td>
<td>1000-2000</td>
</tr>
<tr>
<td>pallidus</td>
<td>year round</td>
<td>0-1200</td>
</tr>
<tr>
<td>mians</td>
<td>January-July</td>
<td>600-1500</td>
</tr>
<tr>
<td>pearci</td>
<td>May-July</td>
<td>1000-2000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mexitilia species</th>
<th>Months in which adults were collected</th>
<th>Elevation (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>avara</td>
<td>April-August</td>
<td>600-1000</td>
</tr>
<tr>
<td>trivittata</td>
<td>June-September</td>
<td>1300-3000</td>
</tr>
<tr>
<td>new species A</td>
<td>April-August</td>
<td>900-3000</td>
</tr>
</tbody>
</table>
Figure 1. Distribution of *Mallos* and *Mexitilia* species
mature very late in the year, or, in the case of *M. hesperius*, are mature throughout the year (see Table 1). A number of mature *Mallos niveus* females were collected during August of 1994. Two of these females produced 3 egg sacs each in the laboratory. These lenticular egg sacs had a diameter of 4-5 mm size and were suspended in the female's web. Each egg sac contained 8-10 eggs from which 0.88-0.90 mm long spiderlings emerged.

From July 23 to August 13, 1994 *Mallos* and a *Mexitiilia* species were studied in 1) the area surrounding the American Museum Natural History's Southwestern Research Station (SWRS) in the Chirichahua Mountains of Southwestern Arizona (Cochise County), 2) the Santa Rita Mountains of Arizona, and 3) the Guadalupe Mountains of Texas. At these sites, *Mallos* and *Mexitiilia* species were found in habitats classified as temperate Madrean Evergreen Woodland community (Brown 1982). The trees in this area were mainly Apache pine (*Pinus engelmannii*), alligator juniper (*Juniperus deppeana*), Arizona white oak (*Quercus arizonica*), and sycamore (*Platanus wrightii*) (Vinegar 1975).

The mean annual rainfall from 1974-1991 at SWRS was 55.9 cm (+0.695), with approximately 40% of this rainfall occurring during July and August. Temperatures at SWRS range from an average low of -4.9 C in January to an average high of 30.4 C in July (range based on minimum and maximum temperatures for each month, 1965-1989). Within the Madrean Evergreen Woodland, *Mallos* and *Mexitiilia* species were found on vegetation immediately adjacent to dry creek beds. Despite careful searches no spiders were found more than about 15-20 meters from a creek.
bed. These semi-riparian habitats experience water flow only during the rainy season of July and August when flash flooding is common.

A typical *Mallos* web consists of closely spaced pairs of non-sticky threads that radiate outward from a central point. Cribellar threads are deposited across these paired lines at regular intervals to form ladder-like units. In some cases a spider constructs a small silken retreat in the web. The webs are typically littered with the remains of consumed prey, dust, debris, and tangles of old cribellar threads. Although these webs have some degree of organization, the substrate appears to dictate the structure of the web. Because the webs of *Mallos* species are so plastic in form, it is nearly impossible to associate a particular web type with any one species. Figures 2 - 4 illustrate several of the webs observed.

The small webs of *Mallos niveus* were typically found on the tips of dead *Quercus* branches. However, in the same area, a number of *M. niveus* individuals were also collected from webs built in the tops of grasses. *Mallos bryanti* and *M. dugesi* webs were usually found only in the tops of grasses (Figs. 2,3). *Mallos blandus* and *M. pallidus* individuals were collected from webs built on the tops of *Quercus* leaves. Species of *Mallos* were easy to collect because when their web is disturbed they usually remain motionless. Perhaps this stationary behavior, when associated with the accumulation of prey remains and other debris in the web, makes the spider more cryptic. As long as the spider remains still, potential predators cannot distinguish it from web debris. When *Mallos* and *Mexitilia* juveniles were collected and placed into small (4.5 cm x 4.5 cm x 2.0 cm) plexiglass containers, individuals
Figures 2 - 4 - Webs. 2. Mallos niveus; 3. Mallos dugesi; 4. Mexitilia trivitatta
constructed irregular sheet type webs, further demonstrating the plasticity of their web construction behavior. Even adults accommodated their webs to these small containers and appeared to feed and behave normally.

In the Chiricahua Mountains, *Mexitilia trivittata*, a communal species of dictynids, was found in a large culvert through which East Turkey Creek passes. The inside corrugated walls of the culvert were covered with the webs of hundreds of *M. trivittata* individuals, and this colony is acknowledged to have persisted at this site for a number of years. This culvert provides an ideal habitat for these spiders. It is damp and, therefore, must attract a number of flying insects. However, I observed that about 60% of the spiders were removed from the culvert by a flash flood. The webs of *M. trivittata* differed from those of *Mallos* species (Fig. 4) by typically having a number of long lines that radiated outward from their retreat. These lines consist of a support thread on which cribellar threads were deposited in a looped fashion reminiscent of *Miagrammopes* (Opell 1990; Eberhard and Pereira 1993).

Materials and Methods

All measurements are in millimeters and were made with a dissecting microscope equipped with an ocular micrometer scale. Measurements of eye features and appendages were made at 50X. These were accurate to 0.02 mm. When more than one specimen was measured, measurements and ratios are followed by the sample size, range, and standard deviation. Dorsal views of the spiders were illustrated with the aid of a camera lucida. Drawings of the male and female genitalia were made
with the aid of a drawing grid. Epigynae were removed and cleared, first in 10% sodium hydroxide and then clove oil, to resolve duct architecture. Illustrations of cleared female genitalia were made with a compound microscope fitted with a camera lucida. I prepared specimens for scanning electron microscope study by dehydrating them in ethanol, critical point drying, and sputter coating them with gold.

A cladistic analysis of generic and species relationships was performed with the computer programs PAUP (Phylogenetic Analysis Using Parsimony 3.0; Swofford 1990) and Hennig86 version 1.5 (Farris 1986). Decisions regarding character polarity were based on outgroup comparison. All binary characters were treated as reversible and all multistate characters treated as unordered with the exception of character 8.

**Abbreviations**

(institutional)

AMNH- American Museum of Natural History; New York, New York

BMNH - Natural History Museum; London, United Kingdom

CAS- California Academy of Sciences; San Francisco, California

MCZ - Museum of Comparative Zoology; Harvard University

MMDN- Museum National d'Histoire Naturelle; Paris, France

MZU- Museo Zoologico Universita; Firenze, Italia

NMNH- National Museum of Natural History; Washington, D.C

(taxonomic)

AME- anterior median eye
ALE- anterior lateral eye
PME- posterior median eye
PLE- posterior lateral eye
DiTA- dictynid tegular apophysis
RTA- retrolateral tibial apophysis

Phylogenetic analysis

An analysis of 22 characters (Table 2) produced the cladogram shown in Figure 5. Character state 0 is the hypothesized plesiomorphic condition. All polarity decisions were based on a generalized Emblyna species as the outgroup. Characters states of Emblyna are based on the species descriptions of Chamberlin and Gertsch (1958) and museum specimens that I examined. I ordered character 8 under the assumption that the anterior spermetheca, once derived, increased in size. This ordering is supported a posteriori by: the retention of that order in the clade, and the single appearance of a divided cribellum as a result of this ordering.

Approximately 160 morphological features per species were surveyed. Only discrete characters proved to be useful in a cladistic analysis. The quantitatively evaluated features surveyed showed either considerable overlap and/or were correlated to change in some other feature. Characters of the female genitalia proved to be most useful. The characters and their respective states are defined as follows:
**Table 2. Character data matrix**

<table>
<thead>
<tr>
<th>Species</th>
<th>character states</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Emblyna</em></td>
<td>00000 00000 00000 000000</td>
</tr>
<tr>
<td><em>Mallos</em></td>
<td></td>
</tr>
<tr>
<td>margaretae</td>
<td>??1?? ?0010 00000 0113111</td>
</tr>
<tr>
<td>hesperius</td>
<td>10111 00010 00000 0113111</td>
</tr>
<tr>
<td>gregalis</td>
<td>10111 00011 20010 0113010</td>
</tr>
<tr>
<td>bryanti</td>
<td>10111 00011 20010 0011010</td>
</tr>
<tr>
<td>kraussi</td>
<td>10111 00011 10011 0001010</td>
</tr>
<tr>
<td>dugesi</td>
<td>10111 00011 10011 0001010</td>
</tr>
<tr>
<td>blandus</td>
<td>10111 00111 10020 0001010</td>
</tr>
<tr>
<td>new species C</td>
<td>??1?? ?0211 10020 0004010</td>
</tr>
<tr>
<td>new species B</td>
<td>??1?? ?0311 11020 1021010</td>
</tr>
<tr>
<td>new species A</td>
<td>10111 00311 11020 1021010</td>
</tr>
<tr>
<td>niveus</td>
<td>10111 00310 00010 1001010</td>
</tr>
<tr>
<td>pallidus</td>
<td>10111 00310 00110 1002010</td>
</tr>
<tr>
<td>mians</td>
<td>10111 00310 00110 0002010</td>
</tr>
<tr>
<td>pearci</td>
<td>10111 00310 00110 0002010</td>
</tr>
<tr>
<td><em>Mexitilia</em></td>
<td></td>
</tr>
<tr>
<td>trivittata</td>
<td>11000 11010 00000 0000010</td>
</tr>
<tr>
<td>new species A</td>
<td>??0?? ?1010 00000 0000010</td>
</tr>
<tr>
<td>avara</td>
<td>11000 11010 00000 0000010</td>
</tr>
</tbody>
</table>
Figure 5. Cladistic relationships of *Mallos* and *Mexitilia* species.
1. **RTA of male palp**: 0. present, 1. absent

2. **Distal/lateral margin of male palp tibia**: 0. without triangular projection, 1. with a triangular projection.

3. **Guanine crystals**: 0. not deposited in the lateral margins of the carapace, 1. deposited in the lateral margins of the carapace.

4. **Embolus**: 0. thick in diameter, 1. thin in diameter.

5. **Tip of embolus**: 0. branched; 1. unbranched.

6. **Palpal femur**: 0. without a lateral ridge, 1. with a lateral ridge.

7. **Femur, leg I**: 0. noticeably thick in diameter, 1. not noticeably thick in diameter.

8. **Epigynal duct work (ordered)**: 0. without an anterior lobe, 1. with a short anterior lobe, 2. with an elongate uncoiled anterior lobe, 3. with an elongate coiled anterior lobed.

9. **Lateral foveae of epigynum**: 0. present, 1. absent.

10. **Posterior duct of spermesthca**: 0. unbranched, 1. branched.

11. **Paired posterior spermesthcal lobes**: 0. absent, 1. present small in size

2. present large in size.

12. **Externally epigynal duct work**: 0. not visible above the bursal opening, 1. visible above the bursal opening.

13. **Externally coiled epigynal ducts**: 0. not visible between bursal openings, 1. visible between bursal openings.

14. **Number of spermesthcal lobes**: 0. one, 1. two, 2. three.
15. **Bursal openings:** 0. not heavily sclerotized, 1. heavily sclerotized.

16. **Cribellum:** 0. undivided, 1. divided.

17. **Thoracic groove:** 0. prominent, 1. weak.

18. **Chelicerae:** 0. without distinct markings, 1. with a stripe on anterior surface, 2. black in color.

19. **Dorsal abdominal coloration:** 0. Dark center patch with pairs of spots down dorsal/lateral surface, 1. anterior anchor shaped mark, 2. mottled color pattern 3. chevron color pattern, 4. solid white with an anterior H-shaped mark.

20. **Median line on venter of abdomen:** 0. present, 1. absent.

21. **Cheliceral retromargin:** 0. 0-1 tooth, 1. 2-3 teeth

22. **Posterior eye row:** 0. straight, 1. recurved.

**Discussion and Conclusions**

**Systematics**

Two equally parsimonious cladograms (CI = 0.83, RI = 0.92), with a length of 36 steps were obtained with the Branch and Bound algorithm of PAUP. The analysis was repeated by using the iε* (all available tree spaced used) option of HENNIG86 1.5, which produced cladograms of identical length and topology, to those obtained in PAUP.
The two cladograms of equal length differed in their resolution of the *Mexitilia* clade (Fig. 5). A more resolved cladogram (not shown) united *Mexitilia avara* and *Mexitilia trivittata* on the basis of character 2, a feature of the male palp. However, as *Mexitilia* new species A is known only from female individuals, this dichotomy does not seem justified. Therefore, I have chosen to accept the least resolved cladogram, as I cannot rule out the possibility that character state 2 is actually a synapomorphy for the *Mexitilia* clade.

This cladogram supports the monophyletic nature of the *Mallos-Mexitilia* clade. Synapomorphies supporting this monophyly are 1) the loss of the RTA (character 1, state 1), 2) loss of the lateral foveae of the epigynum (character 9, state 1), and 3) the increase in number of retromarginal teeth (character 22, state 2). Additionally, the monophyly of *Mallos*, is supported by 1) the loss of an unbranched embolus tip (character 5, state 1), 2) the thin nature of the embolus (character 4, state 1), and 3) the deposition of guanine in the lateral margins of the carapace. The monophyly of *Mallos* is also supported by the trend towards a more complex, diverticulate internal female genitalia.

Although Lehtinen's (1967) hypothesis of the polyphyletic nature of the genus *Mallos* may have been unfounded, his splitting of the genus into two genera is supported. The monophyly of the *Mexitilia* clade is supported by the 1) the presence of a triangular projection on the distal/lateral margin on the tibia of the male palp (character 2, state 1), 2) the lateral ridge on the femur of the male palp (character 6, state 1), and 3) the thickened femur of the 1st leg (character 7, state 1).
Social behavior

Of the 109 recognized spider families (Coddington and Levi 1991), only eight contain species that display some degree of social behavior (Foelix 1982). Of these, only four species, each belonging to a different family (Agelendiae, Erisidae, Theridiidae, and Dictyizidae), meet Kullman's (1972) criteria for social status. It is important to note that Kullman's definition of a social spider would be considered "quasisocial" with respect to Michener's (1969) classification of social stages (as summarized by Wilson 1971). For spiders to exhibit true social behavior (semsocial or eusocial), a reproductive division of labor among individuals of the same sex must exist, a phenomenon that has not been discovered in spiders.

A number of studies have compared spider species with varying degrees of social interaction (e.g. Jackson 1977, 1979, 1980, 1982). Many of these studies, particularly those of Jackson, have focused on dictynids, with an emphasis on the genus Mallos, as this genus is known to contain species that are asocial (M. niveus), communal (Mexitilia trivittata), and quasisocial (Mallos gregalis). If comparative studies are to be of maximum value (Harvey and Pagel 1991), they must take into account the phylogenetic history of the taxa involved. With the cladogram of the genus Mallos, it is possible to test the hypothesis that the quasisocial state has evolved once in the genus Mallos and that less well developed social states reflect a transformational series leading to this state.

Figure 6 imposes known social behavior of Mallos species on the group's phylogeny. The lack of a clear phylogenetic trend toward quasisocial behavior in the
Figure 6. Social behavior of *Mallos* and *Mexitilia* species imposed on their phylogeny.
Social behavior

- Mallos n. sp. B
  - Mallos n.sp. A
    - pearci
    - mians
      - pallidus
      - niveus
    - Mallos n. sp. C
      - blandus
        - kruassi
        - dugesi
          - bryanti
            - gregalis
              - hesperius
              - margaretae
                - M. trivittatus
                  - Mexitilia n.spA
                    - M. avara
                      - Emblyna
                      - solitary
                      - solitary
                      - solitary
                      - communal/solitary
                      - quasisocial
                      - communal
genus *Mallos* is not surprising, as this behavior has evolved independently a number of
times within the araneomorphae. The results of this phylogenetic study suggest that
cautions should be used when drawing conclusions about the evolution of social
behavior from comparative studies of *Mallos* species.
Key to species of *Mallos* and *Mexitilia*

**Females**

1. Lateral margins of carapace with distinct white band ........................................................................... *Mallos* (2)
   Lateral margins of carapace without distinct white bands ................................................................. *Mexitilia* (15)

2(1). Abdominal color pattern formed of alternating dark green and yellow chevrons, transverse band on anterior surface of chelicerae ................................................................. 3

   Abdominal color pattern not formed of alternating dark green and yellow chevrons, anterior surface of chelicerae with or without transverse band ......................................................... 5

3(2). Poseterior eye row recurved by 1/2 the diameter of PME, epigynal ducts unbranched ................................................................................................................................. 4

   Posterior eye row straight; epigynal duct with two large lobes, typically found in large colonies ................................................................................................................................. *gregalis*

4(3). Epigynal bursae are separated by six times their diameter, epigynal ducts visible as two small circles in center of epigynum................................................................. *margaretae*

   Epigynal bursae separated by twice their diameter, epigynal ducts visible as a trapezoid in center of epigynum................................................................. *hesperius*

5(2). Brown anchor shaped mark on on dorsum of abdomen, anterior surface of chelicerae with dark transverse band, epigynal duct with two large lobes ........................................................................... *bryanti*

   Anterior surface of chelicerae without dark transverse band, epigynal ducts with two or three lobes. If bilobed, 2 small posterior lobes or one coiled anterior lobe and one elongate posterior lobe ............................................................................. 6

6(5). Epigynal duct with a small bifurcate posterior lobe, opening of epigynum heavily sclerotized ................................................................................................................................. 7
Epigynal duct trilobed, or if bilobed, anterior lobe coiled, epigynal opening not heavily sclerotized ......................................................8

7(6). Epigynum without distinct bursal rims, openings consist of a pair of dark anteriorly positioned spots..................................................*dugesi*

Epigynum with distinct curved bursal rims that open laterally .................................................................*kruassii*

8(6). Epigynal duct with 3 lobes, 1 anterior lobe, coiled or uncoiled, 2 posterior lobes.................................................................9

Epigynal duct with 2 lobes, one coiled anterior lobe and one elongate posterior lobe...............................................................12

9(8). Cribellum divided................................................................................10

Cribellum undivided................................................................................11

10(9). Bursal rim U-shaped with opening directed anteriorly
.................................................................*Mallos new species A*

Bursal rim convex relative to center of epigynum with short sclerotized ridge that runs parallel to the epigastric furrow......*Mallos new species B*

11(9). Abdomen uniformly white with H-shaped mark on cardiac region, lobe of anterior epigynal duct elongate but uncoiled ....*Mallos new species C*

Abdomen with brown anchor shaped mark, anterior lobe of epigynal duct short ..............................................................................*blandus*

12(8). Cribellum divided................................................................................13

Cribellum undivided................................................................................14

13(12). Bursal rims of epigynum concave, separated by 1.5 times their width, relative to center of epigynum, enclosing a dark patch, coiled anterior epigynal lobe horizontally oriented, but not visible externally
.................................................................*niveus*

Convace bursal rims of epigynum almost contiguous. Coiled epigynal duct visible externally and vertically positioned ..........................*pallidus*
14(12). Lengths of epigynal bursae 1/2 that of epigynum, separated by 2X their width ............................................................... **pearci**

Lengths of epigynal bursae 1/3 that of epigynum, separated by 7X their width ............................................................... **mians**

15(1). Epigynal bursae almost contiguous, length of bursae greater than width .......................................................................................................................... **16**

Epigynal bursae separated by a small central scape, width of bursae greater than length, anteriorly positioned .................................................. **trivittata**

16(15). Epigynal bursae extend to center of epigynum, epigynal ducts separated medially by 1/2 their diameter .......................... **Mexitilia new species A**

Epigynal bursae extend to epigastric furrow, epigynal ducts nearly contiguous .................................................................................. **avara**

**Males**

1. Embolus diameter small, embolus tip unbranched .................. **Mallos(2)**

Embolus diameter large, embolus tip bifurcate ...................... **Mexitilia(11)**

2(1). DiTA terminus corkscrew shaped............................................................... **3**

DiTA terminus C-shaped, oval shaped, curled, or slender with triangular tab .................................................................................. **5**

3(2). Total length less than 2.20, posterior eye row recurved 1/2 the diameter of the PME .......................................................... **hesperius**

Total length greater than 3.20, posterior eye row is straight.......... **4**

4(3). DiTA terminus has a sharp point, no sclerite under embolus base, chelicerae widely emarginated (bowed) .................. **Mallos new species A**

DiTA terminus has a blunt end, rounded sclerite under lateral margin of embolus base, chelicerae only slightly emarginated........ **blandus**

5(2). DiTA terminus abruptly bent and folded back over on itself to form a distinct curl ........................................................................ **niveus**
DiTA terminus C-shaped, oval shaped, or slender projection with distal triangular tab .................................................. 6

6(5). DiTA terminus oval shaped .................................................. 7
DiTA terminus slender projection with distal triangular tab .......... 9
DiTA terminus c-shaped .......................................................... 10

7(6) Proximal/leading edge of DiTA terminus straight and oriented prepindicular to the long axis of the cymbium ........................................... pallidus

Proximal/leading edge of DiTA terminus rounded ...................... 9

8(7). Tip of leading edge of DiTA terminus overlaps more proximal edge of terminus ......................................................... pearci

Tip of leading edge of DiTA terminus does not overlap more proximal edge of terminus ......................................................... mians

9(6). Brown anchor shaped mark on dorsum of abdomen, anterior surface of cheliceræ does not extend past anterior margin of carapace .......... dugesi

Dorsum of abdomen solid greyish green, anterior surface of cheliceræ extends past anterior margin of carapace ................................ kraussi

10(6). Dorsum of abdomen with dark brown anchor shaped mark, cephalic region has a wide, tan median line ......................................... bryanti

Dorsum of abdomen without dark green anchor, carapace uniform in color ........................................................................... gregalis

11(1). DiTA terminus runs parallel to length of cymbilum ............... trivittata
DiTA terminus nearly perpendicular to length of cymbilum .......... avara
Mallos Pickard-Cambridge 1902

Figs. 19 - 89, Tbls. 3 - 16

Mallos Pickard-Cambridge 1902, vol. 1 p. 308 (juvenile holotype BMNH, not examined). Etymology:


Coenothele Simon 1909, p. 376.


Diagnosis: Like its sister genus, Mexitilia, Mallos is characterized by the loss of the male retrolateral tibial apophysis and the putative correlated loss of the lateral foveae of the female's epigynum. In Mallos the embolus of the male palp is very thin and unbranched, whereas the embolus of Mexitilia males is much thicker and has a bifurcate tip. Additionally, both male and female Mallos species have a distinct, continuous, white band of guanine deposits circumventing the lateral margins of the carapace. With the exception of four species, the members of this genus all have a distinctive anchor shaped mark on the anterior dorsal surface of the abdomen.

FEMALE: Total length 2.08-6.64. Cephalic width typically 3/5's cephalothorax
width. Thoracic groove, when evident, consists of a shallow, bowl shaped depression located just posterior to cephalic region. Carapace dark orange or brown, in most species clothed with 5 rows of thick white setae: three rows extending the length of cephalic region, and two additional rows located anterior laterally. Carapace usually uniform in color, some species cephalic region with light median band. Distinct white band circumventing lateral margins of carapace.

Posterior eye row straight, or, if recurved only by 1/2 the diameter of the PME. Borders of eyes with thin black border, a few species with heavy black pigment. AME, ALE and PME round and equal in size, PLE usually oval and slightly larger than other eyes. AME AME, ALE ALE, AME PME, separated by a distance approximately equal to the diameter of the AME. ALE PLE separated by 1/5 the diameter of the AME. PME PME, PME PLE separated by a distance approximately equal to diameter of PME.

Clypeus height 1-2 times AME diameter, covered in thick white setae. Chelicerae width approximately 1/2 times length. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 2-3 small retromarginal teeth. Chelicerae usually unmarked and similar in coloration to carapace, some species with transverse anterior band or black coloration. Endites, sternum and labium light orange, tan, or brown. In some species labium noticeably darker in color. Labium width equal to, or slightly greater than length. Endite width 1/2 length. Sternum oval with concave or straight anterior margin. Sternum width 0.24-1.00 times width. Legs coloration variable, some species with distinct banding.
Leg formula I-II-IV-III or I-IV-II-III, with lengths of leg II and leg IV similar.

Calimistrum uniserate (Fig. 8) length 2/3’s length metatarsus IV.

Abdomen oval, dorsum of most species with brown anchor shaped mark or chevron color pattern (Fig. 34). The cribellum may be either undivided (Fig. 7) or divided (Fig. 10) by a thin sclerotized ridge. The epigynum of Mallos females lacks a lateral foveae. Sclerotized rims of epigynal bursae may be directed medially or laterally. In most cases, the epigynal ducts are visible externally. Internally epigynal ducts are either simple and unbranched or diverticulate. (Figs. 11 - 13)
Figures 7,8 - *Mallos dugesi*, female. 7. cribellum; 8. calimistrum
MALE: Total length 1.30-6.72. Width of cephalic region 3/5's that of cephalothorax. Thoracic groove, located just posterior to the cephalic region like that of female. Carapace coloration and setal pattern like that of the female.

Posterior eye row is straight. Eye pigmentation like that of female. Eyes equal in diameter, ALE's in some individuals slightly larger. AME-AME, AME-ALE, AME-PME, separated by a distance approximately equal to the diameter of the AME. ALE-PLE separated by 1/5 the diameter of the AME. PME-PME, PME-PLE separated by a distance approximately equal to diameter of PME.

Clypeus height 1-2 times AME diameter. Chelicerae elongate, length 2 times width. Anterior distal margin of chelicerae keeled in most species. Cheliceral emargination varies from widely emarginated to slightly emarginated. In some species anterior dorsal surface of chelicerae extends anterior to the clypeus. Cheliceral dentition like that of female. Coloration of endites, sternum, and labium like that of female. In most species labium length equal to width, however, in some individuals labium is longer than it is wide. Sternum oval, anterior margin straight or concave. Leg coloration like that of female. Leg formula I-II-IV-III or I-IV-II-III, with legs II and IV similar in length. Abdomen oval, coloration like that of female.

Most features of the male palp of *Mallos* species are homogenous. Figure 14 illustrates the anatomy of the male palp. The length of the cymbium is 1.5-2.00 times its width. Mallos species have lost the RTA. The thin, unbranched embolus (Fig. 91) originates from a round or oval base between the 8:00 and 12:00 position. The DiTA consists of a conductor with a differentiated terminus. The shape of the terminus
(Figs. 15 - 18) is the most important characteristic in distinguishing *Mallos* males.
Figure 14 - left palp, *Mallos grandis* [note cymbium (C), embolus (E), embolus base (B), conductor (C), dictynid tegular apophysis (DiTA) and terminus (T)].
Mallos margaretae Gertsch 1946

Figs. 19 - 21, Tbl. 3

Mallos margaretae Gertsch 1946, p. 8, fig. 4 (female holotype from El Volcan Chiriqui, Panama, in AMNH, examined).

Diagnosis: This species, known from only a single female, closely resembles its sister species, Mallos hesperius. Like the females of this species, they have a total length less than 3.40, a posterior eye row that is slightly recurved and eye borders, particularly those of the AME's, that are dark. The epigynum of both has a pair of centrally located, heavily sclerotized, spermethcae. The widely separated bursal openings of M. margaretae are reduced in size and are only slightly longer than they are wide (Fig. 20). Those of M. hesperius are longer than they are wide and are not nearly as separated. Like species of Dictyna and Emblyna, the epigynal duct work appears externally as two dark circles between the bursae.

FEMALE: Total length 3.32. Cephalothorax 1.09 long. Cephalothorax length 1.04 times wide. Cephalic width 0.57 times cephalothorax width. Weakly developed thoracic groove, when evident, located just posterior to cephalic region, 0.83 carapace length from anterior carapace margin. Carapace, uniform dusky tan. Most setae have fallen off of specimen, however, it appears that this species has the typical 5 narrow
rows of thick white setae found in most *Mallosp* species.

Posterior eye row in most individuals slightly recurved by one-half the diameter of the PME's. Borders of eyes, particularly the AME's, with heavy black pigmentation. Eye diameters: AME 0.06, ALE 0.08, PME 0.06, PLE 0.06. ALE's separated by 0.30 diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.33, AME-ALE 1.00, AME-PME 1.33, ALE-PLE 0.33. PLE's separated by 0.40 diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.67, PME-PLE 1.67.

Clypeus height 1.33 times AME diameter. Chelicerae length quite variable. 6.00 times clypeus height. Chelicerae length 1.85 times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 3 small retromarginal teeth. Chelicerae have a wide dark median transverse band on their anterior surfaces. Labium slightly darker in color than endites and sternum. Endites and sternum pale yellow. Labium length 0.83 times width. Endite length 1.5 times width. Sternum 0.74 long, length 1.28 times width. Anterior margin of the sternum slightly concave. Legs light yellow with no distinct banding pattern. Leg formula assumed to be I-II-IV-III (articles of LI missing), with leg II only slightly longer than leg IV. Calimistrum length 0.70 times that of metatarsus IV.

Abdomen length 1.58 times width. Dorsum pattern very faded, appears to have been a chevron-like color pattern, however, abdominal color pattern illustrated as observed from preserved specimen (Fig. 19). Lateral surfaces of abdomen have dark stripe in the anterior two thirds. Venter, uniformly light yellow, lacking the median
line typical of most *Mallos* species. The cribellum is undivided. Sclerotized rims of epigynal bursae convex relative to center of epigynum and widely separated. Bursae situated anteriorly. A single pair of simple contiguous, heavily sclerotized spermethcae lie in the center of epigynum and are visible externally as two heavy dark circles. (Figs. 20, 21)

Distribution: Panama

Material examined: Panama: El Volcan Chiriqui, 1 female (1936, W. J. Gertsch) AMNH.
Table 3. Mean lengths of female leg articles, *Mallos margaretae*.

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<th>f</th>
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<td>-</td>
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**Mallos hesperius** (Chamberlin) 1916

Figs. 22 - 27, Tbl. 4

*Dictyna hespera* Chamberlin 1916, p. 60, fig. 6 (female holotype from San Miguel, Peru in MCZ, examined).

*Mallos apanus* Gertsch 1946, p. 8,9, figs. 5,6 (male holotype and female allotype from Apa, Paraguay in AMNH, examined).

**Diagnosis:** Females similar to those of *M. margaretae*. The bursal openings of *M. hesperius* are longer than they are wide (Fig. 24), whereas, those of *M. margaretae* are equal in length and width. In many individuals the epigynal ducts appear externally as a dark trapezoid between the bursae. Males of this species are best identified by their small in size, less than 2.08 long, and the DiTA of the pedipalp has a corkscrew shaped terminus (Fig. 27).

**FEMALE:** Total length 2.90 (6, 2.16-3.16, 0.375). Cephalothorax 0.97 long (5, 0.80-1.10, 0.129). Cephalothorax length 1.13 times wide (5, 1.00-1.23, 0.093). Cephalic width 0.56 (7, 0.59-0.53, 0.059) times cephalothorax width. Weakly developed thoracic groove, when evident, located just posterior to cephalic region, 0.869 carapace length (3, 0.80-1.00, .115) from anterior carapace margin. Carapace, uniform dusky
tan, with 5 narrow rows of thick white setae: three rows extending the length of
cephalic region, and two additional rows located anterior laterally.

Posterior eye row in most individuals slightly recurved by one-half the diameter
of the PME. Borders of eyes, particularly the AME's, with heavy black pigmentation.

Eye diameters: AME 0.06 (7, .06-.06, 0), ALE 0.079 (7, .07-.08, .038), PME 0.06 (7,
.04-.08, .0115), PLE 0.069 (7, 0.06-0.08, 0.011). ALE's separated by 0.263 (7, 0.24-
0.30, 0.269) diameter. Remaining anterior eye interdistances, expressed as AME
diameters: AME-AME 0.952 (7, 0.67-1.00, 0.126), AME-ALE 0.76 (7, 0.67-1.00,
0.163), AME-PME 1.17 (6, 1-1.33,0.183), ALE-PLE 0.67 (7, 0.67-0.67, 0). PLE's
separated by 0.36 (7, 0.32-0.34, 0.035) diameter. Remaining posterior eye
interdistances, expressed as PME diameters: PME-PME 1.43 (7, 1.00-2.00, 0.371),
PME-PLE 1.26 (7, 1.00-1.67, 0.270).

Clypeus height 1.14 (7, 0.67-1.33, 0.262) times AME diameter. Chelicerae
length quite variable, 6.55 (7, 4.75-10.00, 1.667) times clypeus height. Chelicerae
length 2.00 (7, 1.81-2.11, 0.093) times width. Chelicerae with 3 promarginal teeth, the
center tooth approximately 2 times larger than the others, and 2 small retromarginal
teeth. Chelicerae have a wide dark median transverse band on their anterior surfaces.
Labium, endites and sternum pale yellow. Labium length 0.862 (7, 0.75-1.00, 0.098)
times width. Endite length 2.00 (7, 1.85-2.25, 0.16) times width. Sternum 0.637 (6,
0.56-0.68, .043) long, length 1.20 (6, 1.18-1.26, 0.032) times width. Anterior margin
of sternum straight. Legs light yellow with light, non-distinct, dusky grey bands on
the tibia and femur. Leg formula I-II-IV-III, with leg II only slightly longer than leg
IV. Calimistrum length 0.67 (5, 0.63-0.71, 0.07) times that of metatarsus IV.

Abdomen length 1.46 (6, 1.29-1.68, 0.13) times width. Dorsum of most individuals with alternating, dark green and yellow chevrons. However, preserved female lacking a distinct abdominal color pattern was illustrated (Fig. 22). Lateral surfaces of abdomen have dark stripe in the anterior two thirds. Venter, uniformly light yellow, lacking the median line typical of most Mallos species. The cribellum is undivided. Sclerotized rims of epigynal bursae convex relative to center of epigynum. Bursae situated anteriorly. A single pair of simple contiguous, heavily sclerotized spermethcae lie in the center of epigynum and are visible externally as a dark trapezoid.

MALE: Only one male was measured. Total length 2.08. Cephalothorax 0.94 long, length 1.21 times width. Width of cephalic region 0.59 times that of cephalothorax. Weakly developed thoracic groove, when evident, located just posterior to the cephalic region, 0.70 carapace length from anterior carapace margin. Carapace color and setal pattern like that of the female (Fig. 26).

Posterior eye row is slightly recurved by one-half the diameter of the PME. Borders of eyes, particularly AME's, have heavy, black pigmentation. Eye diameters: AME 0.06, ALE 0.08, PME 0.08, PLE 0.08. ALE's separated by 0.22 diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 0.67, AME-ALE 0.67, AME-PME 1.00, ALE-PLE 0.67. PLE's separated by 0.30 diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 0.75,
PME-PLE 075.

Clypeus height 1.33 times AME diameter. Cheliceral length 5.25 times clypeus height, length 2.10 times width. Chelicerae slightly emarginated with the anterior dorsal surface not extending anterior to the clypeus. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Labium, endites and sternum pale yellow. Labium length 0.90 times width. Endite length 1.86 times width. Sternum 0.60 long, length 1.30 times width. Anterior margin of sternum concave. Leg color similar to that of female. Leg formula I-II-IV-III, with leg II being only slightly longer than leg IV.

Abdomen length 1.67 times width. Venter solid grayish green without distinct markings. No distinct lateral or ventral markings. (Fig. 26)

The DiTA of the pedipalp has a corkscrew shaped terminus with its tip directed inward and towards the embolus base (Fig. 27). The embolus originates at 11:00 from an oval base. Cymbium length 1.89 times width.

Distribution: From Southern Mexico through Central America and into Peru and Paraguay.

Ivie coll.) AMNH; Nayarit, Palm Grove 5 mi. East of San Blas, 1 female (1954, W.J. Gertsch) AMNH. **Panama:** Cerro Pena, near El Valle, 1 female (Nov. 1946, N. L. H. Krauss) AMNH. **Paraguay:** Apa, 1 female and male (Jan. - Feb. 1909) AMNH.

**Peru:** San Miguel 6,000', Yale Peruvian Expedition, 1 female (July, 1911) MCZ.
Table 4. Mean lengths of female and male leg articles, *Mallos hesperius*.

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*Mallos gregalis* (Simon) 1909

Figs. 28 - 33, Tbl. 5

*Coenothele gregalis* Simon 1909, p. 736 (male and female holotypes from Sierra de Hapugahua, Mexico in MNDM, examined).

*Coenothele gregalis* Berland 1913, p. 27, figs. 27-30.

*Mallos gregalis* Chamberlin and Gertsch 1958, p. 37, figs. 9, 14, 15.

**Diagnosis:** The females of this species closely resemble *M. hesperius* and *M. margaretae* in size, abdominal color pattern, and cheliceral markings. However, the posterior eye row is not recurved and the epigynal ducts consists of a pair of heavily sclerotized, bifurcate, spermethcae (Fig. 30). The males of this species are small, less than 3.20 in length. The male palp has a C-shaped DiTA terminus, like that of *M. bryanti*, however, in *M. gregalis* the cymbium length is only 1.5 times its width, whereas, in *M. bryanti* it is twice the cymbium width.

**FEMALE:** Total length 3.58 (3, 3.16-3.88, 0.38). Cephalothorax 1.41 long (3, 1.28-1.60, 0.17). Cephalothorax length 1.21 times wide (3, 1.12-1.28, 0.08). Cephalic width 0.64 (3, 1.51-1.58, 0.04) times cephalothorax width. Weakly developed thoracic
groove, when evident, located just posterior to cephalic region, 1.14 (2, 0.98-1.30, 0.23) from anterior carapace margin. Carapace dark brown, covered in thick white setae.

Posterior eye row without recurve. Borders of eyes only lightly pigmented.

Eye diameters: AME 0.08 (3, 0.08-0.08, 0), ALE 0.10 (3, 0.10-0.10, 0), PME 0.08 (3, 0.08-0.08, 0), PLE 0.08 (3, 0.08-0.08, 0). ALE's separated by 0.37 (3, 0.34-0.38, 0.02) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.00 (3, 1.00-1.00, 0), AME-ALE 1.00 (2, 1.00-1.00, 0), AME-PME 1.00 (3, 1.00-1.00, 0), ALE-PLE 0.50 (3, 0.50-0.50, 0). PLE's separated by 0.49 (7, 0.32-0.34, 0.035) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.41 (3, 1.25-1.50, 0.14), PME-PLE 1.33 (3, 1.25-1.50, 0.14).

Clypeus height 1.17 (3, 1.00-1.25, 0.14) times AME diameter. Chelicerae length 6.47 (3, 6.2-7.00, 0.46) times clypeus height. Chelicerae length 2.00 (3, 1.87-2.07, 0.11) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 3 small retromarginal teeth. Chelicerae have a wide dark median transverse band on their anterior surfaces.

Labium, endites and sternum dark brown like carapace. Labium length 0.88 (3, 0.71-1.00, 0.15) times width. Endite length 1.99 (3, 1.82-2.27, 0.25) times width. Sternum 0.81 (3, 0.70-0.92, 0.043) long, length 1.15 (3, 1.14-1.17, 0.01) times width. Anterior margin of sternum slightly concave. Legs light brown. Tibia and distal 2/3's of femur, LI and LII, have dark bands. Leg formula I-IV-II-III, with leg IV only slightly longer than leg II. Calimistrum length 0.64 (3, 0.57-0.81, 0.07) times that of
metatarsus IV.

Abdomen length 1.40 (3, 1.36-1.42, 0.03) times width. Dorsum of most individuals with alternating, dark green and yellow chevrons (Fig. 28). Lateral surfaces of abdomen lacking distinct markings. Venter, with median line. The cribellum is undivided. Sclerotized rims of epigynal bursae concave relative to center of epigynum. Bursae situated anteriorly. A single pair of bifurcate, heavily sclerotized spermethcae are positioned directly above the epigastric furrow and are visible externally as small dark circles.

MALE: Total length 3.13 (3, 3.00-3.20, 0.12). Cephalothorax 1.29 (3, 1.24-1.32, 0.05) long, length 1.11 (3, 1.10-1.13, 0.12) times width. Width of cephalic region 0.66 (3, 0.65-0.67, 0.02) times that of cephalothorax. Weakly developed thoracic groove, when evident, located just posterior to the cephalic region, 0.69 from anterior carapace margin. Carapace color and setal pattern like that of the female (Fig. 31).

Posterior eye row straight. Borders of eyes lack heavy, black pigmentation.

Eye diameters: AME 0.08 (3, .08-.08, 0), ALE 0.10 (3, 0.10-0.10, 0), PME 0.08 (3, 0.08-0.08, 0), PLE 0.08 (3, 0.08-0.08, 0). ALE's separated by 0.43 (3, 0.362-0.52, .08) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.17 (3.075-1.75, .52), AME-ALE 1.17 (3, 1.00-1.50, 0.29), AME-PME 1.17 (3, 1.00-1.25, 0.14), ALE-PLE 0.50 (3, 0.50-0.50, 0). PLE's separated by 0.56 (3, 0.50-0.68, 0.10) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.83 (3, 1.50-2.50, 0.58), PME-PLE 1.58 (3, 1.25-2.00, 0.38).
Clypeus height 1.58 (3, 1.25-2.00, 0.38) times AME diameter. Cheliceral length 5.44 (3, 4.00-7.00, 1.50) times clypeus height, length 2.14 (3, 1.78-2.46, 0.34) times width. Chelicerae slightly emarginated with the anterior dorsal surface not extending anterior to the clypeus. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 3 small retromarginal teeth. Labium and sternum darker brown in color than endites. Labium length 0.96 (3, 0.94-1.00, 0.03) times width. Endite length 2.09 (3, 1.67-2.30, 0.37) times width. Sternum 0.78 (3, 0.72-0.82, 0.06) long, length 1.16 (3, 1.13-1.17, 0.03) times width. Anterior margin of sternum concave. Leg color similar to that of female. Leg formula I-II-IV-III, with leg II being only slightly longer than leg IV.

Abdomen length 1.52 (3, 1.49-1.57, 0.04) times width. Dorsal coloration like that of female, however, markings much lighter in color. Light stripes down sides of abdomen. Venter with gray median line

The DiTA terminus is c-shaped with its tip directed outward and away from the embolus base (Fig. 32). The embolus base is oval and angled away from the embolus/embolus base junction. The embolus originates at 11:00. Cymbium length 1.55 (3, 1.5-1.57, 0.05) times width.

Distribution: Southern Mexico.

Material examined: **Mexico**: Jalisco, Guadalajara, 1 females, 1 male (Jul. 1974, from colony in Raleigh, NC, R. Jackson.) AMNH; Jalisco, Guadalajara, 1 female (Jul.
1974, W. Buress) AMNH; Dignet, Cerro de Huejotilian, 1 female, 1 male AMNH.
Figures 28 - 33 - *Mallos gregalis* (Simon). 28. female, dorsal view; 29. epigynum, ventral view; 30. internal ducts of epigynum; 31. male, dorsal view; 32. left palp, ventral view; 33. same, retrolateral view.
Table 5. Mean lengths of female and male leg articles, *Mallos gregalis*

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Mallos bryanti Gertsch 1946

Figs. 34 - 39, Tbl. 6

Mallos bryanti Gertsch 1946, p. 6, figs. 2, 3 (male holotype and female allotype from Arizona, Santa Rita Mts in AMNH, examined).

Diagnosis: The reproductive structures of this species closely resemble those of M. gregalis. Females of both species have a heavily sclerotized, bifurcate spermethcae and the anteriorly situated bursae are concave relative to the center of the epigynum, males have a c-shaped DiTA terminus oriented away from the embolus base. However, M. bryanti females are large, total length greater than 4.32, whereas M. gregalis individuals are less than 4.00 long. Both female and male M. bryanti have a distinct anchor shaped marking on the dorsal surface of the carapace as well as a distinct dark yellow band down the center of the carapace. This contrasts with the uniform carapace coloration and chevron abdominal pattern of M. gregalis.

FEMALE: Total length 5.07 (5.432-5.73, 0.77). Cephalothorax 1.74 long (5, 1.52-1.96, 0.18). Cephalothorax length 1.27 times width (5, 1.00-1.23, 0.093). Cephalic width 0.58 (5, 0.55-0.61, 0.07) times cephalothorax width. Prominent thoracic groove, located just posterior to cephalic region, 1.27 carapace length (5, 1.08-1.42, 0.14) from anterior carapace margin. Carapace, dark brown with yellow median line, with 5
narrow rows of thick white setae: three rows extending the length of cephalic region, and two additional rows located anterior laterally.

Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.08 (5, 0.08-0.08, 0), ALE 0.098 (5, 0.09-0.10, 0.004), PME 0.08 (5, 0.08-0.08, 0), PLE 0.08 (5, 0.08-0.10, 0.009). ALE's separated by 0.40 (5, 0.34-0.38, 0.06) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.05 (5, 0.75-1.25, 0.21), AME-ALE 0.90 (5, 0.75-1.25, 0.22), AME-PME 1.15 (5, 1.00-1.25, 0.14), ALE-PLE 0.25 (5, 0.25-0.25, 0). PLE's separated by 0.52 (5, 0.46-0.60, 0.07) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.65 (5, 1.25-2.00, 0.34), PME-PLE 1.15 (5, 1.25-1.75, 0.07).

Clypeus height 1.30 (5, 1.00-1.50, 0.21) times AME diameter. Chelicerae length 7.00 (5, 6.40-7.75, 0.52) times clypeus height. Chelicerae length 2.26 (5, 2.10-2.67, 0.23) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Chelicerae have a wide dark median transverse band on their anterior surfaces. Labium, endites and sternum dark brown, labium slightly darker in color. Labium length 0.94 (5, 0.81-1.00, 0.08) times width. Endite length 2.02 (5, 1.83-2.18, 0.14) times width. Sternum 1.07 (5, 0.94-1.20, 0.12) long, length 1.30 (5, 1.27-1.33, 0.03) times width. Anterior margin of sternum concave. Legs light brown with light, non-distinct, dusky grey bands on the distal patella and tibia. Leg formula I-II-IV-III, with leg II only slightly longer than leg IV. Calimistrum length 0.62 (5, 0.46-0.71, 0.32) times that of metatarsus IV.
Abdomen length 1.34 (5, 1.15-1.43, 0.13) times width. Dorsum of most individuals with a distinct anchor shaped mark and two additional posterior stripes (Fig. 34). Lateral surfaces of abdomen have no distinct markings. Venter with dark median line. Tips of spinnerets black. The cribellum is undivided. Sclerotized rims of epigynal bursae concave relative to center of epigynum and situated anteriorly. Epigynal ducts consist of a simple pair of heavily sclerotized, bifurcate, spermethecae (Fig. 35) that are visible externally as hazy black patches posterior to bursal the openings. (Fig. 36)

MALE: Total length 4.30 (5, 3.72-4.98, 0.51). Cephalothorax 1.97 (6, 1.68-2.36, 0.26) long, length 1.30 (6, 1.23-1.39, 0.06) times width. Width of cephalic region 0.63 (6, 0.60-0.65, 0.05) times that of cephalothorax. Prominent thoracic groove located just posterior to the cephalic region, 1.50 (6, 1.28-1.74, 0.18) carapace length from anterior carapace margin. Carapace color and setal pattern like that of the female except much darker in color (Fig. 37).

Posterior eye row straight. Borders of eyes without heavy, black pigmentation. Eye diameters: AME 0.08 (6, 0.08-0.08, 0), ALE 0.10 (6, 0.10-0.10, 0), PME 0.08 (6, 0.08-0.08, 0), PLE 0.083 (6, 0.08-0.10, .008). ALE's separated by 0.46 (6, 0.42-0.52, 0.04) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.25 (6, 1.00-1.50, 0.22), AME-ALE 1.21 (6, 0.75-1.25, 0.25), AME-PME 1.75, ALE-PLE 0.25 (6, 0.25-0.25, 0). PLE's separated by 0.60 (6, 0.54-0.74, 0.06) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-
PME 1.96 (6, 1.5-2.25, 0.30), PME-PLE 1.71 (6, 1.5-2.25, 0.30).

Clypeus height 2.08 (6, 1.5-2.75, 0.54) times AME diameter. Cheliceral length 6.79 (6, 5.45-8.00, 1.04) times clypeus height, length 2.37 (6, 2.29-2.46, 0.07) times width. Chelicerae emargination variable, anterior dorsal surface not extending anterior to the clypeus. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Labium, endites and sternum dark brown. Labium length 1.16 (6, 1.05-1.25, 0.09) times width. Endite length 2.14 (6, 1.89-2.27, 0.14) times width. Sternum 1.03 (6, 0.90-1.30, 0.15) long, length 1.24 (6, 0.69-1.53, 0.29) times width. Anterior margin of sternum straight.

Legs dark brown, distal 2/3's of femurs I and II with dark band. Leg formula I-II-IV-III, with leg II exceptionally longer than leg IV.

Abdomen length 1.59 (6, 1.35-1.75, 0.13) times width. Dorsum like that of female. No distinct lateral markings. Ventral abdomen with dark median line, black patch in center and red anterior spot.

The pedipalp's DiTA terminus is an open c-shape with its tip directed outward and away from the embolus base (Fig. 38). The embolus originates from a round base at 11:00. Cymbium length 1.90 (6, 1.82-2.05, 0.08) times width.

Distribution: Southwestern New Mexico and Arizona and northern Mexico.

Select Material examined: New Mexico: 25 mi. north of Alma, Forest Camp, Cottonwood Canyon, 2 males and 1 female (Sept. 1950, Gertsch coll.); Arizona:
Santa Rita Mtns, 2 female and male paratypes (Sept, 1936); Cochise County, AMHH

Southwestern Research Station, 2 males and 2 females (Aug. 1994, Bond coll.);

**Mexico:** Chihuahua, 22.4 mi. south of South Minaca, 1 female (Aug. 1950, Smith coll.).
Figures 34 - 39 - *Mallos bryanti* Gertsch. 34. female, dorsal view; 35. epigynum, ventral view; 36. internal ducts of epigynum; 37. male, dorsal view; 38. left palp, ventral view; 39. same, retrolateral view.
Table 6. Mean lengths of female and male leg articles, *Mallos bryanti*.

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Mallos dugesi (Becker) 1886

Figs. 40 - 46, Tbl. 7


Dictynoides arizonensis Chamberlin 1919, vol. 12, p. 244, fig. 1 (female holotype from Arizona, Huachuca Mts. in MCZ, examined).

Mallos arizonensis Gertsch and Davis 1942, no. 1158, p. 17.


Diagnosis: This species closely resembles its sister species M. kraussi. The epigynal duct work of both consists of two posteriorly positioned small bifurcate spermethcae. In females of both species the dorsum of the abdomen bears an anchor shaped mark. Externally the epigynum of M. dugesi appears as two black spots with no visible openings (Fig. 41), whereas M. kraussi females have distinct bursal openings (Fig. 48). The palps of male M. dugesi and M. kraussi each have a thin, elongate DiTA terminus with a small triangular tail and an embolus that originates from the base at 8:00 position. However, M. dugesi males have the distinct anchor shaped mark on their dorsum, while, the male M. kraussi specimen does not.
FEMALE: Total length 4.71 (9, 3.56-5.64, 0.68). Cephalothorax 1.83 long (10, 1.60-2.16, 0.18). Cephalothorax length 1.23 times (10, 1.11-1.35, 0.08) width. Cephalothorax width 0.58 (10, 0.54-0.63, 0.07) times cephalothorax width. Prominent, but shallow, thoracic groove, located just posterior to cephalic region, 1.36 (10, 1.14-1.66, 0.14) from anterior carapace margin. Carapace margins light brown, cephalic region slightly lighter in color. 5 narrow rows of thick white setae intermingled with thin black setae: three rows extending the length of cephalic region, and two additional rows located anterior laterally. One row of single black setae down center of carapace.

Posterior eye row straight. Borders of eyes without heavy black pigmentation. Eye diameters: AME 0.07 (10, .06-.08, 0.01), ALE 0.094 (10, 0.08-0.12, .01), PME 0.08 (10, 0.06-0.10, 0.01), PLE 0.09 (10, 0.08-0.10, 0.01). ALE's separated by 0.41 (10, 0.36-0.50, 0.04) diameter. Remaining anterior eye interdistancess, expressed as AME diameters: AME-AME 1.44 (10, 1.00-2.33, 0.42), AME-ALE 1.26 (10, 1.00-1.67, 0.31), AME-PME 1.48 (10, 0.75-2.33, 0.40), ALE-PLE 0.29 (10, 0.25-0.33, 0.04). PLE's separated by 0.54 (10, 0.48-0.68, 0.04) diameter. Remaining posterior eye interdistancess, expressed as PME diameters: PME-PME 1.83 (10, 1.25-2.67, 0.41), PME-PLE 1.69 (7, 1.50-2.30, 0.28).

Clypeus height 1.80 (10, 1.50-2.33, 0.30) times AME diameter. Chelicerae length 6.50 (10, 5.71-7.20, 0.42) times clypeus height. Chelicerae length 2.40 (10, 2.10-2.67, 0.21) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 3 small retromarginal teeth. Labium, endites and sternum yellow, labium with a gray hue. Labium length 1.01 (10, 0.65-
1.11, 0.14) times width. Endite length 2.26 (10, 1.73-2.63, 0.27) times width. 

Sternum 1.10 (10, 1.00-1.38, 0.11) long, length 1.27 (10, 1.20-1.41, 0.07) times width. 

Anterior margin of sternum concave. Legs light yellow without distinct markings. 

Leg formula I-II-IV-III, with leg II only slightly longer than leg IV. Calimistrum length 0.73 (8, 0.59-0.97, 0.18) times that of metatarsus IV.

Abdomen length 1.35 (10, 1.21-1.57, 0.12) times width. Dorsum of most individuals with simple anchor shaped marking and 3 pairs of posterior spots connected by light red streaks (Fig. 40). Lateral surface of abdomen has no distinct markings. Venter with light median line. The cribellum is undivided.

From the exterior bursal openings not visible and surrounded by area of heavy sclerotization. Bursae situated anteriorly. Internally the epigynum consists of a pair of small bifurcate spermethæcae located posteriorly to the bursal openings.

MALE: Total length 3.76 (7, 3.12-4.73, 0.67). Cephalothorax 1.72 (8, 1.36-2.12, 0.27) long, length 1.31 (8, 1.20-1.77, 0.19) times width. Width of cephalic region 0.68 (8, 0.63-0.87, 0.14) times that of cephalothorax. Prominent thoracic groove located just posterior to the cephalic region, 1.34 (8, 1.04-1.68, 0.21) from anterior carapace margin. Carapace uniform light brown (Fig. 43). Carapace setal pattern like that of the female.

Posterior eye row straight. Borders of eyes without black pigmentation. Eye diameters: AME 0.07 (8, 0.06-0.08, 0.01), ALE 0.09 (8, 0.06-0.12, 0.02), PME 0.08 (0.06-0.10, 0.01), PLE 0.08 (8, 0.06-0.10, 0.10). ALE's separated by 0.40 (7, 0.32-
0.48, 0.06) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.17 (8, 1.00-1.67, 0.26), AME-ALE 1.27 (7, 1.00-1.75, 0.25), AME-PME 1.33 (8, 1.25-1.50, 0.08), ALE-PLE 0.30 (8, 0.25-0.33, 0.04). PLE's separated by 0.51 (8, 0.40-0.60, 0.08) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.46 (8, 1.25-1.75, 0.18), PME-PLE 1.50 (8, 1.00-2.00, 0.31).

Clypeus height 1.89 (8, 1.50-2.67, 0.38) times AME diameter. Cheliceral length 8.89 (8, 7.50-11.50, 1.50) times clypeus height, length 2.55 (8, 2.14-3.00, 0.28) times width. Chelicerae emargination, very variable, with the anterior dorsal surface extending anterior to the clypeus. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 3 small retromarginal teeth. Endites and sternum dark brown, labium very dark brown. Labium length 1.32 (8, 0.88-1.46, 0.19) times width. Endite length 2.20 (8, 1.35-3.00, 0.53) times width. Sternum 1.06 (8, 0.84-1.26, 0.16) long, length 1.31 (8, 1.23-1.41, 0.07) times width. Anterior margin of sternum concave. Legs light yellow with dusky grey bands on distal segments of the femur and tibia. Leg formula I-II-IV-III, with leg II considerably longer than leg IV.

Abdomen length 1.86 (8, 1.72-2.19, 0.15) times width. Dorsum like that of female. No distinct lateral or ventral markings. Venter has dusky median line. Red spot posterior to the pedicle.

The pedipalp's DiTA terminus is a thin projection with a small distal triangular tab. (Fig. 45). The small distal tab orientated away from the embolus base. The
embolus originates at 9:00 from a round base. Cymbium length 1.86 (8, 1.74-2.11, 0.12) times width.

Distribution: Southwestern Arizona and New Mexico and Northern (?) Mexico.

Select Material examined: Arizona: Cochise County, AMNH Southwestern Research Station, 5 miles west of Portal, 46 females and 3 males (Oct. 1956, Gertsch coll.) AMNH; Mule Mts., 3 mi. N. Bisbee, 16 males, 12 females, 7 juveniles (Sept. 1950, Gertsch coll.) AMNH; White House Canyon, Santa Rita Mts., 3 females (Oct. 1936, Gertsch coll.) AMNH; Cochise Stronghold, Dragoon Mts., 1 female and 1 male (Sept. 1950, Gertsch coll.) AMNH; Tuscon, 2 females (Sept. 1940, Gertsch coll.) AMNH; New Mexico: Geronimo Trail, Peloneillo Mts., elev. 1440 m., 1 female (Aug. 1994, Bond and Opell coll.) Mexico: Sonora, N. side Sierra Alamos, 2000 m., 11 females (Nov. 1972, Roth coll.) AMNH; Taxco, Guererro, 1 male (Sept. 1959, Degner coll.) AMNH; Morelos, Cuernavaca 1 female (Sept. 1965, Krauss) AMNH; Nombre de Dios, 2 females and 15 juveniles (Aug. 1947, Gertsch coll.) AMNH; Jalisco, 14.5 miles west of Mixtlans, 1520 m. (Nov. 1987) AMNH.
Figures 40 - 46 - *Mallos dugesi* (Becker). 40. female, dorsal view; 41. epigynum, ventral view; 42. internal ducts of epigynum; 43. male, dorsal view; 44. chelicerae of male; 45. left palp, ventral view; 46. same, retrolateral view.
Table 7. Mean lengths of female and male leg articles, *Mallos dugesi*.

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*Mallos kraussi* Gertsch 1946

Figs. 47 - 51, Tbl. 8

*Mallos kraussi* Gertsch 1946, no. 1319, p. 6, fig. 1 (female holotype from Mexico: Cuernavaca, Morelos in AMNH, examined).

**Diagnosis:** Female *Mallos kraussi* are distinguished from those of its sister species *M. dugesi* by having a body length greater than 5.30. *M. dugesi* females are typically less than 5.00 long. The bursal openings of *M. kraussi* females are large and have convex (relative to the center of the epigynum) bursal rims, whereas those of *M. dugesi* are very small and lack developed bursal rims. Male *M. kraussi* lack distinct abdominal markings, whereas *M. dugesi* males have a distinctive anchor shaped mark on the dorsum of the abdomen.

**FEMALE:** Total length 5.54 (3, 5.31-5.82, 0.26). Cephalothorax long 1.90 (3, 1.73-2.16, 0.23). Cephalothorax length 1.68 (2, 1.15-1.23, 0.06) times wide. Cephalic width 0.60 (2, 0.59-0.60, 0.02) times cephalothorax width. Prominent thoracic groove located just posterior to cephalic region, 1.40 (2, 1.30-1.50, 0.14) from anterior carapace margin. Carapace dark orange with 5 rows of thick white setae: three rows extending the length of cephalic region, and two additional rows located anterior laterally.
Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.09 (3, 0.08-0.10, 0), ALE 0.13 (3, 0.12-0.14, 0.01), PME 0.10 (3, 0.10-0.10, 0), PLE 0.10 (3, 0.10-0.10, 0). ALE's separated by 0.45 (3, 0.42-0.50, 0.04) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.15 (3, 1.00-1.25, 0.13), AME-ALE 0.93 (3, 0.80-1.00, 0.12), AME-PME 1.17 (3, 1.00-1.50, 0.29), ALE-PLE 0.22 (3, 0.20-0.25, 0.03). PLE's separated by 0.59 (3, 0.54-0.64, 0.05) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.33 (3, 1.20-1.60, 0.23), PME-PLE 1.47 (3, 1.20-1.60, 0.23).

Clypeus height 1.23 (3, 1.00-1.50, 0.25) times AME diameter. Chelicerae length 7.45 (3, 6.50-9.20, 1.51) times clypeus height. Chelicerae length 2.56 (3, 2.35-2.79, 0.22) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 3 small retromarginal teeth. Chelicerae with no distinct markings. Endites and sternum light orange, labium very dark brown. Labium length 0.97 (3, 0.91-1.06, 0.08) times width. Endite length 1.99 (3, 1.79-2.31, 0.28) times width. Sternum 1.21 (3, 1.12-1.30, 0.09) long, length 1.28 (3, 1.24-1.33, 0.05) times width. Anterior margin of sternum concave. Legs orangish/brown, I and II darker in color than III and IV. Leg formula I-II-IV-III, with leg II only slightly longer than leg IV. Calimistrum length 0.57 (3, 0.54-0.60, 0.10) times that of metatarsus IV.

Abdomen length 1.31 (3, 1.21-1.40, 0.09) times width. Dorsum of most individuals with anchor shaped mark (Fig. 47). Lateral surfaces without distinct markings. Venter with brown median line typical of most Mallos species. The
cribellum is undivided. Sclerotized rims of epigynal bursae convex relative to center of epigynum. Bursae situated anteriorly. Dark, heavily sclerotized spots in upper corner of bursal openings. Epigynum with pair of single ducts that terminate in two small posterior spermathecal lobes. (Figs. 48, 49)

MALE: Only one male was measured. Total length 4.89. Cephalothorax 2.16 long, length 1.31 times width. Width of cephalic region 0.65 times that of cephalothorax. Prominent thoracic groove, located just posterior to the cephalic region, 1.50 from anterior carapace margin. Carapace color and setal pattern like that of the female (Fig. 50).

Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.08, ALE 0.12, PME 0.10, PLE 0.10. ALE's separated by 0.52 diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.50, AME-ALE 1.50, AME-PME 1.50, ALE-PLE 0.25. PLE's separated by 0.66 diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.60, PME-PLE 1.80.

 Clypeus height 1.25 times AME diameter. Cheliceral length 13.80 times clypeus height, length 2.56 times width. Chelicerae emarginated (bowed) with the anterior dorsal surface extending anterior to the clypeus. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 3 small retromarginal teeth. Endites and sternum orange, labium slightly darker in color. Labium length 1.40 times width. Endite length 2.18 times width. Sternum 1.30 long,
length 1.33 times width. Anterior margin of sternum straight. Legs dark orange, without distinct markings. Leg formula I-II-IV-III, with leg II considerably longer than leg IV.

Abdomen length 1.68 times width. Dorsum solid grayish green without distinct markings. No distinct lateral markings. Venter with brown median line.

The terminus of the pedipalp's DiTA is a thin projection with a small distal triangular tab. (Fig. 51). The embolus originates at 8:00 from a round base.

Cymbium length 1.84 times width.

Distribution: Southern Mexico.

Material examined: Mexico: Cuernavaca, Morelos 1 females (Nov. 1945, Kruass coll.) AMNH; Cuernavaca, Morelos 1 female paratype (Nov. 1946) AMNH; Cuernavaca, Morelos 2 female paratypes (Nov. 1945, Kruass coll.) AMNH; Guerrero, Taxco 1 female (Jan. 1946, Isaacs coll.) AMNH; Guerrero, Taxco W99.36: N18.32 1 male (Sept. 1966, J. & W Ivie colls.) AMNH.
Figure 47 - 51 - *Mallos kraussi* Gertsch. 47. female, dorsal view; 48. epigynum, ventral view; 49. internal ducts of epigynum; 50. male, dorsal view; 51. left palp, ventral view.
Table 8. Mean lengths of female and male leg articles, *Mallos kraussi*.

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<th>Mean Lengths of Leg Articles</th>
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<td></td>
<td>f</td>
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<td>Coxa</td>
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<td>Tibia</td>
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<td>Metatarsus</td>
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<td>Tarsus</td>
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<td>TOTAL</td>
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Mallos blandus Chamberlin and Gertsch 1958

Figs. 52 - 58, Tbl. 9

**Mallos blandus** Chamberlin and Gertsch 1958, vol. 116 (1), p. 40, fig. 7 (female holotype from New Mexico: Whites City in AMNH, examined).

**Diagnosis:** The abdominal color pattern of *Mallos blandus* females resembles that of *M. bryanti* and *M. niveus*. However, externally the epigynum closely resembles that of *Mallos* new species C externally. The convex sclerotized rims of the epigynal bursae continue as a straight ridge that runs parallel to the epigastric furrow. Internally both have a tri-lobed spermetheca. The most anterior spermethecal lobe in *M. blandus* is short, whereas in all other *Mallos* species having a tri-lobed spermetheca, it is elongate and/or elongate and coiled. The male palp is similar to *Mallos* new species A, but the DiTA terminus is thicker than that of this species and terminates in a blunt, rather than sharp point. *M. blandus* also has a large, rounded sclerite, visible under the proximal outer edge of the embolus base. That of *Mallos* new species A is small and not visible.

**FEMALE:** Total length 4.33 (4, 2.08-5.31, 1.51). Cephalothorax long 1.80 (5, 1.52-2.00, 0.20). Cephalothorax length 1.20 (5, 1.15-1.24, 0.04) times wide. Cephalic width 0.58 (5, 0.57-0.59, 0.02) times cephalothorax length. Prominent thoracic
groove located just posterior to cephalic region, 1.37 (5, 1.24-1.44, 0.09) from anterior carapace margin. Carapace brownish orange with 5 rows of thick white setae: three rows extending the length of cephalic region, and two additional rows located anterior laterally.

Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.08 (5, 0.08-0.08, 0), ALE 0.096 (5, 0.08-0.10, 0.009), PME 0.08 (5, 0.06-0.08, 0.009), PLE 0.08 (5, 0.06-0.08, 0.009). ALE's separated by 0.43 (5, 0.38-0.46, 0.04) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.20 (5, 1.00-1.25, 0.11), AME-ALE 0.90 (5, 0.75-1.00, 0.14), AME-PME 1.40 (5, 1.25-1.50, 0.14), ALE-PLE 0.25 (5, 0.25-0.25, 0). PLE's separated by 0.57 (5, 0.50-0.60, 0.04) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.83 (5, 1.00-2.67, 0.60), PME-PLE 1.83 (5, 1.00-2.67, 0.60).

Clypeus height 1.80 (5, 1.50-2.25, 0.27) times AME diameter. Chelicerae length 5.62 (5, 4.67-6.17, 0.63) times clypeus height. Chelicerae length 2.28 (5, 2.10-2.47, 0.14) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Chelicerae without distinct markings. Labium, endites, and sternum light orange. Labium length 1.02 (5, 0.94-1.06, 0.05) times width. Endite length 1.99 (5, 1.14-2.54, 0.55) times width. Sternum 1.10 (5, 0.98-1.20, 0.09) long, length 1.24 (5, 1.14-1.35, 0.07) times width. Anterior margin of sternum concave. Legs I and II dusky orange, no prominent markings. Leg formula I-II-IV-III, with leg II only slightly longer than
leg IV. Calimistrum length 0.68 (5, 0.60-0.75, 0.15) times that of metatarsus IV.

Abdomen length 1.26 (5, 1.15-1.39, 0.09) times width. Dorsum of most individuals with brown anchor shaped mark (Fig. 52). Lateral surfaces without distinct markings. Venter with brown median line typical of most Mallos species. The cribellum is undivided.

Sclerotized rims of epigynal bursae convex relative to center of epigynum with short sclerotized ridge that runs parallel to the epigastric furrow. Bursal opening situated anteriorly. Externally the epigynal ducts appears as a small dark patch below lateral extension of bursal rim. From each epigynal opening with a short duct connects to a tri-lobed spermtheca. Arranged as single short anterior lobe and a bifurcate posterior lobe. (Figs. 53,54)

MALE: Total length 3.58 (2, 3.44-3.72, 0.20). Cephalothorax 1.66 (2, 1.64-1.68, 0.03) long, length 1.22 (2, 1.21-1.24, 0.02) times width. Width of cephalic region 0.60 (2, 0.60-0.60, 0) times that of cephalothorax. Prominent thoracic groove, located just posterior to the cephalic region, 1.02 (2, 0.80-1.24, 0.31) from anterior carapace margin. Carapace color and setal pattern like that of the female (Fig. 55).

Posterior eye row is straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.08 (2, 0.08-0.08, 0), ALE 0.10 (2, 0.10-0.10, 0), PME 0.08 (2, 0.08-0.08, 0), PLE 0.08 (2, 0.08-0.08, 0). ALE's separated by 0.39 (2, 0.38-0.40, 0.01) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.00 (2, 1.00-1.00, 0), AME-ALE 0.75 (2, 0.75-0.75, 0), AME-PME 1.13 (2,
1.00-1.25, 0.18), ALE-PLE 0.25 (2, 0.25-0.25, 0). PLE's separated by 0.52 (2, 0.52-0.52, 0) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.50 (2, 1.50-1.50, 0), PME-PLE 1.50 (2, 1.50-1.50, 0).

Clypeus height 1.75 (2, 1.75-1.75, 0) times AME diameter. Cheliceral length 6.71 (2, 6.71-6.71, 0) times clypeus height, length 2.69 (2, 2.61-2.76, 0.11) times width. Chelicerae intermediately emarginated (bowed) with the anterior dorsal surface not extending anterior to the clypeus. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Endites and sternum orange, labium slightly darker in color. Labium length 1.18 (2, 1.18-1.18, 0) times width. Endite length 1.81 (2, 1.77-1.85, 0.05) times width.

Sternum 0.90 (2, 0.90-0.90, 0) long, length 2.69 (2, 2.61-2.76, 0.11) times width. Anterior margin of sternum concave. Leg color tan without distinct markings. Leg formula I-II-IV-III, with leg II considerably longer than leg IV.

Abdomen length 1.55 times width. Dorsum with brown anchor shaped marking markings. No distinct lateral markings. Venter with median line.

The terminus of the pedipalp's DiTA is broad and corkscrew shaped (Fig. 56) and directed toward the embolus/embolus base junction. The embolus originates at 12:00 from an oval base. The tip of the embolus is hooked. This species also has a large sclerite that terminates under the lateral proximal margin of the embolus base in a blunt point. Cymbium length 1.49 (2, 1.45-1.52, 0.05) times width.

Distribution: Southern New Mexico..
Material examined: New Mexico: Whites City, Eddy Co. 24 females and 2 males

(Oct. 1961, Gertsch and Ivie coll.) AMNH; Whites City, Eddy Co. 3 female paratypes (Sept. 1950, Gertsch coll.) AMNH.
Figures 52 - 54. *Mallos blandus* Chamberlin and Gertsch. 52. female dorsal view; 53. epigynum, ventral view; 54. internal ducts of epigynum.
Figures 55 - 58 - *Mallos blandus* Chamberlin and Gertsch. 55. male, dorsal view; 56. left palp, ventral view; 57. same, expanded; 58. same, retrolateral view.
Table 9. Mean lengths of female and male leg articles, *Mallos blandus*.

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Mallos new species C

Figs. 59 - 61, Tbl. 10

**Diagnosis:** This large species known only from the female holotype. It is best distinguished by the solid white coloration of its abdomen. The bursae of the epigynum are very small and widely separated, and are located directly above the epigastric furrow. This is the only species with a long, uncoiled anterior spermathecal lobe.

**FEMALE:** Total length 4.98. Cephalothorax long 1.78. Cephalothorax length 1.14 times wide. Cephalic width 0.58 times cephalothorax width. Prominent thoracic groove located just posterior to cephalic region, 1.34 from anterior carapace margin. Carapace dark orange with 5 rows of thick white setae: three rows extending the length of cephalic region, and two additional rows located anterior laterally.

Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.09, ALE 0.11, PME 0.09, PLE 0.10. ALE's separated by 0.40 diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 0.89, AME-ALE 0.89, AME-PME 1.33, ALE-PLE 0.22. PLE's separated by 0.40 diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.33, PME-PLE 1.33.

Clypeus height 1.33 times AME diameter. Chelicerae length 6.67 times clypeus height. Chelicerae length 2.50 times width. Chelicerae with 3 promarginal
teeth, the center tooth approximately 2 times larger than the others, and 3 small retromarginal teeth. Chelicerae with no distinct markings. Endites and sternum light orange, labium darker orange. Labium length 1.00 times width. Endite length 1.47 times width. Sternum 1.08 long, length 1.17 times width. Anterior margin of sternum concave. Legs brownish orange with no distinct markings, I and II darker in color than III and IV. Leg formula I-II-IV-III, with leg II only slightly longer than leg IV. Calistrum length 0.79 times that of metatarsus IV.

Abdomen length 1.32 times width. Abdomen solid white with small horizontal H-shaped mark on cardiac region of dorsum (Fig. 59). Venter with brown median line typical of most Mallos species. The cribellum is undivided. Widely separated sclerotized rims of epigynal bursae convex relative to center of epigynum. Bursae situated posteriorly. Externally anterior spermhecal lobe visible as a dark patch above bursal openings. A single duct leads from each opening to a trilobed spermheca, with an elongate anterior lobe elongate and a short bifurcate posterior lobe. (Figs. 60, 61)

Distribution: Southern Mexico

Material examined: Mexico: Guerrero, Taxco 1 female (1948, Isaacs) AMNH.
Figures 59 - 61 - *Mallos* new species C. 59. female, dorsal view; 60. epigynum, ventral view; 61. internal ducts of epigynum.
Table 10. Mean lengths of female leg articles, *Mallos* new species C.

<table>
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<tr>
<th></th>
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<th>III</th>
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<td>m</td>
<td>f</td>
<td>m</td>
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<td>0.40</td>
<td>-</td>
<td>0.46</td>
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<td>0.52</td>
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**Mallos new species B**

Figs. 62, 63, Tbl. 11

**Diagnosis:** This species is known only from two female specimens. Like its sister species Mallos new species A, this species has a total length greater than 5.00, a divided cribellum and a trilobed spermethca. The epigynal bursae are more like that of *M. blandus*. The anterior spermethca is elongate, coiled, and visible externally as a thick anterior line circumventing the bursal openings. In *M. blandus* the anterior spermethcal lobe is short, uncoiled, and not visible from the exterior.

**FEMALE:** Total length 5.95 (2, 5.26-6.64, 0.98). Cephalothorax 2.14 (2, 2.12-2.16, 0.03) long. Cephalothorax length 1.16 (2, 1.161-1.155, 0.002) times wide. Cephalic width 0.56 (2, 0.55-0.56, 0.02) times cephalothorax width. Prominent thoracic groove located just posterior to cephalic region. Carapace dark margins orangish/brown, cephalic region light tan with 5 rows of thick white setae: three rows extending the length of cephalic region, and two additional rows located anterior laterally.

Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.10 (2, 0.10-0.10, 0), ALE 0.12 (2, 0.11-0.12, 0.007), PME 0.10 (2, 0.10-0.10, 0), PLE 0.10 (2, 0.10-0.10, 0). ALE's separated by 0.54 (2, 0.52-0.56, 0.03) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.00 (2, 1.00-1.00, 0), AME-ALE 1.20 (2, 1.20-1.20, 0), AME-PME 0.90 (2,
0.60-1.20, 0.42), ALE-PLE 0.20 (2, 0.20-0.20, 0) . PLE's separated by 0.62 (2, 0.54-0.70, 0.11) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.60 (2, 1.40-1.80, 0.28) , PME-PLE 1.50 (2, 1.40-1.60, 0.14) .

Clypeus height 1.50 (2, 1.40-1.60, 0.14) times AME diameter. Chelicerae length 6.49 (2, 6.12-6.86, 0.52) times clypeus height. Chelicerae length 2.31 (2, 2.27-2.40, 0.12) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth.

Chelicerae black. Labium, endites, and sternum brownish/orange. Labium length 1.00 (2, 1.00-1.00, 0) times width. Endite length 2.00 (2, 2.00-2.00, 0) times width. Sternum 1.37 (2, 1.36-1.38, 0.01) long, length 1.29 (2, 1.26-1.33, 0.05) times width. Anterior margin of sternum concave. Legs dark brown. Femur of legs I and II with dark band on distal 2/3's. Legs III and IV with 2 distinct bands on femur. Leg formula I-II-IV-III, with leg II only slightly longer than leg IV. Calimistrum length 0.67 (2, 0.62-0.72, 0.15) times that of metatarsus IV.

Abdomen length 1.47 (2, 1.36-1.57, 0.15) times width. Dorsum appears to have typical brown anchor shaped mark. Lateral surfaces without distinct markings. Venter with brown median line typical of most Mallos species. The cribellum is divided. Sclerotized rims of epigynal bursae convex relative to center of epigynum with short sclerotized ridge that runs parallel to the epigastric furrow. Bursae situated anteriorly. Epigynum with a pair of tril-lobed spermethcae. The anterior spermethecal lobe is elongate, coiled, and horizontally orientated; the posterior lobe is bifurcate. The anterior most lobe is visible externally as a dark eyebrow above the
bursal opening. (Figs. 62, 63)

Distribution: Southern Mexico

Material Examined: Mexico: Morelos, Cuernavaca 2 females (Jul. 1956, Roth and Gertsch coll.) AMNH.
Figures 62, 63 - Mallos new species C. 62. epigynum, ventral view; 63. internal ducts of epigynum.
Table II. Mean lengths of female leg articles, *Mallos* new species B

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<th>f</th>
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<th>IV</th>
<th>f</th>
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Mallos new species A

Figs. 64 - 69, Tbl. 12

Diagnosis: Females of this species are separated from those if its sister species, Mallos new species C, by having an epigynal bursae that is u-shaped, relative to the epigastric furrow. Like M. blandus males of this species have a DiTA terminus that is cork screw. However, the DiTA terminus of this species terminates in a sharp point, whereas, the DiTA terminus of M. blandus terminates in a blunt point.

FEMALE: Total length 5.81 (2, 5.48-6.14, 0.47). Cephalothorax long 2.17 (2, 1.76-2.57, 0.57). Cephalothorax length 1.12 (2, 1.00-1.24, 0.17) times wide. Cephalic width 0.61 (2, 0.59-0.64, 0.09) times cephalothorax width. Prominent thoracic groove located just posterior to cephalic region, 1.79 (2, 1.60-1.98, 0.27) from anterior carapace margin. Carapace margins dark brown, cephalic region dark tan, with 5 rows of thick white setae: three rows extending the length of cephalic region, and two additional rows located anterior laterally.

Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.09 (2, 0.08-0.10, 0.01), ALE 0.11 (2, 0.10-0.12, 0.01), PME 0.09 (2, 0.08-0.10, 0.01), PLE 0.10 (2, 0.08-0.12, 0.03). ALE's separated by 0.61 (2, 0.60-0.62, 0.01) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.45 (2, 1.40-1.50, 0.07), AME-ALE 1.93 (2, 1.60-2.25, 0.46)
AME-PME 1.00 (2, 1.00-1.00, 0), ALE-PLE 0.23 (2, 0.20-0.25, 0.04). PLE's separated by 0.82 (2, 0.20-0.25, 0.04) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 2.03 (2, 1.8-2.25, 0.32), PME-PLE 2.75 (2, 2.00-3.50, 1.06).

Clypeus height 1.93 (2, 1.60-2.25, 0.46) times AME diameter. Chelicerae length 6.06 (2, 6.00-6.12, 0.09) times clypeus height. Chelicerae length 2.19 (2, 2.16-2.23, 0.05) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 3 times larger than the others, and 3 small retromarginal teeth. Chelicerae black. Labium, sternum, and endites very dark brown. Labium length 1.05 (2, 1.00-1.09, 0.06) times width. Endite length 2.03 (2, 1.94-2.12, 0.12) times width. Sternum 1.52 (2, 1.40-1.64, 0.17) long, length 1.45 (2, 1.40-1.49, 0.06) times width. Anterior margin of sternum concave. Legs dark brown. Femur of Legs I and II with dark band on distal 2/3's. Leg formula I-II-IV-III. Calimistrum length 0.68 (2, 0.67-0.70, 0.05) times that of metatarsus IV.

Abdomen length 1.58 (2, 1.53-1.64, 0.08) times width. Dorsal color pattern indistinguishable due to poor preservation. Possibly anchor shaped color pattern, however, I have illustrated the specimen as it appears (Fig. 64). Lateral surfaces with brown anterior stripes. Venter with brown median line typical of most *Mallos* species. Spinnerets black. The cribellum is divided.

Sclerotized rims of epigynal bursae u-shaped relative to the epigastric furrow. Bursae situated posteriorly. Epigynum with a pair of tril-lobed spermthecae. The elongate anterior spermthecal lobe is loosely coiled and horizontally orientated, and
the posterior lobe is bifurcate. The anterior most spermethcal lobes are visible externally as a dark chevrons above the bursal openings. (Figs. 65, 66)

MALE: Males exceptionally large, total length 6.70 (2, 6.67-6.72, 0.04). Cephalothorax 3.03 (2.91-3.15, 0.17) long, length 1.30 (2, 1.19-1.40, 0.15) times width. Width of cephalic region 1.55 (2, 1.51-1.58, 0.05) times that of cephalothorax. Prominent thoracic groove, located just posterior to the cephalic region, 2.08 from anterior carapace margin. Carapace uniform dark brown. Setal pattern like that of the female (Fig. 64).

Posterior eye row is straight. Borders of eyes without heavy pigmentation.

Eye diameters: AME 0.12 (2, 0.12-0.12, 0), ALE 0.14 (2, 0.14-0.14, 0), PME 0.12 (2, 0.12-0.12, 0), PLE 0.12 (2, 0.12-0.12, 0). ALE's separated by 0.70 (2, 0.68-0.72, 0) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 0.83 (2, 0.83-0.83, 0), AME-ALE 1.50 (2, 1.50-1.50, 0), AME-PME 1.25 (2, 1.17-1.33, 0.12), ALE-PLE 0.17 (2, 0.17-0.17, 0). PLE's separated by 0.92 (2, 0.84-1.00, 0.11) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.50 (2, 1.33-1.67, 0.24), PME-PLE 2.50 (2, 2.33-2.67, 0.24).

Clypeus height 2.08 (2, 1.83-2.33, 0.35) times AME diameter. Cheliceral length 7.00 (2, 6.36-7.63, 0.90) times clypeus height, length 2.12 (2, 2.02-2.21, 0.13) times width. Chelicerae widely emarginated (bowed) (Fig. 67) with the anterior dorsal surface extending anterior to the clypeus. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 3-4 small retromarginal teeth.
Endites and sternum dark brown, labium slightly darker in color. Labium length 2.05 (2, 1.96-2.14, 0.13) times width. Endite length 2.05 (2, 1.96-2.14, 0.13) times width. Sternum 1.82 (2, 1.82-1.82, 0) long, length 1.45 (2, 1.37-1.52, 0.10) times width. Anterior margin of sternum straight. Legs dark brown, legs I and II darker than legs III and IV. Distal 2/3’s of femurs I and II with dark band. Legs III and IV with light bands. Leg formula I-II-IV-III, with leg II considerably longer than leg IV.

Abdomen length 1.73 (2, 1.72-1.74, 0.01) times width. Abdominal coloration and markings like that of female.

The terminus of the pedipalp's DiTA forms a corkscrew with its tip directed inward and towards the embolus base (Fig. 68). The embolus originates at 11:00 from a round base. Cymbium length 1.96 (2, 1.88-2.04, 0.11) times width.

Distribution: Southern Mexico.

Material examined: Mexico: Oaxaca, Monte Alban 1 female (Sept. 1947, Mallein coll.) AMNH; Guerrero, Teloloapan, 1200 m 2 females and 2 males (Nov. 1947, Wagner coll.) AMNH.
Figures 64 - 69 - *Mallos* new species A. 64. female, dorsal view; 65. epigynum ventral view; 66. internal ducts of epigynum; 67. male chelicerae, anterior view; 68. left palp, ventral view; 69. same, retrolateral view.
Table 12. Mean lengths of female and male leg articles, *Mallos* new species A.

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<th></th>
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Mallos niveus  Pickard-Cambridge 1902

Figs. 70 - 74, Tbl. 13

Mallos niveus  Pickard-Cambridge 1902, vol. 1, p. 308, fig. 1 (female holotype from Mexico: Cuernavaca, Morelos in AMNH, examined).


Emblyna urica  Chamberlin 1948, vol. 10 (6), p. 13, fig. 63 (female holotype from Utah: Hurricane in AMNH, examined).

Mallos alpheus  Chamberlin 1948, vol. 10 (6), p. 14, figs. 31-32 (female holotype and male allotype from Utah: Timpanogos Park, American Fork Canyon in AMNH, examined).


Diagnosis:  Like Mallos pallidus, females of this species have a divided cribellum and a bi-lobed spermethcal duct, however, the epigynal bursae of M. pallidus are larger and positioned very close together, whereas, those of M. niveus are smaller and more widely separated. The coiled anterior spermethcae of M. pallidus are visible
externally and are vertically positioned. Those of *M. niveus* are not visible externally
and are horizontally positioned. *M. niveus* males have a palp similar to *M. pallidus*,
*M. mians* and *M. pearci*. However, the DiTA terminus is elbow shaped and folds
back over on itself forming a distinct curl. In *M. pallidus*, *M. mians*, and *M. pearci*
the DiTA terminus is oval shaped.

FEMALE: Total length 3.20 (10, 2.72-4.00, 0.43). Cephalothorax long 1.16 (10, 0.86-1.40, 0.15). Cephalothorax length 1.09 (10, 0.90-1.27, 0.10) times wide.
Cephalic width 1.84 (10, 1.78-2.00, 0.06) times cephalothorax width. Prominent
thoracic groove located just posterior to cephalic region, 0.90 (6, 0.82-1.00, 0.08)
from anterior carapace margin. Carapace margins dark brown cephalic region tan.
Dorsal surface of carapace clothed in thick white setae.

Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye
diameters: AME 0.07 (10, 0.06-0.08, 0.01), ALE 0.08 (0.06-0.10, 0.01), PME 0.08
(10, 0.06-0.08, 0.008), PLE 0.08 (10, 0.06-0.08, 0.006). ALE's separated by 0.30 (10,
0.26-0.34, 0.03) diameter. Remaining anterior eye interdistances, expressed as AME
diameters: AME-AME 0.98 (10, 0.75-1.25, 0.18), AME-ALE 0.58 (10, 0.50-0.74,
0.10), AME-PME 1.07 (10, 0.75-1.33, 0.18), ALE-PLE 0.28 (10, 0.25-0.33, 0.04).
PLE's separated by 0.41 (10, 0.36-0.48, 0.05) diameter. Remaining posterior eye
interdistances, expressed as PME diameters: PME-PME 1.35 (10, 1.00-1.67, 0.19),
PME-PLE 1.13 (10, 1.00-1.33, 0.14).

Clypeus height 1.13 (10, 0.75-1.33, 0.14) times AME diameter. Chelicerae
length 6.10 (10, 5.20-7.67, 0.86) times clypeus height. Chelicerae length 2.00 (10, 1.77-2.25, 0.15) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth.

Chelicerae with no distinct markings. Endites and sternum brown, labium dark brown. Labium length 0.92 (10, 0.86-1.00, 0.06) times width. Endite length 1.80 (10, 1.50-2.00, 0.14) times width. Sternum 0.74 (10, 0.64-0.84, 0.07) long, length 1.18 (10, 1.07-1.27, .06) times width. Anterior margin of sternum concave. Legs dark brown.

Distal 2/3's of femurs darkly banded. Tibia of LII-LIV with 2 distinct bands, 1 proximal and 1 distal. Leg formula I-II-IV-III, with leg II only slightly longer than leg IV. Calimistrum length 0.68 (10, 0.59-0.77, 0.13) times that of metatarsus IV.

Abdomen length 1.28 (10, 1.10-1.48, 0.12) times width. Dorsum with brown anchor shaped mark (Fig. 70). Lateral surfaces with distinct stripe. Venter with brown median line typical of most *Mallos* species. The cribellum is divided. Sclerotized rims of epigynal bursae concave relative to center of epigynum. Bursae situated anteriorly and separated by approximately one and a half times the diameter of the bursal openings. Epigynal ducts visible externally only as a dark blotch adjacent to the bursal openings. Epigynum consists of a pair of bi-lobed spermathecae. The anterior most spermatheca elongate, coiled and horizontally orientated. The posterior spermathecal lobe is unbranched. (Figs. 71, 72)

**MALE:** Total length 2.22 (10, 1.30-2.80, 0.41). Cephalothorax 1.08 (10, 0.90-1.20, 0.10) long, length 1.15 (10, 1.08-1.22, 0.05) times width. Width of cephalic region
0.59 (10, 0.56-0.63, 0.07) times that of cephalothorax. Prominent thoracic groove, located just posterior to the cephalic region, 0.83 (9, 0.70-0.90, 0.06) from anterior carapace margin. Carapace coloration uniform dark brown. Setal pattern like that of the female (Fig. 70).

Posterior eye row is straight. Borders of eyes without heavy pigmentation.

Eye diameters: AME 0.07 (10, 0.06-0.08, 0.01), ALE 0.08 (10, 0.06-0.08, 0.01), PME 0.07 (10, 0.06-0.08, 0.01), PLE 0.07 (10, 0.06-0.08, 0.01). ALE's separated by 0.28 (10, 0.22-0.34, 0.04) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 0.92 (10, 0.67-1.33, 0.24), AME-ALE 0.63 (10, 0.50-0.86, 0.12), AME-PME 1.05 (10, 0.75-1.33, 0.21), ALE-PLE 0.29 (10, 0.25-0.33, 0.04). PLE's separated by 0.37 diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.22 (10, 1.00-1.67, 0.22), PME-PLE 1.13 (10, 1.00-1.67, 0.23).

Clypeus height 1.14 (10, 1.00-1.33, 0.16) times AME diameter. Cheliceral length 7.05 (10, 5.50-8.33, 0.83) times clypeus height, length 2.34 (10, 2.14-2.50, 0.12) times width. Chelicerae slightly emarginated, anterior dorsal surface does not extend anterior to the clypeus. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Endites and sternum brown, labium slightly darker in color. Labium length 1.07 (10, 0.81-1.20, 0.11) times width. Endite length 1.93 (10, 1.50-2.50, 0.33) times width. Sternum 0.67 (10, 0.56-0.76, 0.07) long, length 1.22 (10, 1.06-1.38, 0.10 times width. Anterior margin of sternum concave. Leg coloration as in females, bands on LIII and
LIV not as distinct. Leg formula I-II-IV-III, with leg II only slightly longer than leg IV.

Abdomen length 1.49 (10, 1.38-1.66, 0.09) times width. Color pattern like that of female, but less distinct.

The DiTA terminus of the pedipalp is a short projection with its distal end looped back on itself in the direction of the embolus base, to form a small curl (Fig. 73). The embolus originates at 9:30 from a small round base. Cymbium length 1.50 (10, 1.40-1.60, 0.08) times width.

Distribution: Western United States and Mexico.

Huachuca Mts. 1 female (Jul. 1949, Gertsch coll.) AMNH; Yavapi Co. 1 female (May 1984, Roth coll.) AMNH; Madera Canyon, St. Rita Mts. 2 males and 1 female (Jun. 1952); **Colorado**: Larimer Co. 2 females (1977) AMNH; Boulder 1 male (Oct. 1933, Redekoll.) AMNH; Denver 1 female (Apr. 1928) AMNH; **Idaho**: Clearwater Creek near Kooskia 1 male and 1 female (Aug. 1940) AMNH; **New Mexico**: Grant Co. West of Emory Pass 1 male (Hoff coll.) AMNH; Jemez Mts. N. of Jemez Springs 1 male (Hoff) AMNH; 49 mi. N. of Silver City 1 male (May 1949, Shantz) AMNH; Bernalillo Co. 1 female (Hoff) AMNH; 24 mi. S. of Taos 3 females and 1 male (Hoff) AMNH; Bandolier Natl. Monument 3000' 1 female and 1 male (May 1979) AMNH; **Utah**: Ridgfield 1 female (Aug. 1930, Gertsch coll.); Zion Natl. Park 1 male and 1 female (May 1943, Knowlton coll.) AMNH; W 111.40: N 40.26 1 male and 1 female (May 1934, Ivie and Rasmussen colls.) AMNH; Hughes Canyon, Wasatch Mtx. 1 female (Jun. 1940, Ivie coll.) AMNH; Salt Lake City 1 female (May, Gertsch coll.) AMNH; Mt Olympus 1 male and 1 female (May 1934, Ivie coll.) AMNH.
Figures 70 - 74 - *Mallos niveus* Pickard-Cambridge. 70. female, dorsal view; 71. epigynum, ventral view; 72. internal ducts of epigynum; 73. left palp, ventral view; 74. same, retrolateral view.
Table 13. Mean lengths of female and male leg articles, *Mallos niveus*.

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<td>TOTAL</td>
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*Mallos pallidus* (Banks) 1904

Figs. 75 - 78, Tbl. 14

*Dictynina pallida* Banks 1904, ser. 3, vol. 3, p. 342, fig. 22 (female holotype from California: Mt. Shasta, in MCZ, examined).

*Heterodictyna pallidus* Dahl 1904, p. 118.

*Dictyna eutypa* Chamberlin and Gertsch 1928, vol. 41, p. 175 (female holotype from Utah: Bluff, in AMNH, examined).

*Mallos halli* Chamberlin and Ivie 1941, vol. 6(3), p. 4, fig. 1, (female holotype, lacked an epigynum, from California: Ben Lomond, in AMNH, examined).

*Mallos pallidus* Chamberlin and Ivie 1941, vol. 6(3), p. 5.


**Diagnosis:** Females of this species closely resemble those of *M. niveus* in color pattern, although the carapace and abdominal coloration of *M. pallidus* is highly variable and somewhat mottled. The palpal architecture closely resembles that of *M.*
mians and M. pearci. The oval shaped DiTA terminus of M. pallidus males has a flattened distal margin that is perpendicular to the vertical axis of the cymbium, whereas the DiTA terminus of M. mians and M. pearci is more rounded.

FEMALE: Total length 3.45 (10. 2.64-4.40, 0.53). Cephalothorax 1.20 (10, 1.00-1.60, 0.20) long. Cephalothorax length 1.13 (10, 1.00-1.30, 0.09) times wide. Cephalic width 0.58 (10, 0.52-0.63, 0.10) times cephalothorax width. Prominent thoracic groove located just posterior to cephalic region, 0.91 (3, 0.82-0.98, 0.08) from anterior carapace margin. Carapace, like that of M. niveus, margins dark brown, cephalic region tan. Dorsal surface of carapace clothed in thick white setae.

Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.06 (10, 0.06-0.06, 0), ALE 0.07 (10, 0.06-0.08, 0.01), PME 0.06 (1, 0.06-0.06, 0), PLE 0.06 (10, 0.06-0.06, 0). ALE's separated by 0.30 (10, 0.26-0.36, 0.04) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.23 (10, 1.00-1.67, 0.27), AME-ALE 0.87 (10, 0.67-1.30, 0.28), AME-PME 1.37 (10, 1.00-1.67, 0.18), ALE-PLE 0.33 (10, 0.33-0.33, 0). PLE's separated by 0.44 (10, 0.38-0.54, 0.06) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.73 (10, 1.33-2.33, 0.31), PME-PLE 1.70 (10, 1.33-2.00, 0.25).

Clypeus height 1.47 (10, 1.00-2.00, 0.32) times AME diameter. Chelicerae length 5.86 (10, 5.00-8.33, 0.99) times clypeus height. Chelicerae length 2.94 (10, 1.57-2.46, 0.25) times width. Chelicerae with 3 promarginal teeth, the center tooth...
approximately 2 times larger than the others, and 2 small retromarginal teeth.

Chelicerae without distinct markings. Labium, endites, and sternum brownish orange. Labium length 0.92 (0.81-1.00, 0.08) times width. Endite length 1.77 (10, 1.54-2.00, 0.14) times width. Sternum 0.75 (10, 0.62-0.88, 0.08) long, length 1.19 (10, 1.03-1.28, 0.08) times width. Anterior margin of sternum concave. Legs dark brown, distal 2/3's of femurs darkly banded, tibia of LII-LIV with 2 distinct bands, 1 proximal and 1 distal. Leg formula I-II-IV-III, with leg II only slightly longer than leg IV. Calimistrum length 0.65 (10, 1.38-1.75, 0.13) times that of metatarsus IV.

Abdomen length 1.26 (10, 1.12-1.40, 0.10) times width. Dorsum of most individuals with anchor brown shaped mark. In most individuals abdomen is overlain by a mottled color pattern. Lateral surfaces with dusky bands. Venter with brown median line typical of most *Mallos* species. The cribellum is divided. Sclerotized rims of epigynal bursae convex relative to center of epigynum. Large bursal openings situated anteriorly and closely together. Epigynum consists of a bifurcate spermatheca. The anterior lobe is coiled and vertically orientated and elongate posterior lobe is unbranched. The anterior spermathecal lobe is visible externally between the epigynal bursae. (Figs. 75, 76)

**MALE:** Total length 2.51 (10, 1.98-2.96, 0.33). Cephalothorax 1.10 (10, 0.88-1.20, 0.11) long, length 1.16 (10, 1.11-1.22, 0.04) times width. Width of cephalic region 0.56 (10, 0.40-0.62, 0.25) times that of cephalothorax. Prominent thoracic groove, located just posterior to the cephalic region, 0.88 (8, 0.76-0.96, 0.06) from anterior
carapace margin. Carapace color and setal pattern like that of the female.

Posterior eye row is straight. Borders of eyes without heavy pigmentation.

Eye diameters: AME 0.06 (10, 0.04-0.08, 0.009), ALE 0.07 (10, 0.04-0.10, 0.02), PME 0.06 (10, 0.04-0.08, 0.009), PLE 0.06 (10, 0.04-0.08, 0.009). ALE's separated by 0.26 (9, 0.20-0.36, 0.05) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 0.93 (10, 0.50-1.33, 0.23), AME-ALE 0.72 (10, 0.50-1.00, 0.21), AME-PME 1.40 (10, 1.00-2.00, 0.26), ALE-PLE 0.34 (10, 0.25-0.50, 0.06). PLE's separated by 0.38 (10, 0.26-0.44, 0.06) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.42 (10, 0.67-1.67, 0.34), PME-PLE 1.56 (10, 1.25-2.00, 0.24).

Clypeus height 1.40 (10, 1-1.67, 0.22) times AME diameter. Cheliceral length 7.19 (6.20-9.20, 0.93) times clypeus height, length 2.40 (10, 2.20-2.58, 0.15) times width. Chelicerae slightly emarginated and keeled. Anterior dorsal surface does not extend anterior to the clypeus. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Endites and sternum tan, labium slightly darker in color. Labium length 1.13 (10, 0.92-1.20, 0.09) times width. Endite length 1.87 (10, 1.60-2.17, 0.19) times width. Sternum 0.67 (10, 0.56-0.74, 0.06) long, length 0.07 times width. Anterior margin of sternum concave.

Legs tan, I and II darker in color. Femurs of all legs darker in distal 3/4's of length. Leg formula I-II-IV-III.

Abdomen length 1.47 (10, 1.31-1.61, 0.10) times width. Color pattern like that
of female.

The terminus the pedipalp's DiTA is oval in shape (Fig. 77). The DiTA terminus has a flattened distal margin that is perpendicular to the vertical axis of the cymbium. Cymbium length 1.78 (10, 1.64-2.30, 0.19) times width.

Distribution: Western United States and Mexico.

Select material examined: Mexico: Sonora, W110.05: N27.35, 1 male (May 1963 Gertsch and Ivie colls.) AMNH; Cuernavaca, Morelos 1 female (Mar. 1937, Diamond coll.) AMNH; Baja California, del Sur, 45 mi. S. Santa Rita 1 female (Jun. 1977, Griswold coll.) CAS; Baja California, El Mayor 6 females and 3 males (Jun. 1952, Gertsch coll.) AMNH; Arizona: Chiricahua Natl. Monument 1 male (May 1956, Statham coll.) AMNH; Quitobaquito Organ Pipe Natl. Monument 1 female (Jun. 1952) AMNH; San Luis 2 females (Jan. 1941, Mulaik coll.) AMNH; Virgin Narrows 1 female and 1 male (Jun. 1934) AMNH; Summerhaven 1 female (Jun. 1939, Davis coll.) AMNH; Scottsdale 3 females and 1 male (1903, Britcher coll.) AMNH; Pima Co., Baboquivari Mts. 1 male and 1 female Dictyna sp. (Jul. 1959, Roth coll.) AMNH; Yuma Co., Horse Tanks 2 males (May 1960, Roth and Gertsch colls.) AMNH; Grand Canyon 1 female (Oct. 1982, Roth coll.) AMNH; California: Fresno Co., Marshall Station 1 male (Aug. 1983, Burdick coll.) CAS; Ventura Co., Santa Paula 2 females (Jun. 1950, Gertsch coll.) AMNH; Inyo Co., nr. Bishop 1 female (Apr. 1950, Schlinger coll.) AMNH; Siskiyou Co., Weed 1 female (Jul. 1952, Gertsch coll.) AMNH;
Imperial Co. 3 females and 2 males (Apr. 1957) AMNH; Eldorado Co. 6 males and 4 females (Jul. 1952, Gertsch coll.) AMNH; Glendale 1 female (Jul. 1948, Schlinger coll.) AMNH; Humboldt Co. 1 female (Jul. 1952, Gertsch coll.) AMNH; Sierra Co., Peavine 1 female (Dec. 1946, Pearce coll.) AMNH; Yosemite Nat'l. Park 1 female (Jul. 1939, E. Mayr) AMNH; Madera Co., North Fork 1 male (Jul. 1991) CAS; Costa Co. 2 males and 1 female (May 1974) CAS; Napa Co. 1 female (Apr. 84, Leech coll.) CAS; Nevada Co., Nevada City 1 male (Jul. 1956) CAS; San Benito Co. 1 female (Jun. 1969, Craig coll.) CAS; Shasta Co., Castella 1 female (Jul. 1953, Gertsch coll.) AMNH; Los Angeles Co. 1 male (Jun. 1952) AMNH; Monterey Co., Hastings Nat. Hist. Res. 1 female (May 1950, Linsdale collection) AMNH; Mendcino Co. 5 females and 3 males (Aug. 1975, Craig coll.) CAS; San Diego Co., Viejas Valley 2 males and 1 female (Jun. 1947, Pearce coll.) AMNH; Vicinity of Stanford University 2 females and 2 males (Swan coll.) AMNH; Tulare Co. 1 male (Mar. 1985, Burdick coll.) CAS; Yolo Co., Davis 1 female (May 1954, Schlinger coll.) AMNH; Mono Co. 3 females (Jul. 1941, Pearce coll.) AMNH; Colorado: Grand Junction 3 females (Jun. 1940, Ivie coll.) AMNH; Gunnison Co. 1 male (Jul. 1961) AMNH; New Mexico: San doval Co. 1 male (Hoff coll.) AMNH; 8 mi. S.E. Rodeo 1 female (Jun. 1955, Statham coll.) AMNH; 12 mi. S. of Cebolla 1 female (Hoff) AMNH; Neveda: Reno 1 male (Oct. 1949, Larson coll.) CAS; Las Vegas 1 male (Feb.-Jun. 1945, Zinn coll.) AMNH; Utah: Washington Co. 4 females (Apr. 1932, Ivie coll.) AMNH; Ferron 1 male (Jun. 1932) AMNH; Monroe Canyon 1 male (Jul. 1930) AMNH; St. George 1 female (Jul. 1930) AMNH; Washington: Yakima Indian Res. 1 female (Sept. 1954, Markin coll.)
AMNH; Oregon. Grants Pass 1 female (Jul. 1952, Gertsch coll.) AMNH; Mayville 2 males and 2 females (Jun. 1938, Hatch coll.) CAS; Redmond 1 female (Jun. 1939) AMNH.
Figures 75 - 78 - *Mallos pallidus* (Banks). 75. epigynum, ventral view; 76. internal ducts of epigynum; 77. left palp, ventral view; 78. same, retrolateral view.
Table 14. Mean lengths of female and male leg articles, *Mallos pallidus*.

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Mallos mians (Chamberlin) 1919

Figs. 79 - 84, Tbl. 15

Dictyna mians Chamberlin 1919, vol. 12, p. 4, fig. 8 (female holotype from Los Angeles Co., California, in MCZ, examined).


Diagnosis: Females of this species closely resemble those of its sister species Mallos pearci, by having an unidivided cribellum, a mottled abdominal color pattern, and anteriorly positioned epigynal bursae. The bursae of M. mians are very small in diameter (1/14 the diameter of the epigynum), whereas those of M. pearci are wider (1/4 the diameter of the epigynum). The males of both species have palps with an oval DiTA terminus. However, in M. mians the most distal end of the rounded terminus does not overlap the proximal end of the terminus as it does in M. pearci.

FEMALE: Total length 3.96 (10, 3.64-4.32, 0.24). Cephalothorax 1.36 (9, 1.06-1.58, 0.16) long. Cephalothorax length 1.17 (9, 1.05-1.56, 0.15) times wide. Cephalic width 0.56 (10, 0.52-0.67, 0.11) times cephalothorax width. Prominent thoracic
groove located just posterior to cephalic region, 1.05 (10, 0.90-1.20, 0.11) from anterior carapace margin. Carapace, like that of *M. pearci*, margins dark orange/brown, cephalic region tan. Dorsal surface of carapace clothed in thick white setae.

Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.07 (9, 0.06-0.08, 0.01), ALE 0.09 (10, 0.08-0.10, 0.01), PME 0.07 (10, 0.06-0.08, 0.01), PLE 0.07 (10, 0.06-0.08, 0.01). ALE's separated by 0.35 (10, 0.26-0.50, 0.07) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.05 (9, 0.75-1.33, 0.22) , AME-ALE 0.87 (10, 0.67-1.00, 0.14) , AME-PME 1.22 (8, 1.00-1.33, 0.14), ALE-PLE 0.28 (9, 0.25-0.33, 0.04) . PLE's separated by 0.46 (9, 0.38-0.58, 0.06) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.55 (10, 1.25-2.00, 0.34) , PME-PLE 1.51 (10, 0.38-0.58, 0.06).

Clypeus height 1.42 (10, 1.00-2.00, 0.29) times AME diameter. Chelicerae length 5.64 (10, 3.33-6.75, 0.99) times clypeus height. Chelicerae length 1.95 (10, 1.43-2.20, 0.21) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Chelicerae without distinct markings. Labium, endites, and sternum yellow orange. Labium length 0.98 (10, 0.92-1.03, 0.06) times width. Endite length 1.79 (10, 1.60-2.00, 0.12) times width. Sternum 0.90 (8, 0.66-1.08, 0.13) long, length 1.22 (8, 1.10-1.35, 0.08) times width. Anterior margin of sternum concave. Legs with light dusky grey bands. Leg formula I-II-IV-III, with leg II only slightly longer than leg IV.
Calimistrum length 0.65 (10, 0.52-0.74, 0.20) times that of metatarsus IV.

Abdomen length 1.28 (10, 0.91-1.46, 0.18) times width. Dorsum of most individuals with brown anchor shaped mark. In most individuals coloration is mottled (Fig. 79). Lateral surfaces with dusky mottled bands. Venter with brown median line typical of most Mallos species. The cribellum is undivided. Sclerotized rims of epigynal bursae concave relative to center of epigynum. Small bursal openings situated anteriorly and separated by a distance approxiamtely 6 times their diameter. Epigynum consists of a bifurcate spermtheca: an elongate coiled anterior lobe with a vertical orientation and an elongate unbranched posterior lobe. The anterior spermthecal lobe is visible externally between the epigynal bursae. (Figs. 80, 81)

MALE: Total length 3.16 (10, 2.72-384, 0.38). Cephalothorax 1.31 (10, 1.00-1.52, 0.16) long, length 1.19 (10, 1.05-1.27, 0.07) times width. Width of cephalic region 0.59 (10, 0.55-0.72, 0.12) times that of cephalothorax. Prominent thoracic groove, located just posterior to the cephalic region, 1.00 (9, 0.82-1.12, 0.09) from anterior carapace margin. Carapace color and setal pattern like that of the female.

Posterior eye row is straight. Borders of eyes without heavy pigmentation.

Eye diameters: AME 0.07 (10, 0.06-0.08, 0.01), ALE 0.09 (10, 0.07-0.10, 0.01), PME 0.07 (10, 0.06-0.08, 0.01), PLE 0.07 (10, 0.06-0.08, 0.01). ALE's separated by 0.31 (10, 0.26-0.38, 0.04) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.04 (10, 0.75-1.33, 0.26), AME-ALE 0.83 (10, 0.50-1.33, 0.26), AME-PME 1.29 (10, 1.00-1.67, 0.26), ALE-PLE 0.29 (10, 0.25-0.33,
PLE's separated by 0.43 (10, 0.38-0.50, 0.04) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.50 (10, 1.00-2.00, 0.29), PME-PLE 1.45 (10, 1.00-1.67, 0.23).

Clypeus height 1.38 (10, 1.00-1.67, 0.30) times AME diameter. Cheliceral length 7.13 (10, 5.60-9.00, 1.05) times clypeus height, length 2.35 (10, 2.19-2.50, 0.11) times width. Chelicerae slightly emarginated and keeled. Anterior dorsal surface does not extend anterior to the clypeus. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Endites and sternum tan, labium slightly darker in color. Labium length 1.14 (10, 1.00-1.27, 0.10) times width. Endite length 1.92 (10, 1.70-2.80, 0.23) times width. Sternum 0.82 (10, 0.60-0.96, 0.11) long, length 1.21 (10, 1.14-1.32, 0.07) times width. Anterior margin of sternum concave. Leg coloration like that of female. Leg formula I-II-IV-III.

Abdomen length 1.51 (10, 1.27-1.87, 0.16) times width. Abdominal color pattern like that of female. Many individuals with a dark black oval patch on the anterior center surface of abdomen (Fig. 82).

The DiTA terminus of the pedipalp oval in shape (Fig. 83). The most distal aspect of the DiTA terminus is rounded. The embolus originates at 11:00 from an oval base. Cymbium length 1.70 (10, 1.47-1.87, 0.11) times width.

Distribution: California and Baja California, Mexico.
Select material examined: **Mexico**: Baja California, Hamilton Ranch, Colonia Guerrero 1 female (May 1961, Gertsch and Roth colls.) AMNH; **California**:

Idylwild, San Jacinto Mts. 2 females (Jun. 1952, Gertsch coll.) AMNH; Los Angeles Co., Gold Canyon, San Gabriel Mts. 1 male (March 1953, Schick coll.) AMNH; Santa Monica Mts. 1 male (Apr. 1953) AMNH; Orange Co., Fullerton 1 female (Mar. 1948, Pearce coll.) AMNH; Placer Co., Dutch Flat 1 female (May 1954, Schlinger coll.) AMNH; San Antonio Canyon, near Claremont 6 females and 5 males (Jul. 1956, Roth and Gertsch colls.) AMNH; San Diego Co., Mt. Palomar, 3-5,000' 2 females and 1 male (Jun. 1956 Gertsch and Roth colls.) AMNH; Madera Co. 1 male (Jul. 1983) CAS.
Figures 79 - 84 - *Mallos miarys* (Chamberlin).  79. female, dorsal view; 80. epigynum, ventral view; 81. internal ducts of epigynum; 82. male, dorsal view; 83. left palp, ventral view; 84. same, retrolateral view.
Table 15. Mean lengths of female and male leg articles, *Malloso mians*.

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Mallos pearci Chamberlin and Gertsch 1958

Figs. 85 - 89, Tbl. 16


Diagnosis: Females and males of this species closely resemble those of its sister species Mallos mians and are distinguished in diagnosis of that species.

FEMALE: Total length 3.78 (4, 3.40-4.20, 0.40). Cephalothorax 1.31 (4, 1.16-1.44, 0.12) long. Cephalothorax length 1.17 (4, 1.15-1.23, 0.06) times wide. Cephalic width 0.56 (4, 0.55-0.57, 0.02) times cephalothorax width. Prominent thoracic groove located just posterior to cephalic region. Carapace margins dark orange/brown, cephalic region tan. Dorsal surface of carapace clothed in thick white setae.

Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.07 (4, 0.06-0.08, 0.01), ALE 0.09 (4, 0.08-0.10, 0.01), PME 0.08 (4, 0.08-0.08, 0), PLE 0.07 (4, 0.08-0.08, 0). ALE's separated by 0.32 (4, 0.26-0.38, 0.06) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.25 (4, 1.00-1.33, 0.17), AME-ALE 0.94 (4, 0.75-1.00, 0.13), AME-PME 1.40 (4, 1.25-1.67, 0.18), ALE-PLE 0.16 (4, 0.14-0.20, 0.02). PLE's separated by 0.45 (4, 0.40-0.52, 0.05) diameter. Remaining posterior eye interdistances,
expressed as PME diameters: PME-PME 1.44 (4, 1.25-1.50, 0.13), PME-PLE 1.31 (4, 1.00-1.75, 0.31).

Clypeus height 1.63 (4, 1.33-2.00, 0.28) times AME diameter. Chelicerae length 5.30 (4, 4.50-6.50, 0.85) times clypeus height. Chelicerae length 2.14 (4, 2.00-2.25, 0.12) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth.

Chelicerae without distinct markings. Endites and sternum brownish orange, labium slightly darker in color. Labium length 0.91 (4, 0.86-0.93, 0.04) times width. Endite length 1.63 (4, 1.45-1.78, 0.14) times width. Sternum 0.85 (4, 0.76-0.94, 0.07) long, length 1.20 (4, 1.12-1.27, 0.08) times width. Anterior margin of sternum concave.

Legs with light dusky grey bands. Leg formula I-II-IV-III, with leg II only slightly longer than leg IV. Calimistrum length 0.67(4, 0.61-0.70, 0.09) times that of metatarsus IV.

Abdomen length 1.44 (4, 1.32-1.55, 0.10) times width. Dorsum of most individuals with brown anchor shaped marks. In most individuals coloration is mottled (Fig. 85). Lateral surfaces with dusky mottled bands. Venter with median brown line typical of most Mallos species. The cribellum is undivided.

Sclerotized rims of epigynal bursae concave relative to center of epigynum. Large bursal openings situated anteriorly and separated by a distance approximately twice their diameter. Epigynum consists of a bifurcate spermasteca. The elongate coiled anterior lobe is vertically orientation and the elongate posterior lobe is unbranched. The anterior spermastecal lobe is visible externally between the epigynal
MALE: Only one male was measured. Total length 3.08. Cephalothorax 1.34 long, length 1.26 times width. Width of cephalic region 0.60 times that of cephalothorax. Prominent thoracic groove, located just posterior to the cephalic region, 1.06 from anterior carapace margin. Carapace color and setal pattern like that of the female. Posterior eye row is straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.08, ALE 0.08, PME 0.10, PLE 0.090. ALE's separated by 0.32 diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 0.75, AME-ALE 0.75, AME-PME 1.00, ALE-PLE 0.25. PLE's separated by 0.44 diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.00, PME-PLE 1.00.

Clypeus height 1.25 times AME diameter. Cheliceral length 7.00 times clypeus height, length 2.33 times width. Chelicerae slightly emarginated and keeled. Anterior dorsal surface does not extend anterior to the clypeus. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Labium, endites, and sternum tan. Labium length 1.08 times width. Endite length 1.82 times width. Sternum 0.80 long, length 1.14 times width. Anterior margin of sternum concave. Leg coloration like that of female. Leg formula I-II-IV-III. Abdomen length 1.51 (10, 1.27-1.87, 0.16) times width. Abdominal color pattern like that of female.

The terminus of the DiTA of the male pedipalp oval in shape (Fig. 88). The
most distal aspect of the terminus is rounded and overlaps the proximal upper margin of the terminus. The embolus originates at 12:00 from an oval base. Cymbium length 1.50 times width.

Distribution: San Diego Co., California.

Select material examined: California, San Diego County: Bee Canyon 1 females (Jul. 1947, Pearce coll.) AMNH; Jamul 2 females (Jun. 1947, Pearce coll.) AMNH; Viejas Valley 1 female (May 1947, Pearce coll.) AMNH; Potrero 1 female (Jun. 1947, Pearce coll.) AMNH; Lakeview District 1 female (May 1947, Pearce coll.) AMNH; Barrett 1 female (July 1947, Pearce coll.) AMNH.
Figure 85 - 89 - *Mallos pearci* Chamberlin and Gertsch. 85. female, dorsal view; 86. epigynum, ventral view; 87. internal ducts of epigynum; 88. left palp, ventral view; 89. same, retrolateral view.
Table 16. Mean lengths of female and male leg articles, *Mallos pearci*.

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<td>Coxa</td>
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<td>Tarsus</td>
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<td>TOTAL</td>
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<td>6.52</td>
<td>5.15</td>
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</table>
**Mexitilia Lehtinen 1967**

Figs. 92 - 107, Tbls. 17 - 19

**Diagnosis:** Like its sister genus *Mallos*, *Mexitilia* females have an epigynum that lacks a lateral foveae and a male palp that lacks an RTA. Males and females lack a distinctive white band circumventing the lateral margins of the carapace, whereas *Mallos* males and females have such coloration. The male palp has a thick embolus with a bifurcate tip (Fig. 90), whereas the Mallos embolus is thin and unbranched (Fig. 91). The terminus of the DiTA is hatchet shaped.

**FEMALE:** Total length 3.44-6.97. Cephalic width typically 3/5's times cephalothorax width. Thoracic groove, when evident, consists of a shallow, bowl shaped depression located just posterior to cephalic region. Carapace reddish brown, in most species clothed with 5 rows of thick white setae: three rows extending the length of cephalic region, and two additional rows located anterior laterally. Carapace uniform in color.

Posterior eye row straight. Eyes with thin black borders. AME, ALE and PME round and equal in size, PLE usually oval and slightly larger than other eyes. AME-AME, AME-ALE, AME-PME, separated by a distance approximately equal to the diameter of the AME. ALE-PLE separated by 1/5 the diameter of the AME. PME-PME, PME-PLE separated by a distance approximately equal to diameter of PME.

Clypeus height 1-2 times AME diameter, covered in thick white setae.
Chelicerae width 1/2-1/3 times length. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Chelicerae usually unmarked and similar in color to carapace. Endites, sternum and labium reddish brown. Labium width equal or slightly greater than length. Endite width 1/2 length. Sternum oval with concave margin. Sternum width 0.24-1.00 times length. Legs reddish brown, unbanded. Leg formula I-II-IV-III with legs II IV similar in length. Calimistrum length 2/3's length metatarsus IV.

Abdomen oval, dorsum of most individual with a dark brown anterior and posterior patch, with 3 pairs of smaller lateral spots (Fig. 95). Venter with light brown median line. The cribellum is undivided. The epigynum lacks a lateral foveae. Sclerotized rims of epigynal bursae convex relative to center of epigynum. In most cases the epigynal ducts are visible as a dark posterior patch externally. Epigynum with a pair of simple, heavily sclerotized, unbranched ducts. (Fig. 11)

MALE: Total length 3.40-6.00. Width of cephalic region 3/5's that of cephalothorax. Thoracic groove, located just posterior to the cephalic region like that of female. Carapace coloration and setal pattern like that of the female.

Posterior eye row is straight. Eye border pigmentation like that of female. Eyes equal in length, ALE's in some individuals slightly larger. AME-AME, AME-ALE, AME-PME, separated by a distance approximately equal to the diameter of the AME. ALE-PLE separated by 1/5 the diameter of the AME. PME-PME, PME-PLE separated by a distance approximately equal to diameter of PME.

Most features of the male palp of *Mexitilia* species is homogenous. The cymbium is 1.5-2.00 long as wide. *Mexitilia* species have lost the RTA. The thick, bifurcate embolus originates from a round or triangular base between the 8:00 and 12:00 position. The DiTA consists of a conductor with a hatchet shaped terminus.
**Mexitilia new species A**

Figs. 92 - 94, Tbl. 17

**Diagnosis:** This species, known only from females, is similar in general appearance, coloration and features of the female genitalia, to *Mexitilia trivittata* and *M. avara*. Both *M. avara* and *Mexitilia* new species A have epigynal bursae that are vertically orientated and are convex relative to the center of the epigynum. The bursae of *M.* new species A is 1/2 the vertical diameter of the epigynum, whereas, the bursae of *M.* avara are 3/4's the vertical diameter of the epigynum.

**FEMALE:** Total length 4.44 (5, 3.80-5.31, 0.58). Cephalothorax length 1.69 (5, 1.40-1.88, 0.21). Cephalothorax length 1.19 (5, 1.06-1.32, 0.09) times wide. Cephalic width 0.65 (5, 0.63-0.67, 0.04) times cephalothorax width. Prominent thoracic groove located just posterior to cephalic region. Carapace dark reddish brown with 5 rows of thick white setae: three rows extending the length of cephalic region, and two additional rows located anterior laterally.

Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.10 (5, 0.08-0.10, 0.01), ALE 0.11 (5, 0.10-0.12, 0.01), PME 0.10 (5, 0.10-0.10, 0), PLE 0.10 (5, 0.10-0.10, 0). ALE's separated by 0.45 (5, 0.38-0.52, 0.05) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 0.99 (5, 0.80-1.25, 0.17), AME-ALE 0.97 (5, 0.60-1.25, 0.27) , AME-
PME 1.08 (5, 0.80-1.50, 0.28), ALE-PLE 0.21 (5, 0.20-0.25, 0.02). PLE's separated by 0.60 (5, 0.52-0.70, 0.06) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.44 (5, 1.20-1.60, 0.17), PME-PLE 1.48 (5, 1.20-2.00, 0.30).

Clypeus height 0.90 (5, 0.60-1.20, 0.22) times AME diameter. Chelicerae length 9.28 (5, 7.00-11.33, 2.07) times clypeus height. Chelicerae length 2.13 (5, 1.90-2.31, 0.16) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Chelicerae with no distinct markings. Labium, endites, and sternum reddish brown. Labium length 0.98 (5, 0.88-1.05, 0.06) times width. Endite length 1.63 (5, 1.53-1.77, 0.09) times width. Sternum 1.04 (5, 0.94-1.18, 0.10) long, length 1.27 (5, 1.22-1.32, 0.04) times width. Anterior margin of sternum concave. Legs reddish brown, I and II darker in color than III and IV, femur and tibia with light bands. Leg formula I-IV-II-III, with leg IV only slightly longer than leg II. Calimistrum length 0.65 (5, 0.60-0.74, 0.13) times that of metatarsus IV.

Abdomen length 1.66 (5, 1.19-2.17, 0.63) times width. Dorsum with large anterior and posterior spot with 2-3 pairs of small lateral spots, or some individuals with large elaborate medial coloration with dark posterior spot (Fig. 92). Lateral surfaces without distinct markings. Venter with brown median line. The cribellum is undivided. Closely positioned sclerotized rims of epigynal bursae convex relative to center of epigynum. Bursae elongate and situated anteriorly. Epigynal ducts visible externally as dark spots below bursal openings. Epigynum with a pair of heavily

141
sclerotized unbranched oval spermathecae. (Figs. 93, 94)

Distribution: Southern Mexico.

Material examined: Mexico: Hidalgo, 10-20 miles South of Jucala 1 female (Jul. 1956, Roth and Gertsch coll.) AMNH; Diseto de Leones, D.F 1 female (Aug. 1946, Goodnight coll.) AMNH; Desierto de Los Leones, D.F., 9000'-10000' 2 females (Apr. 1946, Pallister coll.) AMNH; District Federal, 2 miles West of Rio Frio, 3200 m 7 females (Jul. 1950, Gertsch and Roth coll.) AMNH.
Figures 92 - 94 - *Mexitilia* new species A. 92. female, dorsal view; 93. epigynum, ventral view; 94. internal ducts of epigynum.
Table 17. Mean lengths of female leg articles, *Mexitilia* new species A.

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*Mexitilia trivittata* (Banks) 1901

Figs. 95 - 99, Tbl. 18

*Lethia trivittata* Banks 1901, vol. 53, p. 577, figs. 9-10 (male and female holotype from New Mexico: Albuquerque in MCZ, examined).

*Lathys trivittata* Petrunkevitch 1911, vol. 29, p. 112.

*Dictynoides trivittatus* Chamberlin 1919, vol. 12, p. 244.

*Dictyna trivittata* Gertsch 1935, no. 792, p. 15.


*Mallos zionis* Chamberlin 1948, vol. 10, no. 6, p. 15. (female holotype from Utah: Zion's National Park in AMNH, examined).


Diagnosis: This species is similar in general appearance to *Mexitilia* new species A and *M. avara*. The epigynal bursae of this species are wider than they are long, whereas, in *M. avara* and *Mexitilia* new species A the epigynal bursae are longer than they are wide. The architecture of the male palp is similar to that of *M. avara*. The terminus of the *M. trivittata* DiTA has a vertical orientation, whereas the terminus of the *M. avara* pedipalp is horizontally oriented.

FEMALE: Total length 6.32 (10, 5.48-6.97, 0.49). Cephalothorax long 2.23 (10, 1.80-2.57, 0.27). Cephalothorax length 1.19 (10, 1.06-1.73, 0.20) times wide.

Cephalic width 0.60 (10, 0.55-0.81, 0.16) times cephalothorax width. Prominent thoracic groove located just posterior to cephalic region, 1.65 (6, 1.30-1.90, 0.21) from anterior carapace margin. Carapace dark reddish brown with 5 rows of thick white setae: three rows extending the length of cephalic region, and two additional rows located anterior laterally.

Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.12 (10, 0.10-0.14, 0.02), ALE 0.14 (10, 0.12-0.16, 0.01), PME 0.12 (10, 0.10-0.14, 0.02), PLE 0.12 (10, 0.10-0.14, 0.01). ALE's separated by 0.51 (10, 0.44-0.58, 0.04) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.04 (10, 0.83-1.40, 0.18), AME-ALE 0.70 (10, 0.57-1.20, 0.18), AME-PME 1.06 (10, 0.86-1.40, 0.16), ALE-PLE 0.16 (10, 0.14-0.20, 0.02). PLE's separated by 0.72 (10, 0.64-0.80, 0.06) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.37 (10, 1.29-1.50, 0.07).
PME-PLE 1.49 (10, 1.14-1.83, 0.24).

Clypeus height 1.16 (10, 1.00-1.43, 0.17) times AME diameter. Chelicerae length 7.29 (10, 5.80-8.67, 0.92) times clypeus height. Chelicerae length 2.29 (10, 2.17-2.41, 0.08) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Chelicerae with no distinct markings. Endites and sternum reddish brown, labium darker in color. Labium length 1.24 (10, 1.05-1.50, 0.13) times width. Endite length 1.70 (10, 1.50-1.94, 0.13) times width. Sternum 1.45 (10, 1.18-1.66, 0.15) long, length 1.26 (10, 1.13-1.33, 0.06) times width. Anterior margin of sternum concave. Legs reddish brown, I and II darker in color than III and IV, femur and tibia with light bands. Leg formula I-II-IV-III. Calimistrum length 0.65 (10, 0.44-0.78, 0.32) times that of metatarsus IV.

Abdomen length 1.34 (10, 1.21-1.93) times width. Dorsum with large anterior and posterior spot with 2-3 pairs of small lateral spots (Fig. 95). Lateral surfaces without distinct markings. Venter with faint grey median line. The cribellum is undivided. Sclerotized rims of epigynal bursae oval shaped and wider than long. In some individuals there is a short sclerotized scape between the two anteriorly positioned bursae. Epigynal ducts visible externally as a pair of very large black spots below bursal openings. Epigynum with a pair of heavily sclerotized unbranched oval spermathecae. (Figs. 96, 97)

MALE: Total length 5.08 (10, 4.15-5.98, 0.04). Cephalothorax 2.30 (10, 2.04-2.56,
long, length 1.20 (10, 1.13-1.27, 0.04) times width. Width of cephalic region 0.60 (10, 0.57-0.61, 0.05) times that of cephalothorax. Prominent thoracic groove, located just posterior to the cephalic region, 1.63 (8, 1.38-1.80, 0.16) from anterior carapace margin. Carapace color and setal pattern like that of the female (Fig. 95).

Posterior eye row is straight. Borders of eyes without heavy pigmentation.

Eye diameters: AME 0.12 (10, 0.10-0.14, 0.01), ALE 0.13 (10, 0.12-0.16, 0.01), PME 0.11 (10, 0.08-0.12, 0.01), PLE 0.11 (10, 0.10-0.12, 0.01). ALE's separated by 0.49 (10, 0.44-0.56, 0.04) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.00 (10, 0.80-1.33, 0.01), AME-ALE 0.73 (10, 0.50-1.33, 0.01), AME-PME 1.07 (10, 0.92-1.17, 0.10), ALE-PLE 0.17 (10, 0.14-0.20, 0.02). PLE's separated by 0.72 (10, 0.64-0.80, 0.05) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.46 (10, 1.20-2.00, 0.23), PME-PLE 1.71 (10, 1.50-2.50, 0.30).

Clypeus height 1.32 (10, 1.14-1.50, 0.16) times AME diameter. Cheliceral length 6.99 (10, 6.11-7.71, 0.52) times clypeus height, length 2.42 (10, 2.19-2.70, 0.16) times width. Chelicerae with very slight emargination. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Endites and sternum reddish brown, labium slightly darker in color. Labium length 1.40 (10, 1.30-1.50, 0.07) times width. Endite length 1.75 (10, 1.65-1.84, 0.07) times width. Sternum 1.43 (1.18-1.60, 0.13) long, length 1.30 (10, 1.23-1.47, 0.07) times width. Anterior margin of sternum straight. Legs reddish brown, lighter in color than carapace. Distal 2/3's of femur I and II with dark band.
Leg formula I-IV-II-III, with leg IV slightly longer than leg II.

Abdomen length 1.44 (10, 1.32-1.60, 0.09) times width. Abdominal coloration like that of female.

The terminus of the DiTA of the pedipalp is hatchet shaped with its flat edge orientated vertically (Fig. 98). The embolus originates at 9:00 from a small triangular base. The embolus has a large diameter and a bifurcate tip. Cymbium length 1.55 (10, 1.41-1.68, 0.09) times width.

Distribution: Western United States Mexico.

Gunnison Co. 8,100' 2 females and 1 male (Aug. 1952) AMNH; Gothic, near Crested Butte 9 females and 3 males (Jul. 1956, Gertsch and Roth colls.) AMNH; Williams Fork near Parshall, 7,500' 3 females, AMNH; Pikes Peak, 10,000' (Jun. 1940, Ivie coll.) AMNH; Piedra Camp, 6,500' 1 female (Jul. 1941, Goodnight coll.) AMNH; Pitkin Co., Maroon Lake, Elk Mts., 9,600' 4 females (Aug. 1957?) AMNH, Idaho: Bear Lake Co. 1 female (Cain coll.) AMNH; New Mexico: Toas Co., Tres Ritos, La Junta Canyon, 2,809 m 3 males and 2 females (Aug. 1992, Cattlely and Loch colls.) AMNH; W 107.47: N 32.50, Nimbres Mts 5 females and 1 male (Sept. 1941, Ivie coll.) AMNH; Cloudcraft 1 male (1934, Mulaik coll.) AMNH; Valencia Co., Mt Taylor 1 female (Hoff coll.) AMNH; Bern Co., Sandia Mts. 1 female AMNH; Otero Co., Camp Mary White 4 females and 2 males (Aug. 1935) AMNH; Utah: Kanab, 1 female (Sept. 1946, Beck coll.) AMNH; San Juan Co. 1 male (Jul. 1960) AMNH; Bear Lake 1 female (Aug. 1947) AMNH; Ferron Reservoir 2 females (Jun. 1934) AMNH; Blanding 1 female (Jun. 1946, Mulaik coll.) AMNH; Wyoming: Albany Co., Laramie 3 males and 1 female (Mossman coll.) MCZ, Richfield 1 female and 1 male (Aug. 1930) AMNH.
Figures 95 - 99 - *Mexitilia trivittata* (Banks). 95. female, dorsal view; 96. epigynum, ventral view; 97. internal ducts of epigynum; 98. left palp, ventral view; 99. same, retrolateral view.
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<tr>
<td>Tarsus</td>
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Dictyna avara  Banks 1898, ser. 3 vol. 7, p. 232 figs. 19 (female holotype presumably deposited in the CAS, reported lost).


Mallos ghiggi (Capriacco) 1938, vol. 77, p. 257, fig. 1.

Diagnosis:  Females of this species closely resembles Mexitilia new species A in colorations and bursal morphology and are distinguished from it in that species' diagnosis. The architecture of the male palp is similar to that of M. trivittata and is distinguished from it in that species' diagnosis.

FEMALE:  Total length 3.98 (7, 3.44-4.52, 0.39). Cephalothorax 1.57 (7, 1.36-1.92, 0.18) long, length 1.12 (7, 0.99-1.20, 0.07) times wide. Cephalic width 0.62 (7, 0.59-0.63, 0.04) times cephalothorax width. Prominent thoracic groove located just posterior to cephalic region, 1.12 from anterior carapace margin. Carapace dark reddish brown with 5 rows of thick white setae: three rows extending the length of cephalic region, and two additional rows located anterior laterally.
Posterior eye row straight. Borders of eyes without heavy pigmentation. Eye diameters: AME 0.09 (7, 0.08-0.10, 0.01), ALE 0.11 (7, 0.10-0.12, 0.01), PME 0.10 (7, 0.08-0.10, 0.008), PLE 0.10 (7, 0.08-0.10, 0.001). ALE's separated by 0.43 (7, 0.40-0.50, 0.04) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 1.22 (7, 1.00-1.50, 0.24), AME-ALE 0.84 (0.60-1.11, 0.21), AME-PME 1.51 (7, 1.00-1.50, 0.18), ALE-PLE 0.22 (7, 0.20-0.25, 0.02). PLE's separated by 0.57 (7, 0.50-0.68, 0.06) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.56 (7, 1.40-1.78, 0.17), PME-PLE 1.50 (7, 1.20-2.00, 0.28).

Clypeus height 0.99 (7, 0.80-1.25, 0.18) times AME diameter. Chelicerae length 8.15 (7, 7.20-9.25, 0.80) times clypeus height. Chelicerae length 2.18 (7, 1.94-2.65, 0.28) times width. Chelicerae with 3 promarginal teeth, the center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Chelicerae with no distinct markings. Endites and sternum reddish brown, labium slightly darker in color. Labium length 1.03 (7, 0.95-1.20, 0.10) times width. Endite length 1.74 (7, 1.62-1.83, 0.08) times width. Sternum 1.23 (7, 1.18-1.31, 0.04) long, length 1.00 (7, 0.92-1.10, 0.08) times width. Anterior margin of sternum concave.

Legs a lighter reddish/brown than carapace, femur and tibia with light bands. Leg formula I-II-IV-III. Calimistrum length 0.74 (7, 0.68-0.88, 0.14) times that of metatarsus IV.

Abdomen length 1.33 (7, 1.30-1.37, 0.03) times width. Dorsum with large anterior and posterior spot with 2-3 pairs of small lateral spots (Fig. 100). Lateral
surfaces without distinct markings. Venter with faint grey median line. The cribellum is unindivided. Bursae elongate and situated anteriorly, traversing 3/4's the vertical diameter of the epigynum. Epigynal ducts visible externally as dark patches below bursal openings. Epigynum with a pair of heavily sclerotized, almost contiguous, unbranched oval spermethcae. (Figs.101, 102)

MALE: Total length 3.69 (3, 3.40-4.00, 0.30). Cephalothorax 1.72 (3, 1.48-1.88, 0.21) long, length 1.17 (3, 1.08-1.25, 0.08) times width. Width of cephalic region 0.62 (3, 0.60-0.63) times that of cephalothorax. Prominent thoracic groove, located just posterior to the cephalic region, 1.44 from anterior carapace margin. Carapace color and setal pattern like that of the female (Fig. 100).

Posterior eye row is straight. Borders of eyes without heavy pigmentation.

Eye diameters: AME 0.10 (3, 0.10-0.10, 0), ALE 0.11 (3, 0.10-0.12, 0.01), PME 0.09 (3, 0.08-0.10, 0.01), PLE 0.10 (3, 0.10-0.10, 0). ALE's separated by 0.43 (3, 0.40-0.46, 0.31) diameter. Remaining anterior eye interdistances, expressed as AME diameters: AME-AME 0.93 (3, 0.80-1.00, 0.12), AME-ALE 0.67 (3, 0.60-0.80, 0.12), AME-PME 1.07 (3, 0.80-1.40, 0.31), ALE-PLE 0.20 (3, 0.20-0.20, 0). PLE's separated by 0.60 (3, 0.58-0.62, 0.02) diameter. Remaining posterior eye interdistances, expressed as PME diameters: PME-PME 1.65 (3, 1.60-1.75, 0.87), PME-PLE 1.72 (3, 1.60-1.80, 0.10).

Clypeus height 1.13 (3, 1.00-1.20, 0.12) times AME diameter. Cheliceral length 7.36 (3, 7.00-7.67, 0.34) times clypeus height, length 2.32 (3, 2.30-2.32, 0.02)
times width. Chelicerae with very slight emargination. Chelicerae with 3 promarginal teeth, center tooth approximately 2 times larger than the others, and 2 small retromarginal teeth. Labium, endites, and sternum reddish brown. Labium length 1.08 (3, 1.00-1.1, 0.07) times width. Endite length 1.82 (3, 1.62-2.00, 0.19) times width. Sternum 1.04 (3, 0.96-1.16, 0.11) long, length 1.24 (3, 1.19-1.32, 0.07) times width. Anterior margin of sternum concave. Leg colors reddish brown. Distal 2/3's of femur I and II with dark band. Leg formula I-IV-II-III, with leg IV slightly longer than leg II.

Abdomen length 1.37 (3, 1.33-1.38, 0.03) times width. Abdominal coloration like that of female.

The terminus of the pedipalp's DiTA is hatchet shaped with its leading edge oriented almost horizontally (Fig. 106). The embolus base embolus originates at 10:00 from a rounded base. The embolus has a large diameter and a bifurcate tip.

Cymbium length 1.54 (3, 1.46-1.60, 0.07) times width.

Distribution: Southern Mexico.

Select material examined: Mexico: Ixmiquilpan, Hidalgo (Rio Tula) 27 females and 10 males (Apr. 1963, Gertsch and Ivie colls.) AMNH; Tlaxcala 11 females (Jul. 1956, Gertsch and Roth colls.) AMNH; Veracruz, Orizaba 2 females and 1 male (Jun. 1944, Davis coll.) AMNH; Morelia, Michoacen 3 females (May 1963, Gertsch and Ivie colls.) AMNH.
Figures 100 - 107 - *Mexitilia avara* (Banks). 100. female, dorsal view; 101. epigynum, ventral view; 102. internal ducts of epigynum; 103. chelicerae of male; 104. expanded left palp, retrolateral view; 105. emblos of palp; 106. left palp, ventral view; 107. same, retrolateral view.
Table 19. Mean lengths of female and male leg articles, *Mexitilia avara*.

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Chapter 2: Molecular phylogeny

Introduction

A phylogeny is a hypothesis of the evolutionary history of a group of organisms, typically depicted as a branching tree diagram. The goal of modern systematics is to establish robust phylogenies that are both objective and testable. These phylogenies provide a framework in which evolutionary, biogeographical, ecological and behavioral questions can be considered. Consequently, systematics can provide a basis for many, perhaps all, biological disciplines (de Pinna, 1991).

The method used to analyze the evolutionary history of a group of organisms has been a point of contention among systematists. At present, cladistics is the most generally accepted and widely used technique. Cladistics establishes genealogy on the basis of shared derived characters, termed synapomorphies, as opposed to phenetics, which relies on overall similarity.

Although there is general agreement on cladistic methodology, there is still debate on the kinds of characters used in this analysis and how these characters are evaluated. Traditionally, a systematist dealt with qualitative morphological features considered to be homologous: to share a common developmental or evolutionary origin (Wiley et al., 1991). Only characters considered to be homologous can be compared across taxa of organisms (de Pinna, 1993; Williams, 1993).

In recent years molecular techniques have become accessible to biologists in every discipline, making it possible for them to characterize and to study differences in
the DNA of organisms. With the advent of these simplified techniques, phylogenies based entirely upon molecular data are becoming more common (Doyle, 1992). In systematics this has raised questions about the agreement of phylogenies based on molecular and morphological data. Is the concept of homology applicable to molecular data (Williams, 1993) and, most importantly, are the evolutionary histories of genes and species congruent? A gene phylogeny is based upon variation in the DNA sequence of a particular chromosomal region and is considered to reflect the evolutionary history of the gene. In contrast, a species phylogeny is traditionally based on morphological features which are considered to reflect the evolutionary history of the species. Morphology is a direct reflection of an organism's genotype and the environment, thus making genes and morphology inseparable. However, it is possible that morphology provides a more comprehensive view of the evolution of a species and its genotype. Evaluation of a single DNA sequence may sometimes provide information only about the evolution of that sequence.

Phylogenetic trees constructed from molecular data do not necessarily reflect the branching pattern of the species tree, and caution must be exercised when determining species phylogenies from molecular phylogenies (Nei, 1987). While congruence between morphology and molecules implies a robust phylogeny, incongruence suggests that the true phylogeny has not been recovered and the characters used in the analysis should be reassessed (Larson 1994). Incongruence between these two types of phylogenies is thought to occur as a result of three processes (Doyle, 1992): 1) introgression, a phenomenon which occurs when there is
hybridization between two species, 2) extinction of one or more members of a group, and 3) gene duplication. According to Doyle's first assumption (1992), if 1) the gene sequence used in the analysis is a single-copy gene, 2) hybridization has not occurred, and 3) the species are well differentiated, then the molecular (gene) phylogeny should match the species phylogeny.

The purpose of this investigation is to apply the cladistic method of systematics to data sets consisting of 1) morphological data, 2) molecular data, and 3) combined morphological and molecular data. This will allow me to test Doyle's (1992) first assumption that asserts that phylogenies based on molecular and morphological data are congruent. If they are congruent it will then be possible to incorporate the two data sets in a cladistic analysis to determine if, together, these two types of data explain the phylogeny's branching pattern with fewer evolutionary steps (i.e. if they produce a more parsimonious phylogeny than does either data set alone). If they are not congruent, I will still combine the two data sets to see if the branching pattern based on the morphological data is retained. If it is retained, I will determine if the resulting phylogeny is made more parsimonious by the addition of the molecular data.

Both nuclear and mitochondrial DNA sequences were used in this study. The nuclear, ITS region of the ribosomal DNA, has long been recognized as a useful sequence for phylogenetic studies (Vogle and DeSalle 1994). Ribosomal RNA genes are tandemly repeated units that are composed of coding and non-coding regions. The ITS regions are internal transcribed, noncoding sequences. The primers I have used are the ITS2 and ITS5 which amplify, by polymerase chain reaction, the ITS1 unit
between the nuclear small rDNA and the 5.8s rDNA. The mitochondrial sequence used in this study is one that spans the 5' end of the 16s ribosomal RNA subunit, a tRNA (Leu) sequence, and a sequence with no known function. These sequences are located between DYAK -12964 and DYAK +12242 (Clary and Wolstenholme 1985).

Methods

Species studied

Morphological data were obtained from museum specimens of all known species of *Mallos* and *Mexitilia*. Fig. 108 summarizes the known species of *Mallos* and *Mexitilia* and their phylogenetic relationships. Molecular data were obtained from five species of *Mallos* and one species of *Mexitilia* (Table 20 and Fig. 108 (those species designated by a closed circle)) that were collected July -August, 1994, at the American Museum of Natural History's Southwest Research Station in Southeastern Arizona. These spiders were preserved in 100% ethanol and stored at 4 C.

Molecular technique

Genomic DNA was obtained by grinding two to three legs removed from each spider in a solution of 5% Chelex (Walsh et al. 1991). The suspension was heated at 95 C for 15-30 minutes, and centrifuged in an Eppendorf microcentrifuge. The supernatant containing the DNA was transferred to a sterile tube and stored at -40 C. A DNA dilution, of unknown concentration, was prepared by diluting the supernatant
Figure 108 - cladistic relationships of *Mallos* and *Mexitilia* species based on the analysis of 22 morphological characters (note solid circles indicate species for which molecular data were collected).
Table 20. Restriction site data for species of *Mallos* and *Mexitilia trivittata* (+ indicates presence of a restriction site, ++ a different site, etc.; ** denotes polymorphism).

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1:10 with distilled water. This was stored at -4 C for subsequent use.

The ITS1 region of the nuclear genome (Fig. 109) was amplified by Polymerase Chain Reaction (PCR) using the primers 5'-GGAAGTAAAA GTCGTAACAAGG-3' (ITS5) and 5'-GCTGCGTCTCCATCGATGC-3' (ITS2) (Innis et al. 1990). The N1165-SPIDND1 region of the mitochondrial genome (Fig. 110) was amplified by using the primers 5'- CGACCTCGATGTTGAATTAA-3' (N1165; Hedin pers. com.) and 5'-TCRTAAGAAATTATGAGC-3' (SPIDND1; Hedin pers. com.). Aliquots of 25 ul of the 1:10 DNA dilution were combined with an equal volume of PCR master mix containing buffer, nucleotide triphosphates, primers, magnesium chloride and Taq polymerase. The final volume of the components were: 5 ul of 10X Taq buffer, 5 ul of an 8mM solution containing equal amounts of dATP, dCTP, dGTP, and dTTP, 5 ul of each primer (concentration 2 pmol/ul), 5 ul of 25mM magnesium chloride, and 1 unit of Taq polymerase. Temperature cycling was carried out using an MJ Research Inc. PTC 100 programmable thermal controller. The PCR amplification consisted of a 2 minute initial denaturation at 94 C and 30 cycles of: 1) denaturing for 45 seconds at 94 C, 2) annealing for 45 seconds at 48 C, and 3) extension for 45 seconds at 72 C. This was followed by a final extension for 5 minutes at 72 C. A control containing all of the reagents except DNA template was run with each reaction to ensure that the reagents and reaction mixtures were without DNA contamination. Amplification results were checked by running 5 ul samples of the PCR product on a 5% agarose gel, staining with ethidium bromide, and visualizing under ultraviolet light.
Figure 109, 110 - DNA sequences used in this study. 109. ITS region of ribosomal DNA. 110. Mitochondrial DNA.
Nuclear DNA

from White et al. (1990) in PCR protocols

Mitochondrial DNA

from Clary and Wolstenholme (1985) The mitochondrial DNA molecule of *Drosophila yakuba*: nucleotide sequence, gene organization, and genetic code
The unpurified PCR product was digested in 12 ul volumes with the restriction endonucleases Rsal, HaeIII, HinfI, CfoI, EcoRV, AluI, HpaII, DdeI, MboI, TaqI, and Tru9I (Table 20). The final volumes of the components were: 4.5 ul distilled water, 1.2 ul 10X buffer, 3 units restriction enzyme, and 6 ul DNA. The reactions were incubated at the optimal temperature for each enzyme for 5-12 hours. Restriction digest data were collected by running the 12 ul sample on a 5% agarose gel, staining with ethidium bromide, and visualizing and photographing the gel under ultraviolet light.

*Phylogenetic Analyses*

Restriction sites were scored as either present or absent. Cladistic analyses were performed using the exhaustive search algorithm of the computer program PAUP (Phylogenetic Analysis Using Parsimony 3.0; Swofford 1990). Decisions regarding character polarity were based on outgroup comparison, with *Mexitilia trivittata* serving as the outgroup. The probability of a restriction site gain is thought to be less likely than the loss of a restriction site (Debry and Slade 1985), therefore, these restriction data were analyzed under the assumptions of Dollo parsimony.

Distribution of characters on cladograms being compared was performed with the computer program MacClade 3.0 (Maddison and Maddison 1992). Congruence between the morphological and molecular tree topologies was evaluated by the quartet method of Estabrook et al. (1985), described by the formula:
\[ Q = \frac{S(S-1)(S-2)(S-3)}{24} \]

where \( Q \) is the number of quartets (four taxon groups) and \( S \) is the number of taxa.

The number and types of quartets shared by two trees is expressed as:

\[ EA = \frac{S}{Q} \]

where \( s \) is defined as the number of fully resolved, identical quartets shared by the two trees. The value of \( EA \) ranges from 0-1. Trees that have no quartets in agreement have an \( EA \) of 0, those that have all quartets in agreement have an \( EA \) of 1.

**Results**

*Molecular analysis*

Table 20 summarizes the restriction site data collected for *Mallos* and *Mexitilia* species. Of the 11 enzymes used, seven revealed sufficient polymorphism in the nuclear sequence, one in the mitochondrial sequence, to be useful in a cladistic analysis. A cladistic analysis of the nuclear and mitochondrial restriction sites (Table 21) produced one cladogram (CI = 0.59, RI = 0.64) (Fig. 111).

*Morphological analysis*

As molecular data were available for only six *Mallos* species, I reanalyzed the relationships of these species based on morphological data (Table 22). A cladistic analysis of 22 morphological features produced three equally parsimonious (CI = 0.95,
RI = 0.88) cladograms (Fig. 112, A-C). A strict consensus tree of the three
cladograms is shown in Figure 112, D.

*Comparison of morphology tree and DNA tree*

A comparison of molecular character distribution on the DNA tree (Fig. 111)
and the morphology consensus tree (Fig. 112, D) showed that character 12 (Table 21)
is optimized for the morphology consensus tree. When the distribution of the
morphological characters were compared for the two trees, I found that the characters
appeared an equal number of times on both trees.

For this analysis, the number of taxa (S) is equal to 6 and the number of
possible quartets (Q) is 15. I compared all 15 possible quartets for both trees and
found that 12 of those quartets were fully resolved and were of the same type for both
the morphology consensus tree (Fig. 113, A) and the molecular tree (Fig. 113, B).
The resulting $E_A$ is 0.80.

*Combined analysis of the molecular and morphological characters*

The morphological and molecular characters were combined into a single data
matrix (Table 23) containing 22 morphological characters and 17 molecular characters.
This resulted in a single cladogram (CI = 0.73, RI = 0.70) (Fig. 114) with a topology
identical to that of the tree based on DNA alone. The tree differed from the
morphology consensus tree only in resolution.
Discussion

Figure 108 shows the morphology-based cladogram of all species of the *Mallos-Mexitilia* clade, as determined from morphological characters. Although only a subset of the species were included in the molecular analysis, these adequately represent the diversity of the genus *Mallos*. An EA value of 0.80 confirms that there is a fundamental agreement between the morphological and molecular data. This value indicates that 4/5's of all possible quartets were of the same type and resolution, rendering this a very good estimate of overall similarity. A less conservative approach to comparing tree topologies measures quartets that do not conflict (Estabrook et al. 1985), and is described by the formula:

\[ DC = \frac{[s + r_1 + r_2 + u]}{Q} \]

where \( s \) is the number of fully resolved, identical quartets shared by two trees, \( r_1 \) is as identical quartets resolved by tree one but not tree two, \( r_2 \) the number of identical quartets resolved by tree two but not tree one, and \( u \) the number of quartets unresolved by both trees. The value of \( DC \), like that of \( EA \) ranges from zero to one, with one signifying two identical trees. For the morphological and molecular trees \( DC = 1 \), indicating that other than resolution, these two tree are in complete agreement, even though the molecular tree more fully resolved the relationship of the *Mallos bryanti - M. blandus - M. dugesi* clade.

Based on the congruences between the molecular and morphological tree topologies, merging the two data sets and repeating the cladistic analysis seems
justified. Although the resulting cladogram had a lower consistency index than the
tree based on morphology alone (0.95 vs. 0.73), it was more resolved than the tree
based on only morphology. These data suggest that morphological and molecular
characters are congruent in their ability to recover phylogenetic history for the *Mallos*
clade. This congruence emphasizes the usefulness of molecular characters in this
group. Additional molecular investigations that consider all species of *Mallos* would
be a robust test of the cladogram shown in Figure 108.
### Table 21. Molecular character data matrix

<table>
<thead>
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<th>Species</th>
<th>character states</th>
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<td>niveus</td>
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<td>trivittata</td>
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### Table 22. Morphological character data matrix

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<tr>
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<td>11000 11010 00000 0000010</td>
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</table>

### Table 23. Morphological and molecular character data matrix

<table>
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<tr>
<td>Mexitilia</td>
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<tr>
<td>trivittata</td>
<td>11000 11010 00000 0000010 1010001101000100</td>
</tr>
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</table>

174
Figure 111. Cladistic relationships of *Mallos* and *Mexitilia* species base on molecular data only.
Molecular Data Only

RI: 0.64
CI: 0.59
Tree length: 29
Figure 112, A - D. cladistic relationships based on morphological characters only.
Figure 113. comparison of consensus tree based on morphology and tree based on molecular data [note explicitly agree (EA) and does not conflict (DC)].
Consensus of 3 trees based on morphological data only

Molecular Data Only

$EA = 0.80$

$DC = 1.00$
Figure 114. Cladistic relationships of *Mallos* and *Mexitilia* species based on an analysis of morphological and molecular data.
Morphological and Molecular Data
Literature Cited


Farris, J. 1988. HENNIG86 version 1.5 computer program. Port Jefferson Station, NY.


Jackson, R. 1979. Comparative studies of Dictyna and Mallos (Araneae, Dictynidae) II. The relationship between courtship, mating, aggression and cannibalism in species with differing types of social organization.


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General and Principles of Biology Labs, January 1994 -
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Papers Published:


Papers in Preparation:

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Published Abstracts of Presented Papers:


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Graduate Student Assembly, Graduate Research Development Project, Degree Contingent Research Grant (1994). Title: Species phylogenies and gene phylogenies of spiders in the genus Malloa: Are they congruent? Amount: $300


