

**NORTH AMERICAN**  
***NAJADICOLA* AND *UNIONICOLA*:**  
**DIAGNOSES AND DISTRIBUTIONS**

by

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## DEDICATION

This book is dedicated to the scientists who studied these mites including James Lester Wilson, Robert Wolcott, Rodger Mitchell, Ronald V. Dimock Jr., Dave Cook, John Conroy, Ian Smith, Robert Crowell, Dale E. Edwards, and others.

## ACKNOWLEDGMENTS

Daniel J. Bereza, Samuel L. H. Fuller, H. Dickson Hoesé and the late Nell B. Causey provided valuable assistance in the many years of my studies. My wife, Gail, and my children, Macky, Daniel, and Caroline, helped in many ways. I also thank my parents and my brothers. Colin Fake and the Drafting Department of Sowela Technological Institute, Lake Charles, Louisiana, are also acknowledged.

Sabbatical leave for the spring semester (1996) provided me with the opportunity to complete this book. Dr. William Richardson and the LSU System are acknowledged for the opportunity. Dr. Barry Good and the faculty in my division supported me and covered my tracts so that I could create this book. The staff at LSUE, especially Bobbie Richard and Denise Foret, provided assistance. The librarians, Sue Forrest and Cathy Good, found some of those rare papers!

The list of colleagues who helped me to do this work is long. Many of them are individually acknowledged by having species or subgenera named for them. The working bibliography lists many of the people who worked with these mites and their mussels for the world. All of these authors and colleagues have made worthy contributions, and I thank them.

People that I have to mention include Ron Dimock, Dale Edwards, Charles Stagg, Steve Parris, Charles Allen, James Cordes, Darryl Clark, Bruno Borsari, Harland Guillory, Steven George, Steven Shively, Roy McLaughlin, Ray Hartenstine, Veryl Board, Doug Shelton, Paul Hartfield, John Harris, Mark Farr, Art Bogan, Ronnie Bouchon, Micheal Poirrier, Jack Burch, Mary Curry, Betty Everitt, Bill Heard, Sylwyn Roback, James L. Wilson, M. Majumder, Dave Cook, John Conroy, Rodger Mitchell, Ian Smith, T. Simmons, C. Cramer, A. Hoffmann, B. Rosso de Ferradas, Harry Smit, Barbara Downes, Terry Gledhill, Jurgen Hevers, Kurt Viets, Jouni Taskinen, Robert Patzner, Thomas Calnan, Robert Dobson, Jim Joy, Doug Smith, Don Gowan, Kevin Cummings, Joyce Crawford, J. P. E. Morrison, Thomas Fuselier, Wayne LaFleur, John Ranero, Alan Buchanan, Mark LaSalle, Dale Bishop, Connie Boone, Alan Neumann, Darryl Felder, Ed Stern, Robie and Steve Hensley, Marc Imlay, Karen Dupont, Kirk Wright, Randall Grace, James D. Williams, Paul Yokley, Dave Stansbery, Joe Rosewater, Sardy Baker, Mark Gordon, Dirk Kavanagh, Alan Pounds, Tom Breaud, Steve Ziser, Shahin Shabanián, Herb Wathan, Ray Robicheaux, and Dicky Bier. Without these colleagues, this would not be possible!

I gratefully acknowledge the Jessup Grant of the Academy of Natural Sciences of Philadelphia for my Jessup Fellowship (1978). This opportunity gave me the chance to study in the academy's mollusk collections. Many other museums also allowed me to examine mussels for mites; these include the Ohio State University Museum of Zoology, Smithsonian Institution, National Museum of Canada, and the Museum of Zoology of the University of Michigan. Types of mites were borrowed from the Marshall Collections of the Field Museum of Natural History in Chicago and the Museum of Comparative Zoology at Harvard University.

Many years ago the Graduate Student Organization at the University of Southwestern Louisiana gave me funds to search the southeastern United States for mites in mussels. That impetus provided the bulk of the mites in my holdings. Many specimens of mites were provided by Samuel Fuller, Dan Bereza, and others.

## PREFACE

The purpose of these books is to engender interest in these remarkable mites and their equally remarkable hosts. All of these organisms are in grave peril as freshwater ecosystems are surrendering to the constant insults of man's activities. In these habitats, mussels and/or their mites are among the first organisms to disappear. Four volumes (Vidrine 1996a, 1996b, 1996c, and this book) are to be simultaneously released as a treatise on the North American mites. A fifth volume is also being released in order to introduce the mites of the world. This particular book is designed to assist the user in the identification of mites belonging to two genera, which are commonly found inside freshwater mollusks and sponges. It is only possible to understand what is being lost if one can name it. Thus, the role of this book is evident.

The book compiles the work of this author and many others who have contributed to the development of a substantial body of literature regarding these mites. By collecting together this information, the future work on this group is facilitated.

## INTRODUCTION

Water mites are extremely diverse assemblages in freshwater ecosystems. The North American assemblage is very diverse (Smith and Cook 1991). Among these mites are two subfamilies of mites which occur in freshwater mussels and snails. My interests center around these molluscan parasites which include *Najadicola* (Pionidae: Najadicolinae) and *Unionicola* (Unionicolidae: Unionicolinae).

The life histories of these mites are generally known (Hevers 1980a). Eggs are oviposited into varied tissues, *e. g.*, the mantle of freshwater mussels. Each egg develops into a 6-legged larva. This larva is referred to as a "prelarva" until it attaches to a chironomid and engorges. After this event, it is called a "postlarva." This larva then encysts in the tissues of a host (sponge, snail, or mussel) and undergoes two molts and exits as an eight-legged nymph. Little is known about the sexually inactive nymphs, but they are commonly encountered with the adults. The nymph engorges and encysts in the host tissues, undergoes two molts, and emerges as an imago or adult. The adults are gonochoristic and sometimes obviously sexually dimorphic. Many species remain in their hosts, especially mollusks, for their entire life. Very few species have been studied in detail, and thus, there is a great deal of biology which remains unknown. However, good strides have been made toward describing species and developing taxonomic schemes for showing their evolutionary relationships.

The ability to discern species is an essential skill of the naturalist and laboratory scientist. These mites occupy a series of very unusual niches as parasites of mollusks and sponges. Informed identifications of both mite parasites and hosts are essential. The subgenera and most species can be generally distinguished by differences in exoskeletal characters. These characters include chaetotaxy, tarsal claw structure, genital field morphology, coxal plate morphology, leg and pedipalp morphologies, and general body morphology. Using these kinds of information, I hope that this book will provide the reader with the essential tools necessary to make informed decisions regarding species names.

This Introduction provides a series of lists and drawings. Two lists of mites immediately follow: the first lists the North American species, and the second lists the known species of the world. These serve to acquaint the reader with the names and general classification of the mites. A list of Key Terms then follows--these terms are used to describe the major anatomical parts of the mites. A series of drawings and a List of Abbreviations follow and serve to further facilitate the use of the key. A key to the species of these mites in North America concludes the general contents of the first part of the Introduction.

The Introduction is continued on page 40. This continuation provides for additional lists and the introduction to the Taxonomic Treatment, which contains diagnoses, figures, distributions, and comments on the 70 species of these mites known to occur in North America are presented. Known host species are listed. Host specificity, host preferences, ecology, and geographic distributions for each species are discussed.

## LIST OF NORTH AMERICAN SPECIES OF MITES

*Najadicola ingens* (Koenike 1895)  
*Unionicola* (*Unionicola*) sp. nr. *figuralis* (Koch 1836) *sensu* J. C. Conroy  
*Unionicola* (*Unionicola*) *gracilipalpis* (Viets 1908)  
*Unionicola* (*Unionicola*) *laurentiana* Crowell and Davids 1979  
*Unionicola* (*Unionicola*) *mexicana* Cook 1980  
*Unionicola* (*Unionicola*) *nearctica* Crowell and Davids 1979  
*Unionicola* (*Unionicola*) *tenuis* (Lundblad 1935)  
*Unionicola* (*Everittatax*) *pectinata* (Wolcott 1898)  
*Unionicola* (*Wilsonatax*) *poirrieri* Vidrine 1984  
*Unionicola* (*Lasalleatax*) *conjuncta* Viets 1954  
*Unionicola* (*Lundbladatax*) *furcula* (Lundblad 1935)  
*Unionicola* (*Lundbladatax*) *furculopsis* Cook 1980  
*Unionicola* (*Pentatax*) *aculeata* (Koenike 1890)  
*Unionicola* (*Anodontinatax*) *belli* Vidrine 1986  
*Unionicola* (*Anodontinatax*) *clarki* Vidrine 1986  
*Unionicola* (*Anodontinatax*) *mitchelli* Conroy 1982  
*Unionicola* (*Anodontinatax*) *smithae* Vidrine 1986  
*Unionicola* (*Anodontinatax*) *wolcottii* (Piersig 1900)  
*Unionicola* (*Unionicolides*) *alleni* Vidrine 1987  
*Unionicola* (*Unionicolides*) *amandita* Mitchell and Wilson 1965  
*Unionicola* (*Unionicolides*) *bakeri* Vidrine 1986  
*Unionicola* (*Unionicolides*) *bogani* Vidrine 1987  
*Unionicola* (*Unionicolides*) *burchi* Vidrine 1986  
*Unionicola* (*Unionicolides*) *calnani* Vidrine 1986  
*Unionicola* (*Unionicolides*) *conroyi* Vidrine 1986  
*Unionicola* (*Unionicolides*) *fossulata* (Koenike 1895)  
*Unionicola* (*Unionicolides*) *fulleri* Vidrine 1986  
*Unionicola* (*Unionicolides*) *gailae* Vidrine 1987  
*Unionicola* (*Unionicolides*) *gordoni* Vidrine 1987  
*Unionicola* (*Unionicolides*) sp. nr. *gordoni*  
*Unionicola* (*Unionicolides*) *gowani* Vidrine 1987  
*Unionicola* (*Unionicolides*) *guilloryi* Vidrine 1987  
*Unionicola* (*Unionicolides*) *hendrixii* Vidrine 1987  
*Unionicola* (*Unionicolides*) *hosei* Vidrine 1986  
*Unionicola* (*Unionicolides*) *kavanaghi* Vidrine 1987  
*Unionicola* (*Unionicolides*) *lasallei* Vidrine 1986  
*Unionicola* (*Unionicolides*) *parkeri* Vidrine 1987  
*Unionicola* (*Unionicolides*) *poundsi* Vidrine 1986  
*Unionicola* (*Unionicolides*) *sakantaka* Mitchell and Wilson 1965  
*Unionicola* (*Unionicolides*) *scutella* Vidrine 1986  
*Unionicola* (*Unionicolides*) *stricta* (Wolcott 1898)

NORTH AMERICAN LIST  
(Continued)

- Unionicola (Unionicolides) tupara* Mitchell and Wilson 1965  
*Unionicola (Unionicolides) vamana* Mitchell and Wilson 1965  
*Unionicola (Unionicolides) vikitra* Mitchell and Wilson 1965  
*Unionicola (Unionicolides) vikitrella* Vidrine 1987  
*Unionicola (Berezatax) acylindrotarsa* Vidrine 1985  
*Unionicola (Berezatax) berezai* Vidrine 1985  
*Unionicola (Berezatax) latipalpa* Vidrine 1985  
*Unionicola (Atacella) entreerrianensis* (Rosso de Ferradas 1976)  
*Unionicola (Atacella) fissipes* (Koenike 1891)  
*Unionicola (Atacella) neoperforata* Vidrine 1985  
*Unionicola (Atacella) petita* Vidrine 1985  
*Unionicola (Ampullariatax) thompsoni* Cook 1974  
*Unionicola (Polyatax) campelomaicola* Marshall 1935  
*Unionicola (Polyatax) dobsoni* Vidrine 1985  
*Unionicola (Polyatax) viviparaicola* Vidrine 1985  
*Unionicola (Neoatax) abnormipes* (Wolcott 1898)  
*Unionicola (Neoatax) australindistincta* Vidrine 1985  
*Unionicola (Neoatax) causeyae* Vidrine 1985  
*Unionicola (Neoatax) indistincta* (Wolcott 1898)  
*Unionicola (Causeyatax) hensleyi* Vidrine 1985  
*Unionicola (Breaudatax) megachela* Vidrine 1985  
*Unionicola (Clarkatax) serrata* (Wolcott 1898)  
*Unionicola (Parasitatax) dimocki* Vidrine 1986  
*Unionicola (Parasitatax) foili* Edwards and Vidrine 1994  
*Unionicola (Parasitatax) formosa* (Dana and Whelpley 1836)  
*Unionicola (Parasitatax) ypsilophora* (Bonz 1783)  
*Unionicola (Wolcottatax) arcuata* (Wolcott 1898)  
*Unionicola (Dimockatax) bishopi* Vidrine 1986  
*Unionicola (Dimockatax) neocooki* Vidrine 1987  
*Unionicola (Dimockatax) tumida* (Wolcott 1898)

LIST OF MITES IN *UNIONICOLA* AND *NAJADICOLA* OF THE WORLD  
(asterisks designate North American species)

Pionidae: Najadicolinae

*Najadicola ingens* (Koenike 1895)\*

Unionicolidae: Unionicolinae

*Unionicola (Ampullariatax) ampullariae* (Koenike 1890)  
*thompsoni* Cook 1974\*

*Unionicola (Anodontinatax) belli* Vidrine 1986\*  
*clarki* Vidrine 1986\*  
*intermedia* (Koenike 1882)  
*mitchelli* Conroy 1982\*  
*smithae* Vidrine 1986\*  
*wolcottii* (Piersig 1900)\*

*Unionicola (Armatax) armata* Walter 1929  
*cooki* Bader 1981  
*dentifera* Cook 1966  
*koenikei* Viets 1913

*Unionicola (Atacella) clathrata* (Lundblad 1937)  
*crassiparma* Vidrine 1985  
*enterrianensis* (Rosso de Ferradas 1976)\*  
*fissipes* (Koenike 1891)\*  
*granadosi* Hoffman and Cramer 1979  
*gigantea* (Caches and Mane-Garzon 1973)  
*nelsoni* Vidrine 1985  
*neoperforata* Vidrine 1985\*  
*parmaphora* Vidrine 1985  
*perforata* (Koenike 1890)  
*petita* Vidrine 1985\*  
*quadriplaca* Vidrine 1985  
*recta* Vidrine 1985  
*redfordi* Vidrine 1985  
*rosewateri* Vidrine 1985  
*rugosa* (Koenike 1890)  
*schubarti* (Viets 1954)  
*subrecta* (Caches and Mane-Garzon 1973)

*Unionicola (Australatax) assimilis* Viets 1980  
*clipeata* Viets 1980  
*conjunctella* Viets 1980  
*ligulifera* Viets 1980  
*procursa* Viets 1980  
*scutata* Viets 1980  
*sinuata* Lundblad 1938



WORLD LIST  
(Continued)

- Unionicola (Australionicola) hammeni* Smit 1992  
*Unionicola (Baderatax) curtipalpis* Bader 1978  
    *macani* Gledhill 1985  
*Unionicola (Bakeratax) chappuisi* Walter 1935  
    *borgerti* (Daday 1907)  
    *dadayi* Cook 1966  
    *incerta* Bader 1981  
    *vietsi* Walter 1935  
*Unionicola (Bassatax) separata* Cook 1966  
*Unionicola (Berezatax) berezai* Vidrine 1985\*  
    *acylindrotarsa* Vidrine 1985\*  
    *latipalpa* Vidrine 1985\*  
*Unionicola (Breaudatax) megachela* Vidrine 1985\*  
*Unionicola (Causeyatax) hensleyi* Vidrine 1985\*  
*Unionicola (Clarkatax) serrata* (Wolcott 1898)\*  
*Unionicola (Conroyatax) setifera* Cook 1967  
*Unionicola (Cookatax) latilaminata* (Viets 1911)  
*Unionicola (Crameratax) acutidens* (Lundblad 1936)  
    *gracilipes* (Lundblad 1936)  
    *tumidipalpis* (Lundblad 1936)  
*Unionicola (Crowellatax) billieaehonore* Crowell 1990  
*Unionicola (Curryatax)prehendens* Viets 1954  
*Unionicola (Davidsatax) inflexa* Viets 1921  
*Unionicola (Dimockatax) bishopi* Vidrine 1986\*  
    *neocooki* Vidrine 1987\*  
    *tumida* (Wolcott 1898)\*  
    *tumidoides* Vidrine 1986  
*Unionicola (Downesatax) vidrinei* Cook 1986  
*Unionicola (Edwardsatax) crassipalpis* Walter 1915  
    *flabelliseta* Cook 1986  
*Unionicola (Everittatax) pectinata* (Wolcott 1898)\*  
*Unionicola (Ferradasatax) procurvipes* (Koenike 1890)  
*Unionicola (Fulleratax) davisii* Vidrine 1984  
    *robacki* Vidrine 1984  
*Unionicola (Giselatax) aberrans* Viets 1984  
    *lundbladi* Viets 1975  
*Unionicola (Gledhillatax) augustipalpis* (Lundblad 1937)  
    *brevisuturata* Viets 1959  
    *simplicipes* (Lundblad 1936)  
    *longipes* Lundblad 1942

WORLD LIST  
(Continued)

- Unionicola (Heteratax) falcipes* (Lundblad 1941)  
*Unionicola (Heversatax) falcifera* (Daday 1907)  
    *kantaka* Cook 1967  
    *tridentifera* Viets 1921  
    *unguiculata* Walter 1929  
*Unionicola (Imamuratax) heardi* Vidrine 1985  
    *neokoenikei* Viets 1957  
    *scutigera* Viets 1926  
*Unionicola (Kovietsatax) cirrosa* (Koenike 1914)  
    *walkeri* Viets 1980  
*Unionicola (Lasalleatax) brasiliensis* (Lundblad 1936)  
    *conjuncta* Viets 1954\*  
    *unidens* Lundblad 1942  
*Unionicola (Lundbladatax) fissipalpis* Lundblad 1942  
    *furcula* (Lundblad 1935)\*  
    *furculopsis* Cook 1980\*  
*Unionicola (Majumderatax) crenipalpis* Lundblad 1969  
    *hankoi* (Szalay 1927)  
*Unionicola (Mitchellatax) curvitaris* Lundblad 1941  
    *annulata* Lundblad 1947  
    *longidens* Lundblad 1942  
    *pseudoannulata* Cook 1986  
*Unionicola (Neoatax) abnormipes* (Wolcott 1898)\*  
    *australindistincta* Vidrine 1985\*  
    *causeyae* Vidrine 1985\*  
    *indistincta* (Wolcott 1898)\*  
*Unionicola (Parasitatax) dimocki* Vidrine 1986\*  
    *foili* Edwards and Vidrine 1994\*  
    *formosa* (Dana and Whelpley 1836)\*  
    *thienemanni* Viets 1957  
    *uchidai* Imamura 1953  
    *ypsilophora* (Bonz 1783)\*  
*Unionicola (Pentatax) aculeata* (Koenike 1890)\*  
    *bonzi* (Claparede 1869)  
    *imamurai* Hevers 1978  
    *inuitata* (Koenike 1914)  
    *rezvoi* Sokolow 1931  
    *setipes* Sokolow 1931  
    *thaiensis* Vidrine 1985  
    *tricuspis* (Koenike 1895)

WORLD LIST  
(Continued)

- Unionicola (Polyatacides) prominens* (Koenike 1890)  
*Unionicola (Polyatax) campelomaicola* Marshall 1935\*  
    *dobsoni* Vidrine 1985\*  
    *japonensis* Viets 1933  
    *viviparaicola* Vidrine 1985\*  
*Unionicola (Poundsatax) retractidens* Lundblad 1937  
*Unionicola (Prasadatax) brandti* Vidrine 1985  
    *diversipes* (Viets 1926)  
*Unionicola (Smithatax) alpa* Cook 1986  
    *davidsi* Smit 1992  
    *minutissima* Lundblad 1947  
*Unionicola (Unionicola) affinis* (Piersig 1906)  
    *crassipes* (Mueller 1776)  
    *cyclophora* Viets 1913  
    *digitata* (Koenike 1898)  
    *dresscheri* Besseling 1946  
    *figuralis* (Koch 1836)\*  
    *fimbriata* Viets 1913  
    *finisbelli* Ramassotti 1947  
    *gilani* Hevers 1984  
    *gracilipalpis* (Viets 1908)\*  
    *graciliseta* (Viets 1935)  
    *harpax* (Koenike 1898)  
    *iheringi* (Koenike 1890)  
    *inermis* Lundblad 1941  
    *laurentiana* Crowell and Davids 1979\*  
    *levipalpis* Besseling 1949  
    *lindrothi* Viets 1981  
    *longiseta* Walter 1915  
    *lyncea* (Koenike 1895)  
    *megalopsis* Viets 1925  
    *mexicana* Cook 1980\*  
    *minor* (Soar 1900)  
    *minuta* Viets 1916  
    *miyazakki* Imamura 1953  
    *motasi* Viets 1959  
    *nearctica* Crowell and Davids 1979\*  
    *necessaria* (Koenike 1906)  
    *neoeffinis* Cook 1986  
    *niigata* Imamura 1954

WORLD LIST  
(Continued)

- parvipora* (Lundblad 1920)  
*parvula* Lundblad 1954  
*perpusilla* Viets 1954  
*pollicigera* Viets 1921  
*postmarginata* Viets 1925  
*pugionipalpis* Viets 1954  
*pusiligera* Viets 1954  
*schmackeri* (Koenike 1895)  
*similis* (Viets 1935)  
*singalensis* (Daday 1898)  
*siolii* Viets 1954  
*tenuis* (Lundblad 1935)\*  
*uncata* Viets 1916  
*Unionicola* (*Unionicolella*) *pachyscelus* Lundblad 1941  
*Unionicola* (*Unionicolides*) *alleni* Vidrine 1987\*  
*amandita* Mitchell and Wilson 1965\*  
*bakeri* Vidrine 1986\*  
*bogani* Vidrine 1987\*  
*bonariensis* Mauri and Alzuet 1972  
*burchi* Vidrine 1986\*  
*calnani* Vidrine 1986\*  
*conroyi* Vidrine 1986\*  
*fossulata* (Koenike 1895)\*  
*fulleri* Vidrine 1986\*  
*gailae* Vidrine 1987\*  
*gordoni* Vidrine 1987\*  
*gowani* Vidrine 1987\*  
*guilloryi* Vidrine 1987\*  
*hendrixii* Vidrine 1987\*  
*hoesei* Vidrine 1986\*  
*kavanaghi* Vidrine 1987\*  
*lasallei* Vidrine 1986\*  
*parkeri* Vidrine 1987\*  
*poundsi* Vidrine 1986\*  
*sakantaka* Mitchell and Wilson 1965\*  
*scutella* Vidrine 1986\*  
*sica* Lundblad 1937  
*stansberyi* Vidrine 1986  
*stricta* (Wolcott 1898)\*

WORLD LIST  
(Continued)

*tupara* Mitchell and Wilson 1965\*

*vamana* Mitchell and Wilson 1965\*

*vikitra* Mitchell and Wilson 1965\*

*vikitrella* Vidrine 1987\*

*Unionicola (Unionicolopsis) opimipalpis* (Viets 1980)

*Unionicola (Vietsatax) parasitica* (Uchida and Imamura 1938)

*Unionicola (Wilsonatax) plaumanni* Lundblad 1937

*poirrieri* Vidrine 1984\*

*viciniseta* (Lundblad 1936)

*Unionicola (Wolcottatax) arcuata* (Wolcott 1898)\*

*arcuatoides* Vidrine 1986

## KEY TERMS

acetabulum--a circular structure on the genital plates  
anal plate--a larval plate surrounding the excretory pore  
apodemes--thickened, internal, raised, sclerotized ridge for muscle attachment  
basifemur--second segment of walking legs (legs I-IV); immediately distal to the coxa and proximal to the telofemur  
bifid--tarsal claw with two obvious terminal prongs  
coxa--first (most proximal) segment of pedipalps and walking legs  
coxal plate--ventral plates which attach to coxa (epimera) (generally four coxal plates on each side of venter)(the plates are often fused into anterior and posterior groups with two plates in each group and often divided by an incomplete suture  
distal--more distant from the center of the body  
dorsum--upper side of the body (with *Najadicola* and *Unionicola*, the eyes are apparent)  
dorsal plate--secondary sclerotization forming a chitinous shield (often reticulate) on the dorsum  
femur--second segment of pedipalp; immediately distal to coxa and proximal to the genu  
genital field--area comprising the genital plates; posterior to coxal plates  
genital plate--chitinous shield with acetabula around genital opening  
genu--the fourth segment of the walking legs and the third segment of the pedipalps; immediately distal to the telofemur in walking legs and the femur in the pedipalps and proximal to the tibia  
pedipalp (= palp)--five-segmented, anterior, modified leg used in feeding  
penal apparatus (aedeagus)--the male intromittent organ used to deposit spermatophore  
plates--genital, coxal, and dorsal, shieldlike, secondary sclerotizations  
prong--a chitinous tip on a tarsal claw, tarsal clawlet, etc.  
proximal--closer to the center of the body  
setae (spine or hair)--any of a number of kinds of chitinous needle-like structures arising from the legs, pedipalps, plates, and even primary sclerotizations (variously modified as to be hair-like, thorn-like, scoup-like, serrated, filamentous, etc.)  
simple--a claw with a single terminal tip  
tarsal claw--hook-like, chitinous structures on the walking legs at the end of the tarsus, often retractible in a groove  
tarsal clawlet--small clawlike structure on the pedipalps  
tarsus--the sixth and ultimate segment of the walking leg and the fifth segment of the pedipalp;  
distal--most segment on all appendages; having claw or clawlets  
telofemur--third segment of the walking leg; immediately distal to the basifemur and proximal to the genu  
tibia--penultimate (fifth) segment of walking legs and fourth segment of the pedipalps  
venter--the under side of the body with obvious coxal plates  
walking leg--six-segmented appendages, usually numbered I-IV, obviously lateral on either side of the body in adult and nymphal mites (note: larvae have only 5 segments)

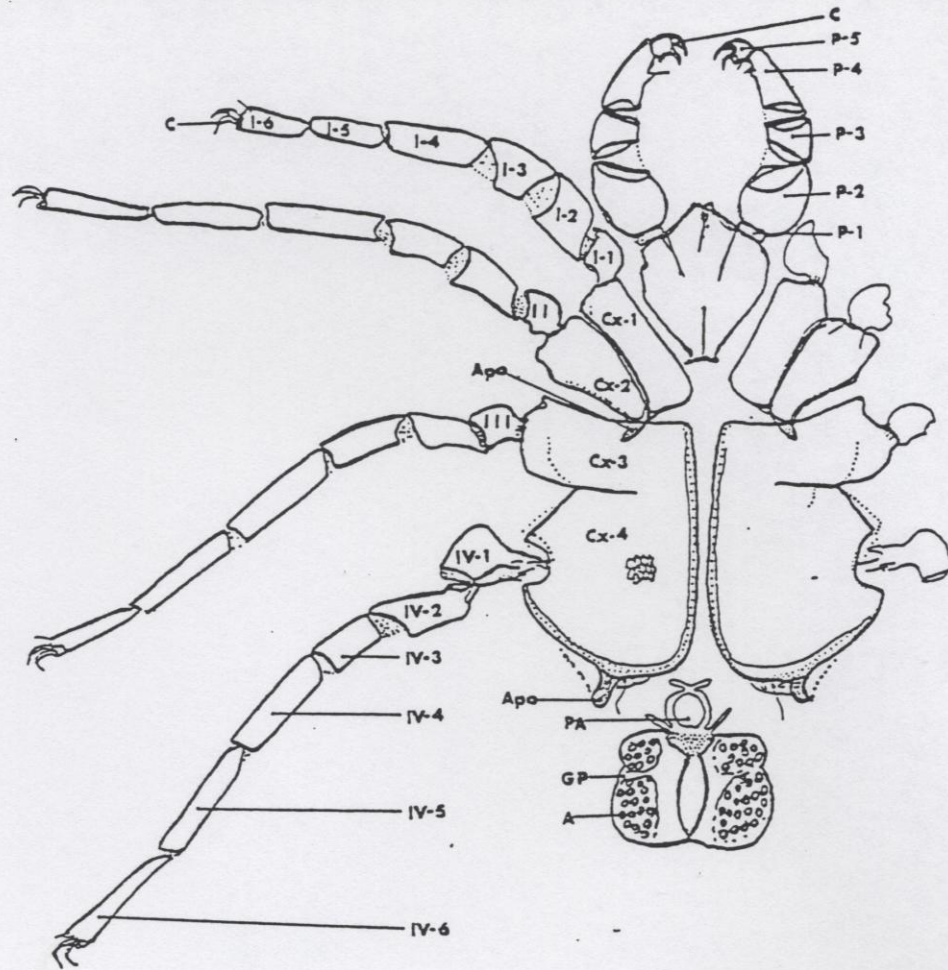


Figure 1. *Unionicola serrata* (Wolcott 1898), adult male venter. Key characteristics:

Pedipalps:

Segments of pedipalps: P-1 Coxa; P-2 Femur; P-3 Genu; P-4 Tibia; P-5 Tarsus;  
C Clawlet

Walking legs:

(I--IV) first, second, third, and fourth

Segments of walking legs: 1 -- Coxa; 2 -- Basifemur; 3 -- Telfemur;

4 -- Genu; 5 -- Tibia; 6 -- Tarsus; C -- Tarsal claw

Coxal plates:

(Cx-1 -- Cx-4) first, second, third, and fourth

Posterior coxal apodemes (Apo)

Genital field:

Genital plate (GP); Penal apparatus (PA); Acetabulum (A)



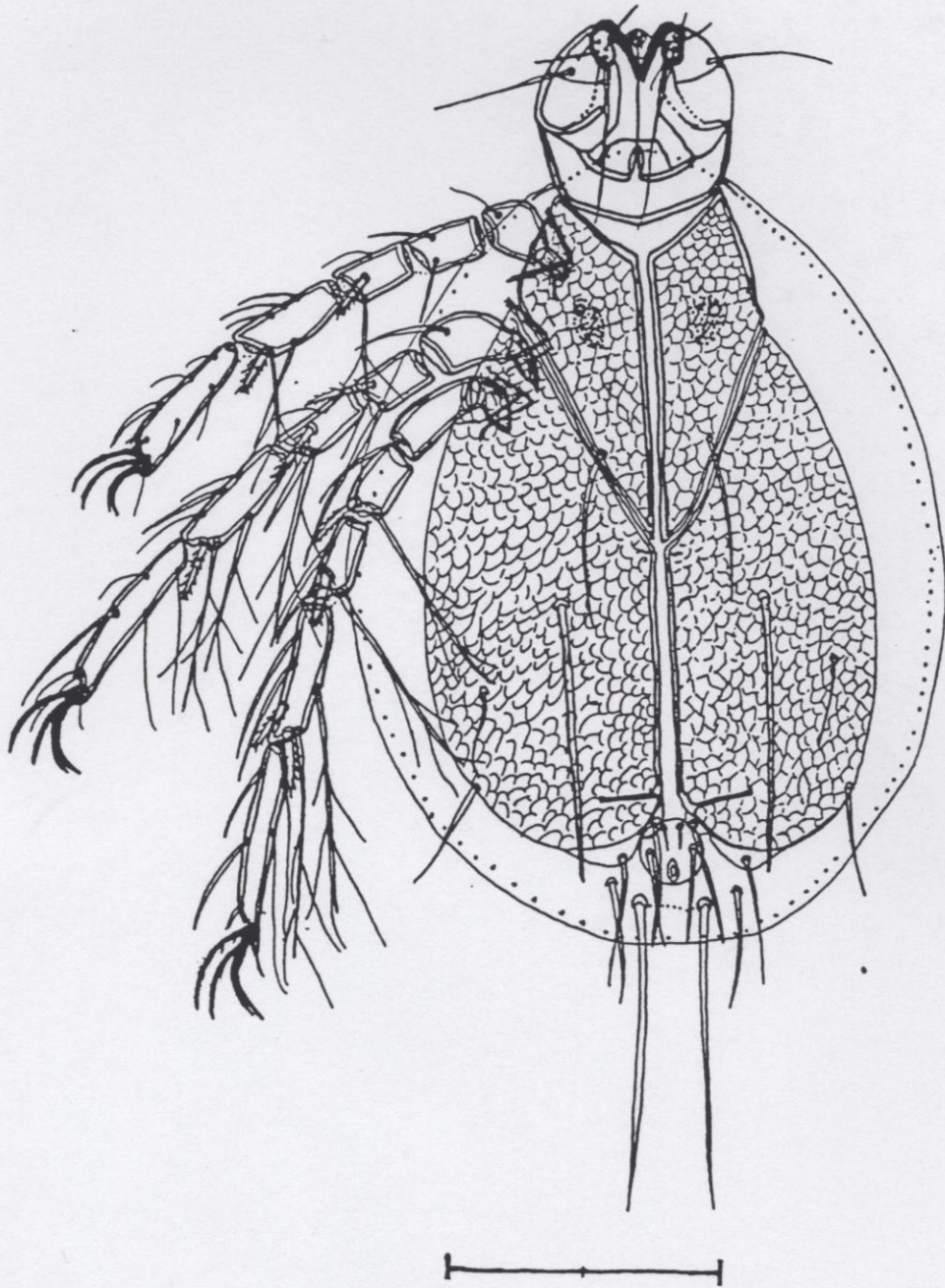
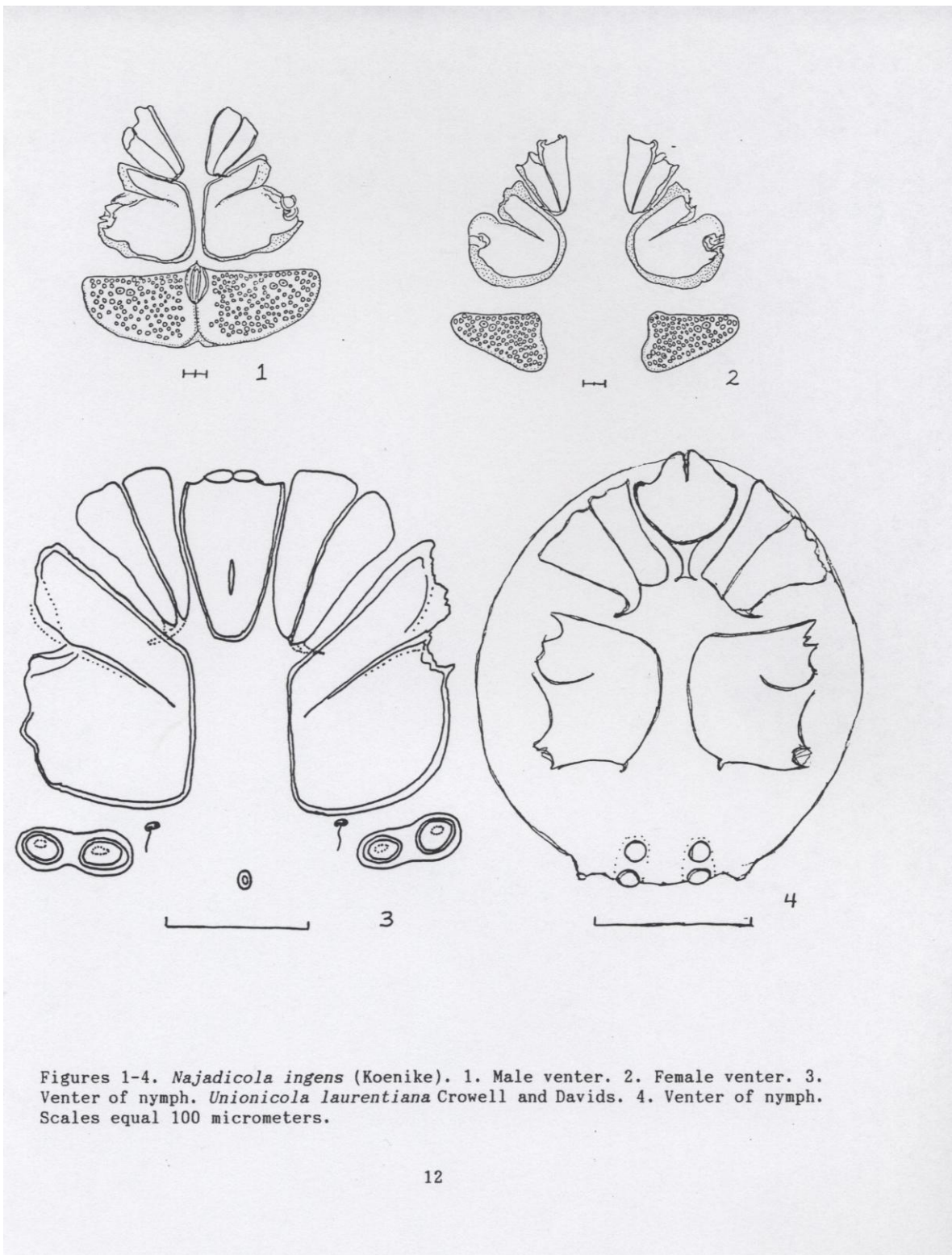


Figure 1. *Unionicola stricta* (Wolcott 1898). Larva. Scale equals 100 micrometers.





Figures 1-4. *Najadicola ingens* (Koenike). 1. Male venter. 2. Female venter. 3. Venter of nymph. *Unionicola laurentiana* Crowell and Davids. 4. Venter of nymph. Scales equal 100 micrometers.



Figure 1. *Najadicola ingens* (Koenike 1895). Larva. Scale equals 100 micrometers.

## List of Abbreviations

### Mite Anatomy

BFe -- basifemur (segment of legs immediately distal to coxa)  
Coxal plate I -- first coxal plate (Cx-1)  
Coxal plate II -- second coxal plate (Cx-2)  
Coxal plate III -- third coxal plate (Cx-3)  
Coxal plate IV -- fourth coxal plate (Cx-4)  
Cx -- coxae (proximal-most segment of pedipalps and legs)  
Fe -- femur (segment of pedipalps immediately distal to coxa)  
Ge -- genu (segment of pedipalps and walking legs immediately proximal to the tibia)  
Leg I -- first walking leg  
Leg II -- second walking leg  
Leg III -- third walking leg  
Leg IV -- fourth walking leg  
TFe -- telofemur  
Ta -- tarsus (ultimate or distal-most segment of pedipalps and legs)  
Ti -- tibia (penultimate segment of pedipalps and legs)

### Museums

ANSP -- Academy of Natural Sciences of Philadelphia, Philadelphia, PA  
CNC -- Canadian National Collections and Biosystematics Institute, Agriculture Canada, Ottawa, Canada  
MC-FMNH -- Marshall Collections, Field Museum of Natural History, Chicago, IL  
MZUM -- The Museum of Zoology of the University of Michigan, Ann Arbor, MI  
NMC -- National Museums of Canada, Ottawa, Canada  
OSUM -- Ohio State University Museum, Columbus, Ohio  
USNM -- United States National Museum (Smithsonian Institution), Washington, DC

### Locations\*

MX -- Mexico  
Rte. -- Rural route  
Co. -- County

### Others

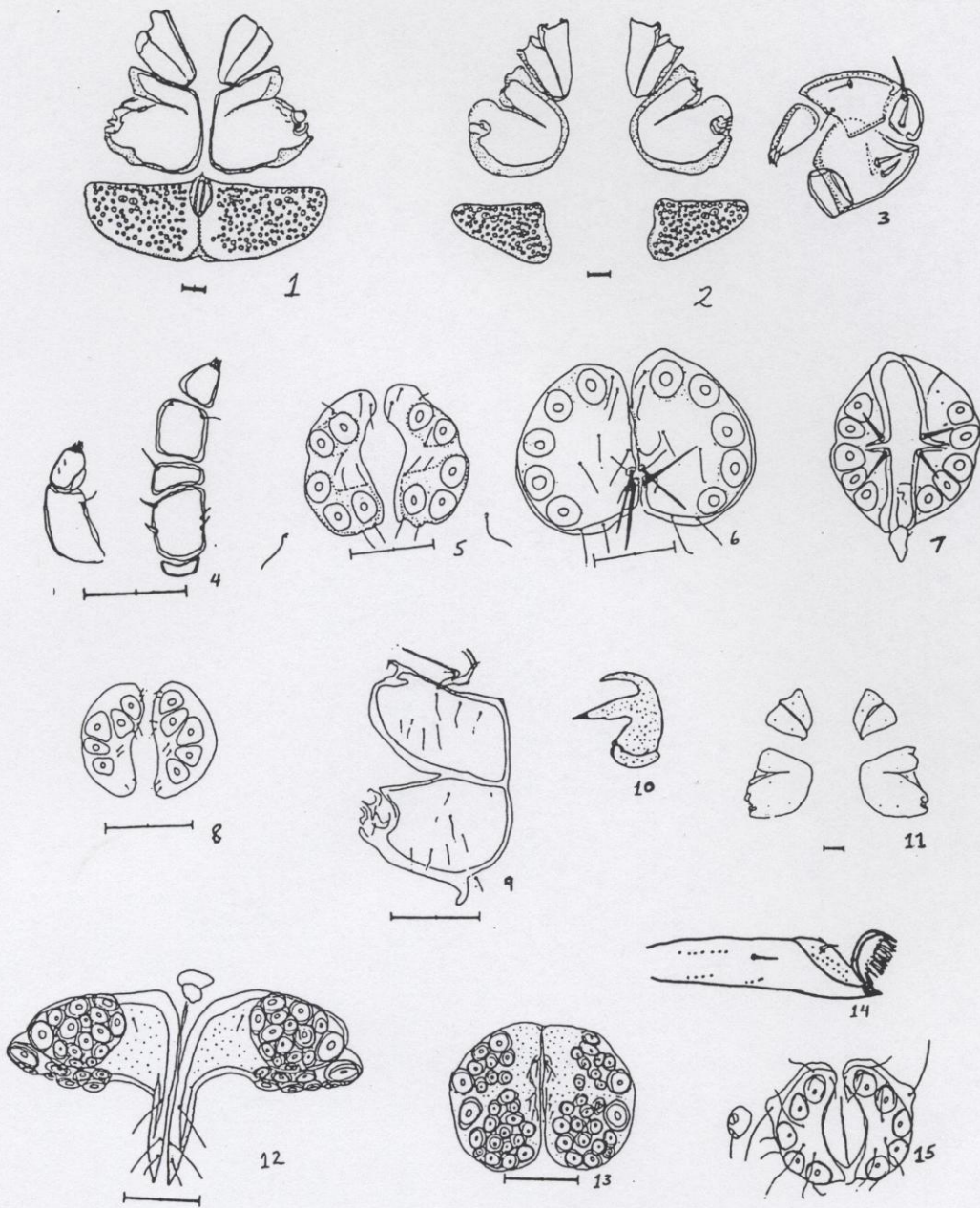
ca. -- circa

~~~~~  
\* Standard two-letter abbreviations are used for states in the United States of America, *e. g.*, LA for Louisiana.

An artificial dichotomous key to the adults of the single species of *Najadicola* and the 69 species in 19 subgenera of *Unionicola* in North America.

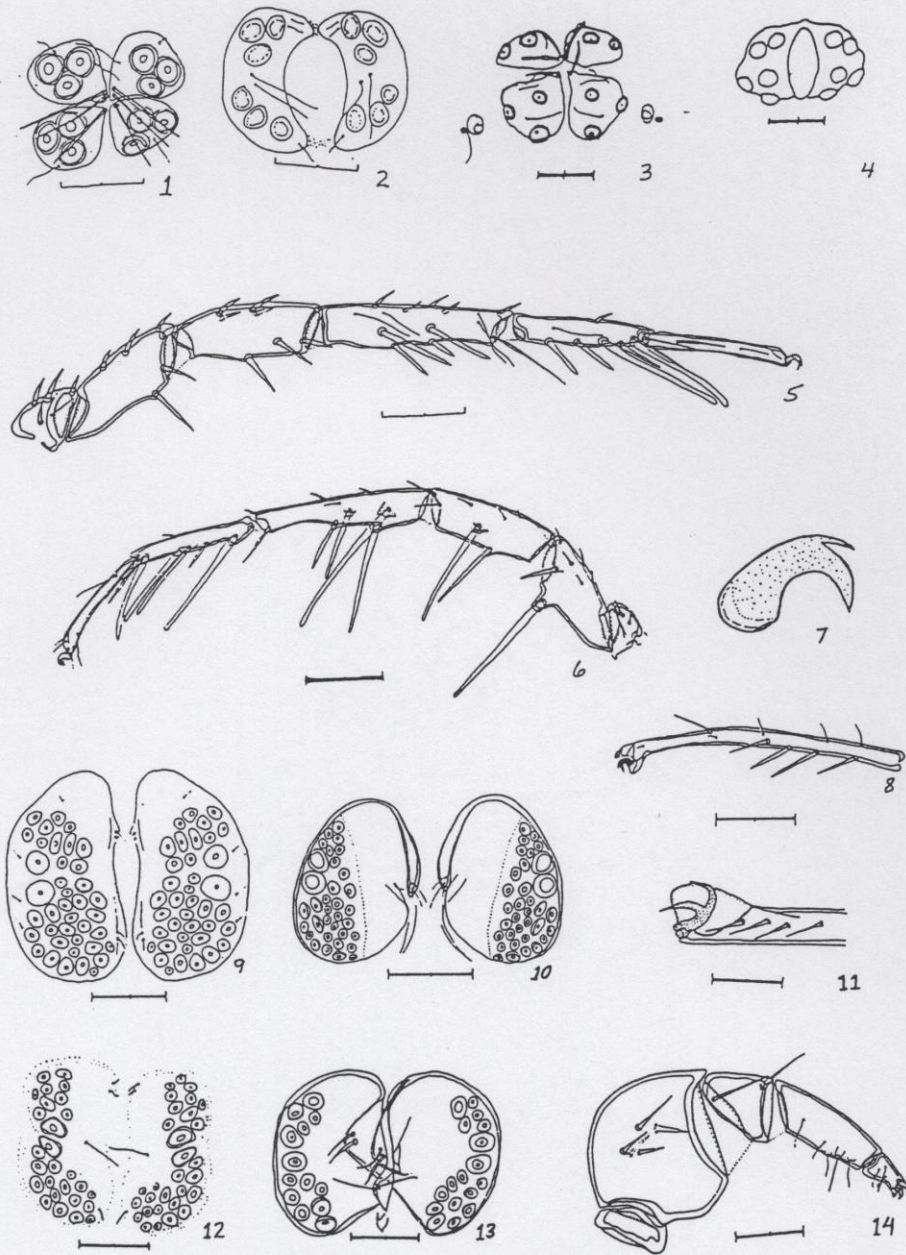
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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 1a. Genital field with triangular plates with numerous (> 70 pairs) acetabula (figs. 1 and 2); female genital field without enlarged setae and with plates separate; mites occur within suprabranchial and/or pericardial and/or renal chambers of mussel hosts...Genus <i>Najadicola</i> (p. 50).....                                             | <i>Najadicola (Najadicola) ingens</i> (p.51)                                                    |
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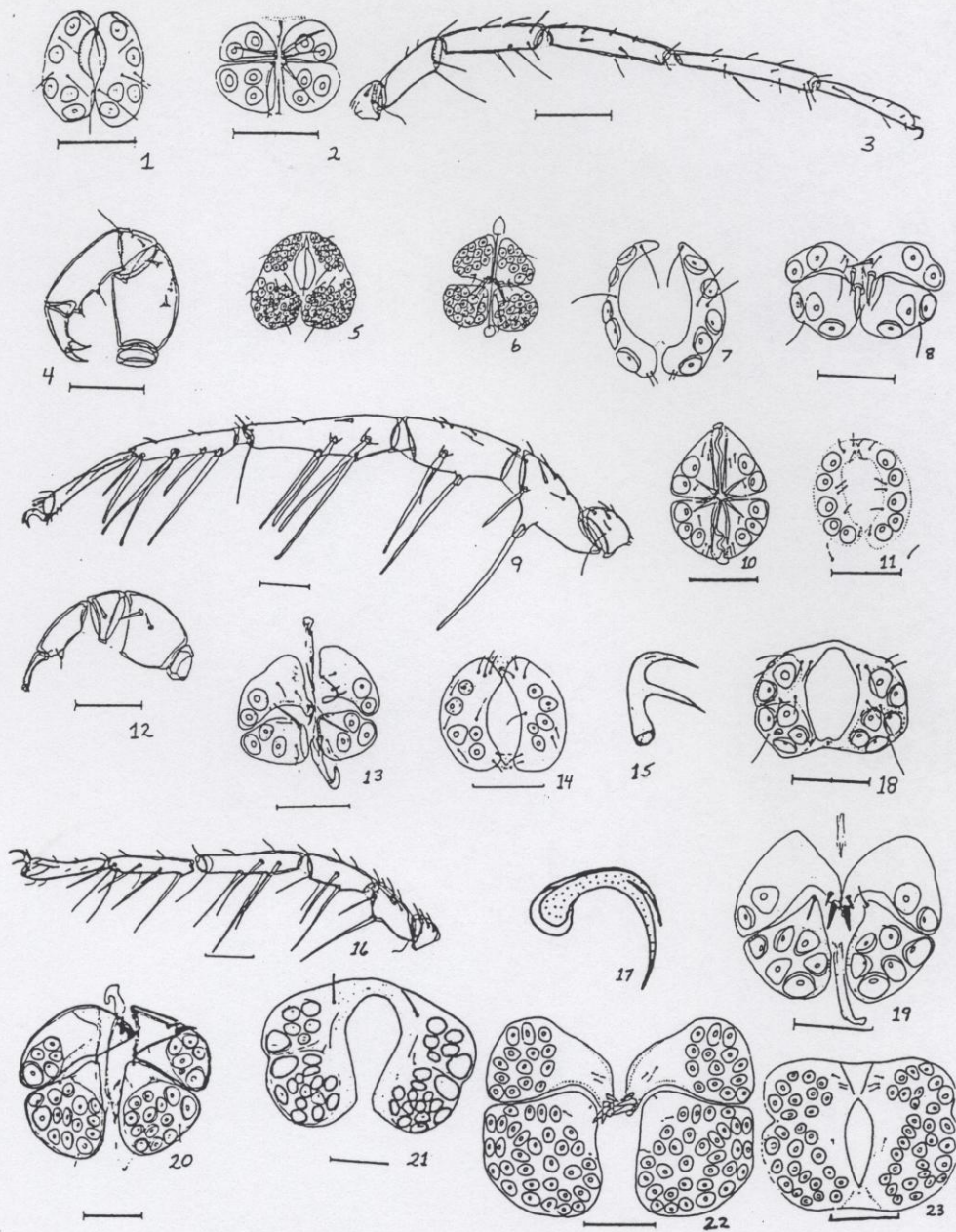
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|                                                                                                                               |                                                                                             |    |
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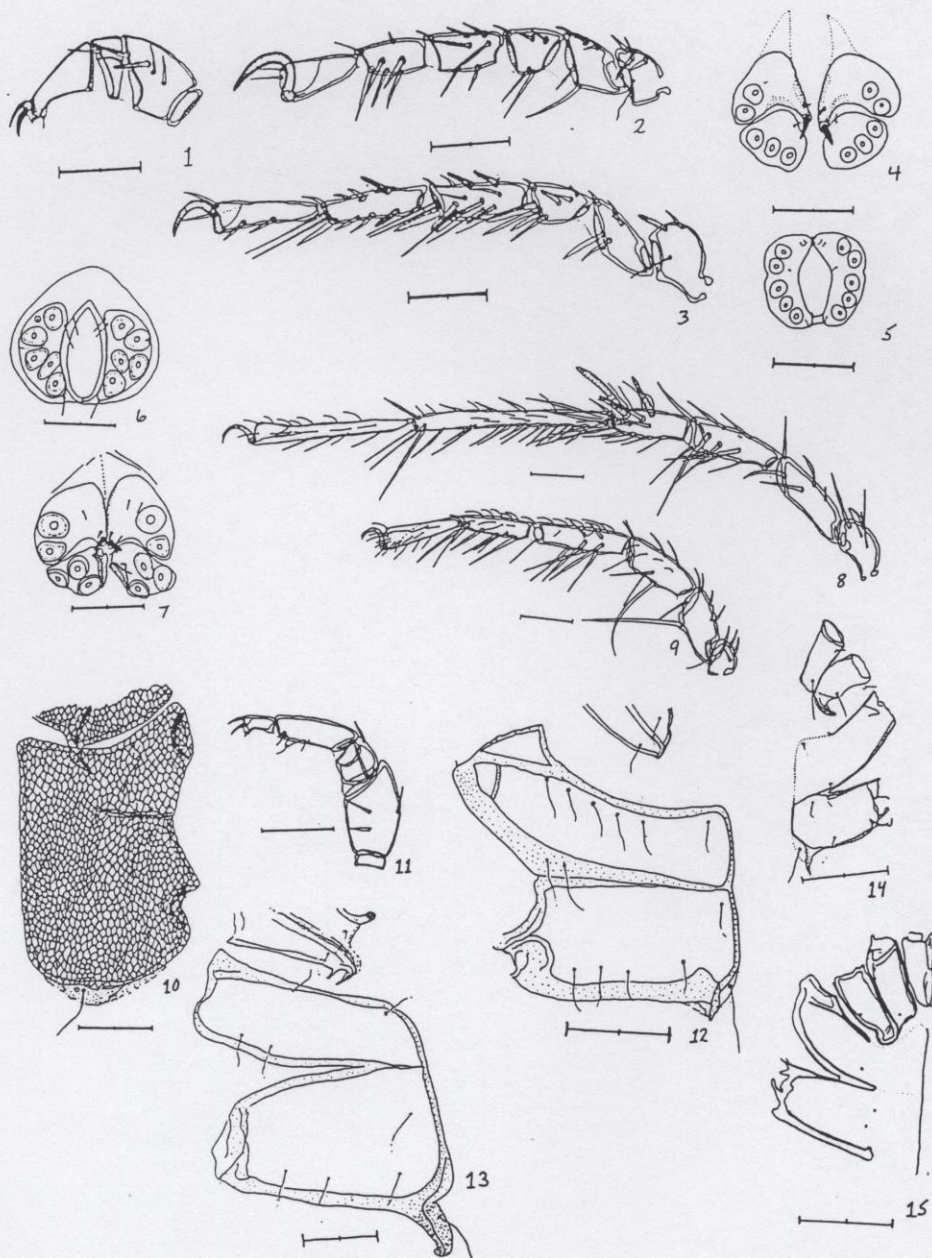
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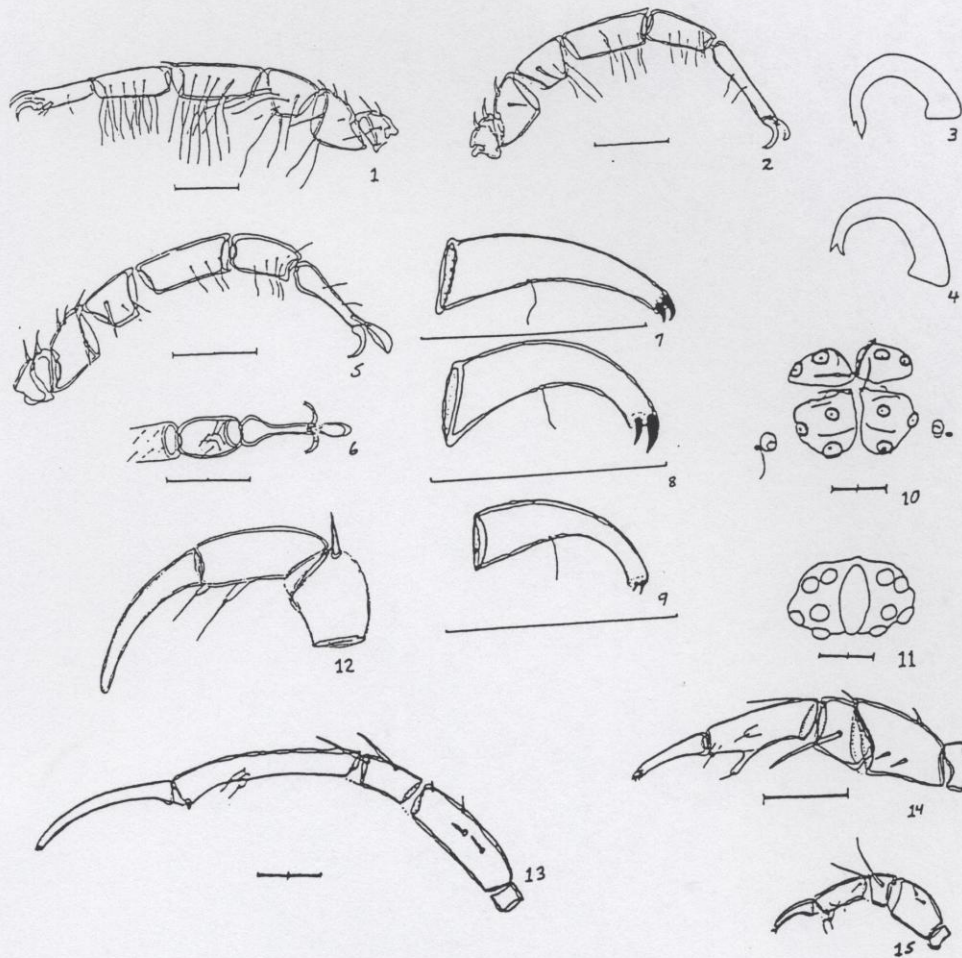
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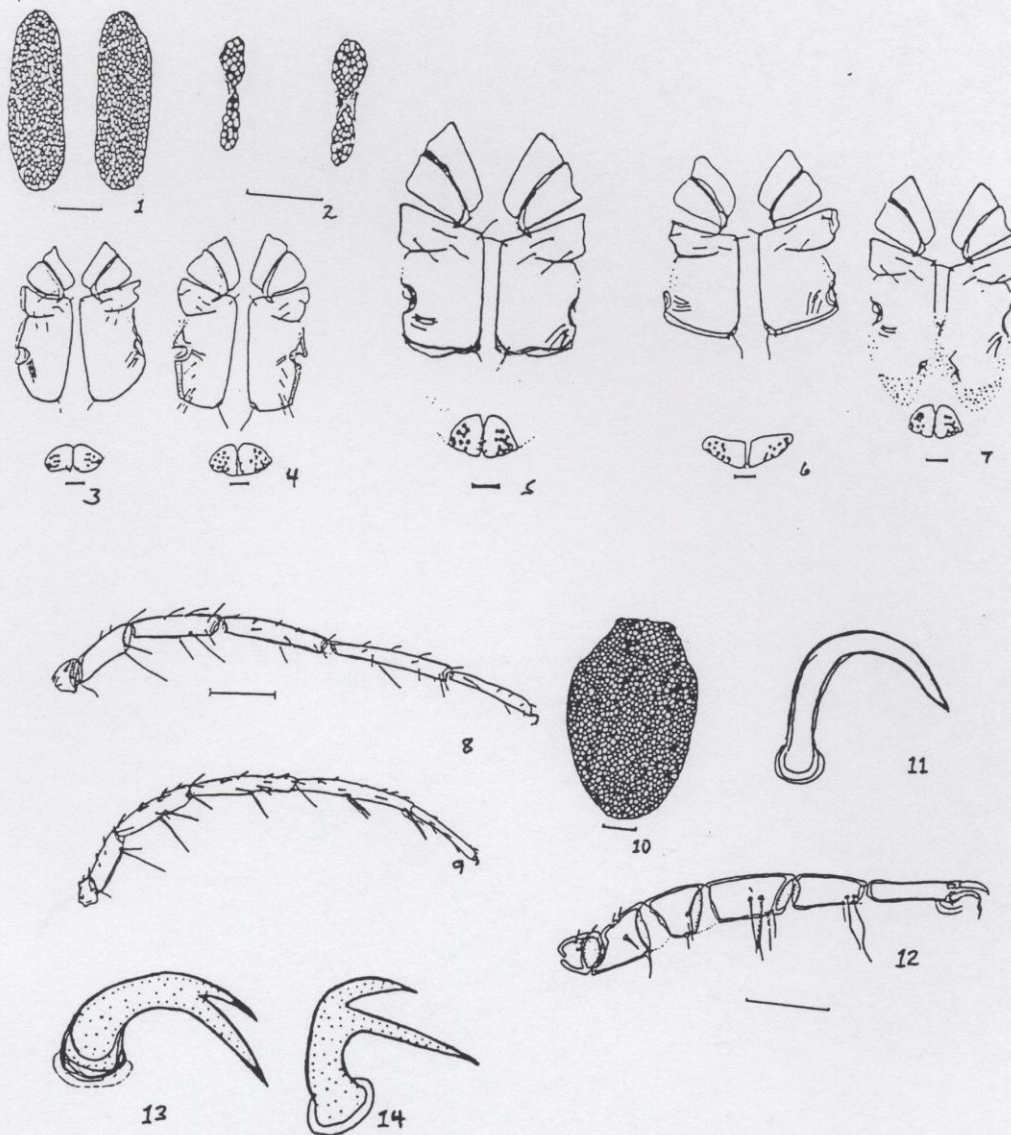
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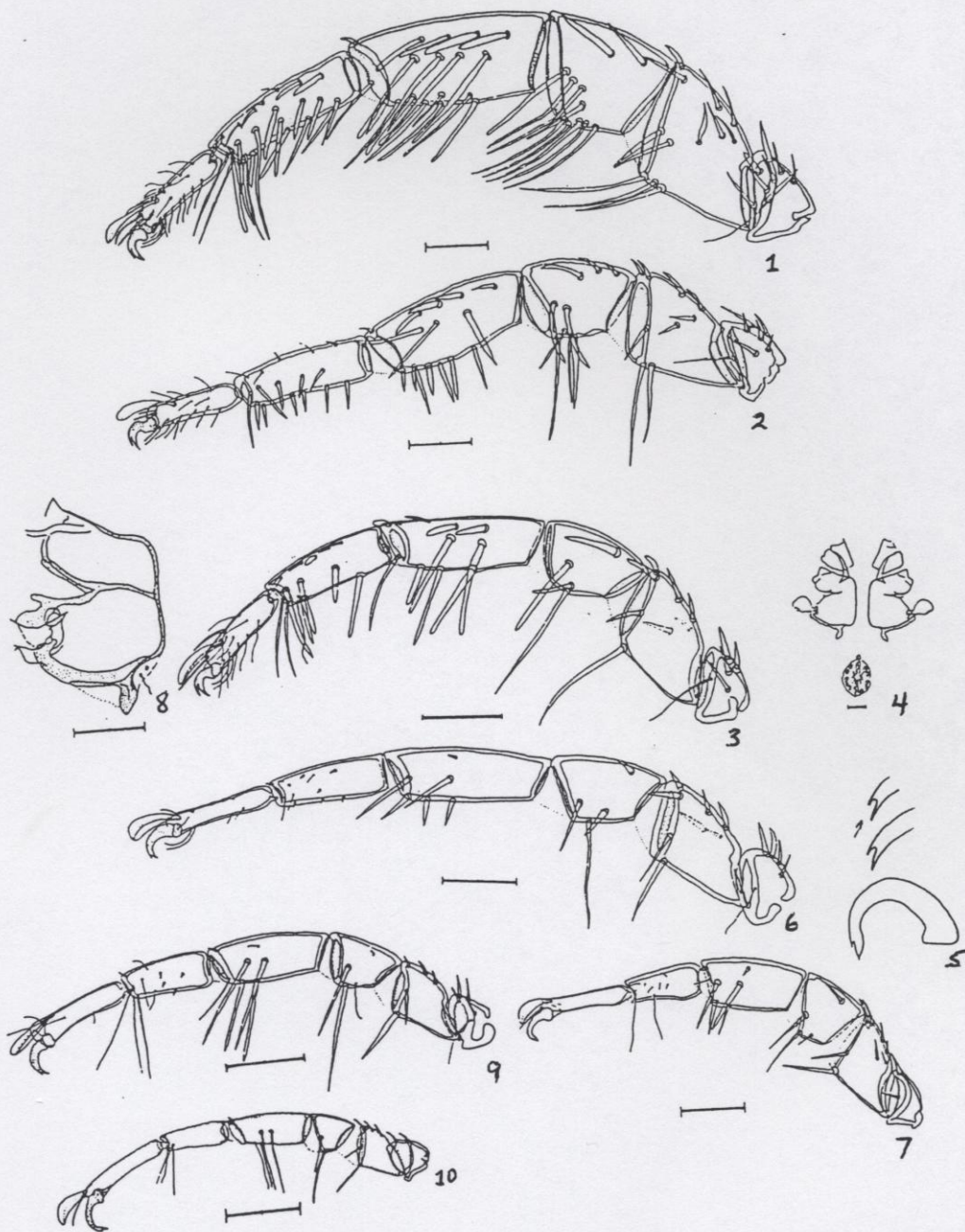




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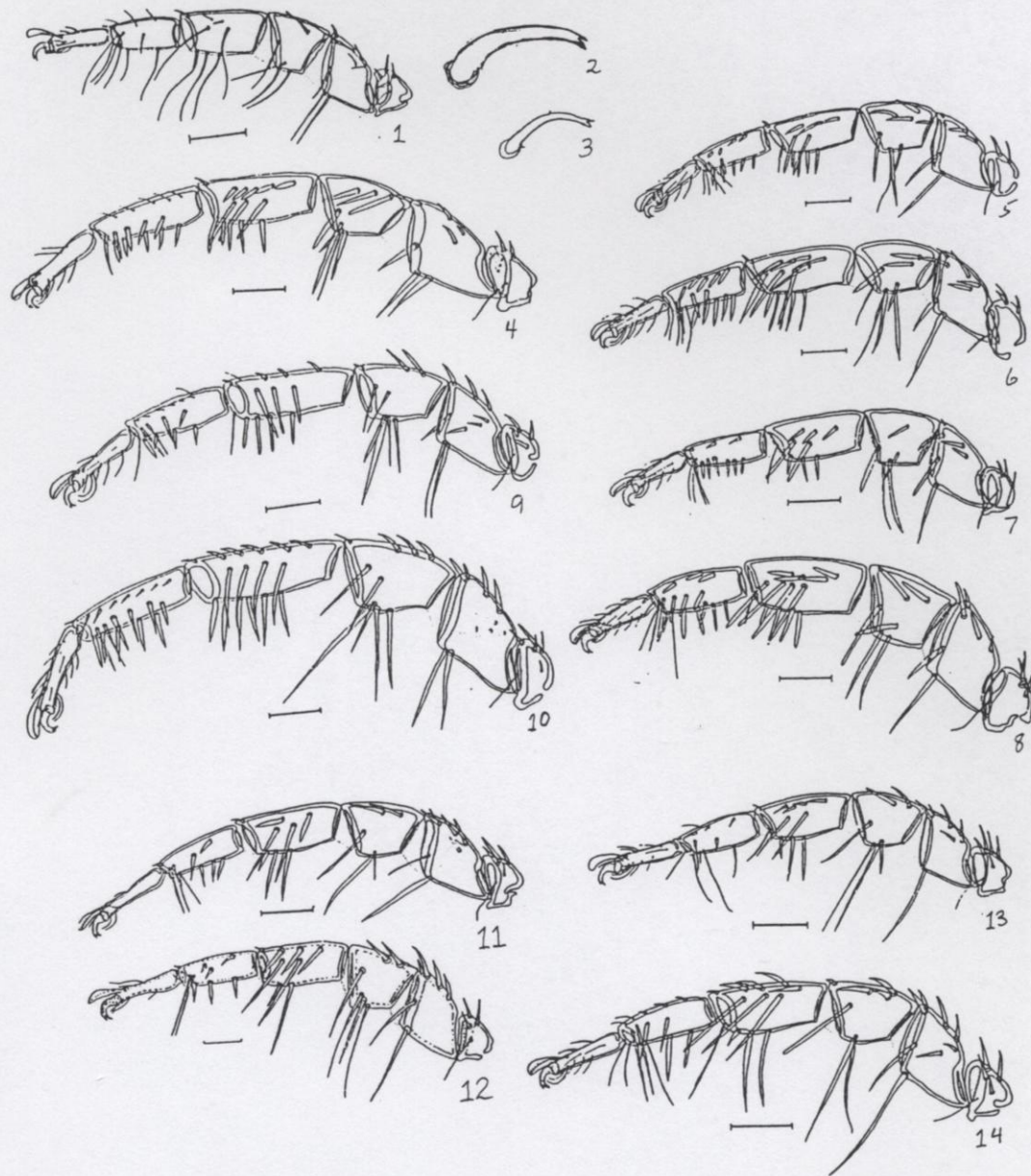


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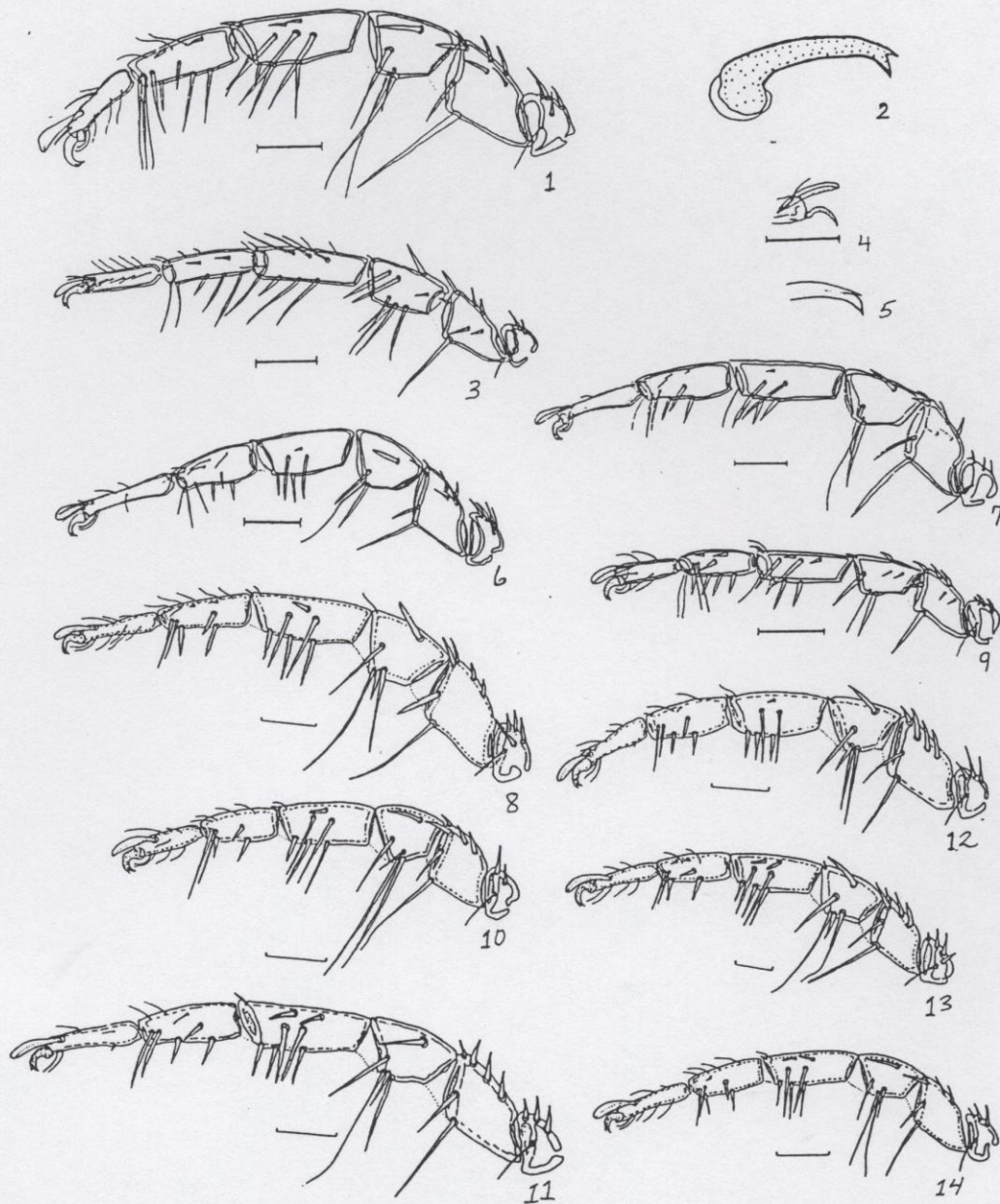
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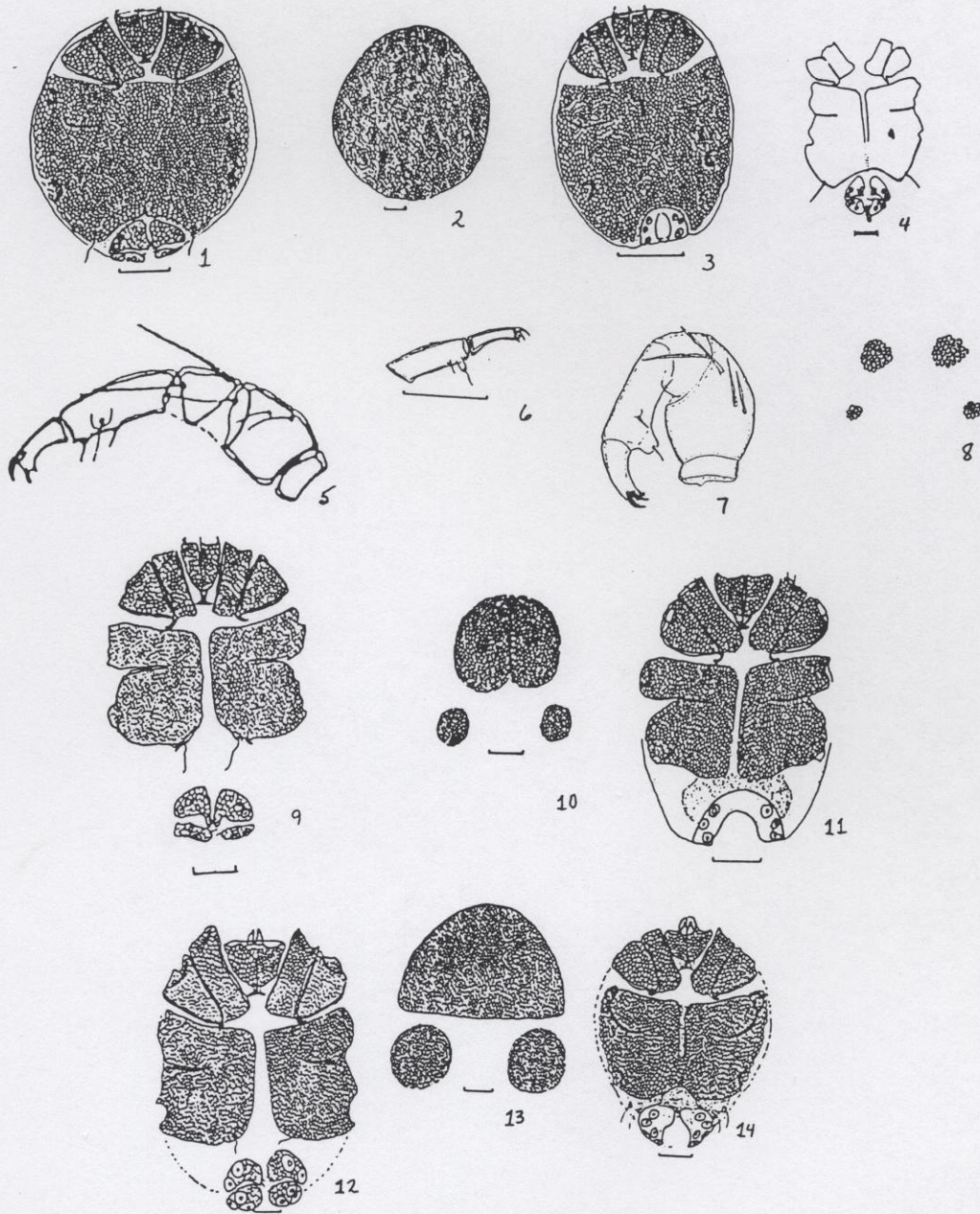




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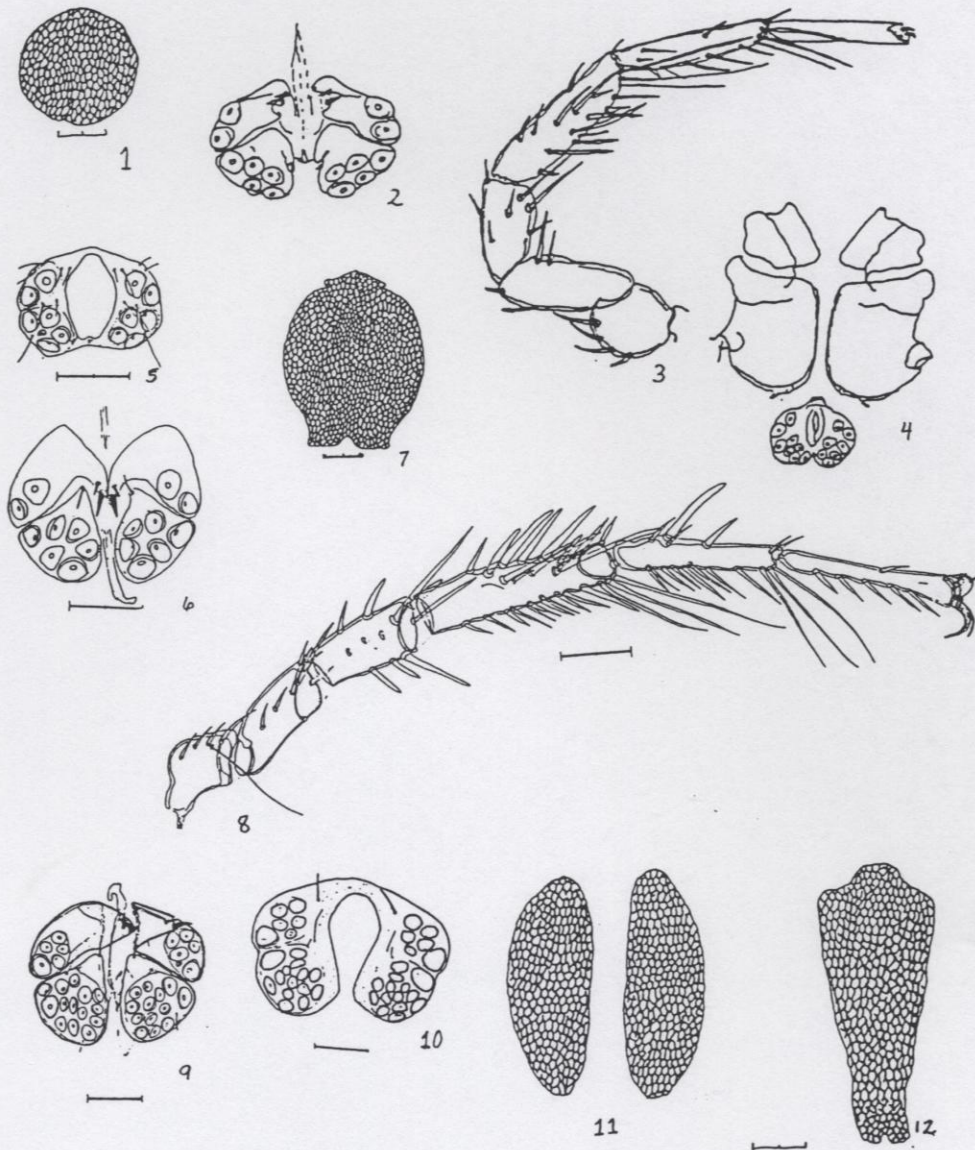
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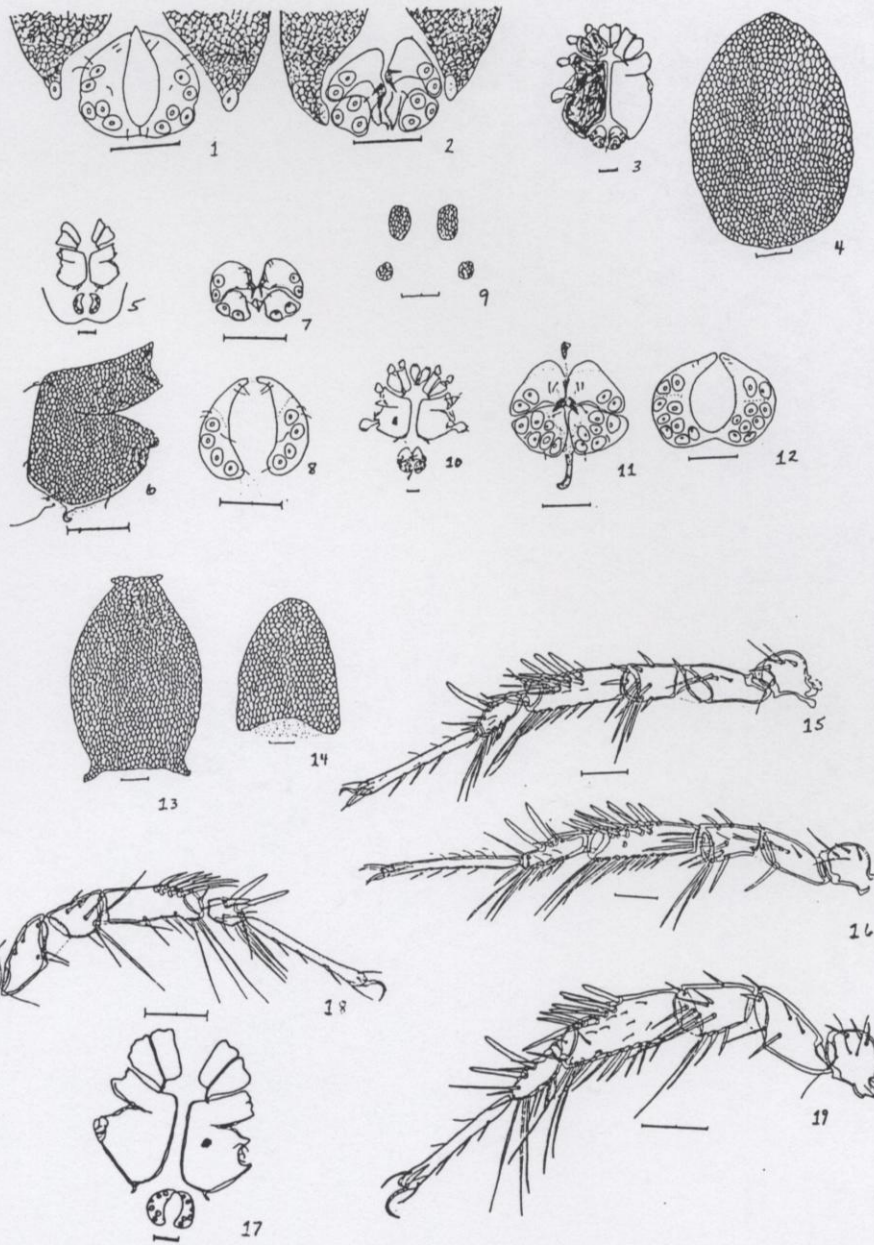
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## INTRODUCTION (continued)

The following section contains the taxonomic treatment of the species of mites. It is preceded by a list of the mussels of North America and a list of other hosts. The names of the mussels are concepts of Turgeon *et al.* (1988), Burch (1975), Hoeh (1990), Bogan (1993 and personal communications), and Daniel Bereza (personal communications). The Mexican fauna is provided based upon concepts by Daniel Bereza (personal communications). A second list contains names of other hosts for North American mite species. Snail names follow concepts of Burch (1989). Sponge names follow concepts of Michael Poirrier and Ronnie Bouchon (personal communications, 1980).

The taxonomic treatment contains various kinds of information on each of the genera, subgenera, and species of mites. Reference is made to available plates for each species in Vidrine (1996a). A brief synonymy is provided; detailed synonymies can be sought in K. H. Viets (1956) and K. O. Viets (1987). Museum type numbers and locations are provided where available. Type localities and hosts are also provided where available. An etymology is provided. Diagnoses and measurements of each species are provided. Figures of each species are provided. Distributions are provided, and maps are included in each species section. Notes (or discussions) regarding each taxon are provided. A list of known hosts from literature records and records of the author and colleagues is provided for each species, where available. Collectively, these treatments present essentially all that is known about each of the species. However, several species, *e. g.*, *U. formosa*, have had rather extensive research conducted upon them, and the authors and/or the papers are cited and/or mentioned.

The book closes with a brief summary and conclusions, which is followed by a working bibliography. Collectively, these serve to elaborate on the available information on these mites and their hosts.



## LIST OF MUSSELS OF NORTH AMERICA

*Actinonaias ligamentina* (Lamarck 1819)  
*Actinonaias pectorosa* (Conrad 1834)  
*Alasmidonta arcula* (Lea 1838)  
*Alasmidonta atropurpurea* (Rafinesque 1831)  
*Alasmidonta heterodon* (Lea 1829)  
*Alasmidonta marginata* Say 1818  
*Alasmidonta mccordi* Athearn 1964  
*Alasmidonta raveneliana* (Lea 1834)  
*Alasmidonta robusta* Clarke 1981  
*Alasmidonta undulata* (Say 1817)  
*Alasmidonta varicosa* (Lamarck 1819)  
*Alasmidonta viridis* (Rafinesque 1820)  
*Alasmidonta wrightiana* (Walker 1901)  
*Amblema neislerii* (Lea 1858)  
*Amblema plicata perplicata* (Conrad 1841)  
*Amblema plicata plicata* (Say 1817)  
*Anodonta beringiana* Middendorff 1851  
*Anodonta californiensis* Lea 1852  
*Anodonta couperiana* Lea 1840  
*Anodonta dejecta* Lea 1857  
*Anodonta implicata* Say 1829  
*Anodonta kennerlyi* Lea 1860  
*Anodonta nuttalliana* Lea 1838  
*Anodonta oregonensis* Lea 1838  
*Anodonta suborbiculata* Say 1831  
*Anodontoides ferussacianus* (Lea 1834)  
*Anodontoides radiatus* (Conrad 1834)  
*Arcidens confragosus* (Say 1829)  
*Arkansia wheeleri* Ortmann and Walker 1912  
*Cumberlandia monodonta* (Say 1829)  
*Cyclonaias tuberculata* (Rafinesque 1820)  
*Cyprogenia aberti* (Conrad 1850)  
*Cyprogenia stegaria* (Rafinesque 1820)  
*Cyrtonaias tampicoensis* (Lea 1838)  
*Disconaias salinasensis* (Simpson 1908)  
*Dromus dromas* (Lea 1834)  
*Ellipsaria lineolata* (Rafinesque 1820)  
*Elliptio ahenea* (Lea 1843)  
*Elliptio angustata* (Lea 1831)  
*Elliptio arca* (Conrad 1834)  
*Elliptio arctata* (Conrad 1834)  
*Elliptio buckleyi* (Lea 1843)  
*Elliptio chipolaensis* (Walker 1905)  
*Elliptio cistelliformis* (Lea 1863)  
*Elliptio complanata* (Lightfoot 1786)  
*Elliptio congaraea* (Lea 1831)  
*Elliptio crassidens* (Lamarck 1819)  
*Elliptio dariensis* (Lea 1842)  
*Elliptio dilatata* (Rafinesque 1820)

**LIST OF MUSSELS (Continued)**

*Elliptio downiei* (Lea 1858)  
*Elliptio fisheriana* (Lea 1838)  
*Elliptio folliculata* (Lea 1838)  
*Elliptio fraternum* (Lea 1858)  
*Elliptio hopetonensis* (Lea 1838)  
*Elliptio icterina* (Conrad 1834)  
*Elliptio jayensis* (Lea 1838)  
*Elliptio lanceolata* (Lea 1828)  
*Elliptio marsupiobesa* Fuller 1972  
*Elliptio mcMichaeli* Clench and Turner 1956  
*Elliptio nigella* (Lea 1852)  
*Elliptio producta* (Conrad 1836)  
*Elliptio raveneli* (Conrad 1834)  
*Elliptio roanokensis* (Lea 1836)  
*Elliptio shepardiana* (Lea 1834)  
*Elliptio spinosa* (Lea 1836)  
*Elliptio steinstansana* Johnson and Clarke 1983  
*Elliptio waccamawensis* (Lea 1863)  
*Elliptio waltoni* (Wright 1888)  
*Elliptioideus sloatianus* (Lea 1840)  
*Epioblasma arcaiformis* (Lea 1831)  
*Epioblasma biemarginata* (Lea 1857)  
*Epioblasma brevidens* (Lea 1831)  
*Epioblasma capsaeformis* (Lea 1831)  
*Epioblasma flexuosa* (Rafinesque 1820)  
*Epioblasma florentina curtisi* (Utterback 1916)  
*Epioblasma florentina florentina* (Lea 1857)  
*Epioblasma florentina walkeri* (Wilson and Clark 1914)  
*Epioblasma haysiana* (Lea 1834)  
*Epioblasma lenior* (Lea 1843)  
*Epioblasma lewisii* (Walker 1910)  
*Epioblasma metastrata* (Conrad 1840)  
*Epioblasma obliquata obliquata* (Rafinesque 1820)  
*Epioblasma obliquata perobliqua* (Conrad 1836)  
*Epioblasma othcaloogensis* (Lea 1857)  
*Epioblasma penita* (Conrad 1834)  
*Epioblasma personata* (Say 1829)  
*Epioblasma propinqua* (Lea 1857)  
*Epioblasma sampsonii* (Lea 1861)  
*Epioblasma stewardsoni* (Lea 1852)  
*Epioblasma torulosa gubernaculum* (Reeve 1865)  
*Epioblasma torulosa rangiana* (Lea 1839)  
*Epioblasma torulosa torulosa* (Rafinesque 1820)  
*Epioblasma triquetra* (Rafinesque 1820)  
*Epioblasma turgidula* (Lea 1858)  
*Fusconaia askewi* (Marsh 1896)  
*Fusconaia barnesiana* (Lea 1838)  
*Fusconaia cerina* (Conrad 1838)  
*Fusconaia cor* (Conrad 1834)

**LIST OF MUSSELS (Continued)**

*Fusconaia cuneolus* (Lea 1840)  
*Fusconaia ebena* (Lea 1831)  
*Fusconaia escambia* Clench and Turner 1956  
*Fusconaia flava* (Rafinesque 1820)  
*Fusconaia lananensis* (Frierson 1900)  
*Fusconaia masoni* (Conrad 1834)  
*Fusconaia ozarkensis* (Call 1887)  
*Fusconaia subrotunda* (Lea 1831)  
*Fusconaia succissa* (Lea 1852)  
*Glebula rotundata* (Lamarck 1819)  
*Gonidea angulata* (Lea 1838)  
*Hemistena lata* (Rafinesque 1820)  
*Lampsilis abrupta* (Say 1831)  
*Lampsilis altilis* (Conrad 1834)  
*Lampsilis australis* Simpson 1900  
*Lampsilis binominata* Simpson 1900  
*Lampsilis bracteata* (Gould 1855)  
*Lampsilis cardium* Rafinesque 1820  
*Lampsilis cariosa* (Say 1817)  
*Lampsilis dolabraeformis* (Lea 1838)  
*Lampsilis fasciola* Rafinesque 1820  
*Lampsilis fullerkeri* Johnson 1984  
*Lampsilis haddletoni* Athearn 1964  
*Lampsilis higginsii* (Lea 1857)  
*Lampsilis hydiana* (Lea 1838)  
*Lampsilis ornata* (Conrad 1835)  
*Lampsilis ovata* (Say 1817)  
*Lampsilis perovalis* (Conrad 1834)  
*Lampsilis powellii* (Lea 1852)  
*Lampsilis radiata conspicua* (Lea 1872)  
*Lampsilis radiata radiata* (Gmelin 1791)  
*Lampsilis rafinesqueana* Frierson 1927  
*Lampsilis reeviana brevicula* (Call 1887)  
*Lampsilis reeviana brittsi* Simpson 1900  
*Lampsilis reeviana reeviana* (Lea 1852)  
*Lampsilis satur* (Lea 1852)  
*Lampsilis siliquoidea* (Barnes 1823)  
*Lampsilis splendida* (Lea 1838)  
*Lampsilis straminea claibornensis* (Lea 1838)  
*Lampsilis straminea straminea* (Conrad 1834)  
*Lampsilis streckeri* Frierson 1927  
*Lampsilis subangulata* (Lea 1840)  
*Lampsilis teres* (Rafinesque 1820)  
*Lampsilis virescens* (Lea 1858)  
*Lasmigona complanata alabamensis* Clarke 1985  
*Lasmigona complanata complanata* (Barnes 1823)  
*Lasmigona compressa* (Lea 1829)  
*Lasmigona costata* (Rafinesque 1820)  
*Lasmigona decorata* (Lea 1852)

**LIST OF MUSSELS (Continued)**

*Lasmigona holstonia* (Lea 1838)  
*Lasmigona subviridis* (Conrad 1835)  
*Lemiox rimosus* (Rafinesque 1820)  
*Leptodea fragilis* (Rafinesque 1820)  
*Leptodea leptodon* (Rafinesque 1820)  
*Leptodea ochracea* (Say 1817)  
*Lexingtonia dolabelloides* (Lea 1840)  
*Lexingtonia subplana* (Conrad 1837)  
*Ligumia nasuta* (Say 1817)  
*Ligumia recta* (Lamarck 1819)  
*Ligumia subrostrata* (Say 1831)  
*Margaritifera falcata* (Gould 1850)  
*Margaritifera hembeli* (Conrad 1838)  
*Margaritifera margaritifera* (Linnaeus 1758)  
*Margaritifera marrianae* Johnson 1983  
*Medionidus acutissimus* (Lea 1831)  
*Medionidus conradicus* (Lea 1834)  
*Medionidus mcglameriae* van der Schalie 1939  
*Medionidus parvulus* (Lea 18660)  
*Medionidus penicillatus* (Lea 1857)  
*Medionidus simpsonianus* Walker 1905  
*Medionidus walkeri* (Wright 1897)  
*Megalonaias boykiniana* (Lea 1840)  
*Megalonaias nervosa* (Rafinesque 1820)  
*Obliquaria reflexa* Rafinesque 1820  
*Obovaria jacksoniana* (Frierson 1912)  
*Obovaria olivaria* (Rafinesque 1820)  
*Obovaria retusa* (Lamarck 1819)  
*Obovaria rotulata* (Wright 1899)  
*Obovaria subrotunda* (Rafinesque 1820)  
*Obovaria unicolor* (Lea 1845)  
*Pegias fabula* (Lea 1838)  
*Plectomerus dombeyanus* (Valenciennes 1827)  
*Plethobasus cicatricosus* (Say 1829)  
*Plethobasus cooperianus* (Lea 1834)  
*Plethobasus cyphus* (Rafinesque 1820)  
*Pleurobema altum* (Conrad 1854)  
*Pleurobema avellanum* Simpson 1900  
*Pleurobema beadleianum* (Lea 1861)  
*Pleurobema bournianum* (Lea 1840)  
*Pleurobema chattanoogaense* (Lea 1858)  
*Pleurobema clava* (Lamarck 1819)  
*Pleurobema collina* (Conrad 1837)  
*Pleurobema cordatum* (Rafinesque 1820)  
*Pleurobema curtum* (Lea 1859)  
*Pleurobema decisum* (Lea 1831)  
*Pleurobema flavidulum* (Lea 1831)  
*Pleurobema furvum* (Conrad 1834)  
*Pleurobema georgianum* (Lea 1841)

**LIST OF MUSSELS (Continued)**

*Pleurobema gibberum* (Lea 1838)  
*Pleurobema hanleyanum* (Lea 1852)  
*Pleurobema johannis* (Lea 1859)  
*Pleurobema marshalli* Frierson 1927  
*Pleurobema murrayense* (Lea 1868)  
*Pleurobema nucleopsis* (Conrad 1849)  
*Pleurobema oviforme* (Conrad 1834)  
*Pleurobema perovatium* (Conrad 1834)  
*Pleurobema plenum* (Lea 1840)  
*Pleurobema pyriforme* (Lea 1857)  
*Pleurobema riddelli* (Lea 1861)  
*Pleurobema rubellum* (Conrad 1834)  
*Pleurobema rubrum* (Rafinesque 1820)  
*Pleurobema sintoxia* (Rafinesque 1820)  
*Pleurobema strodeanum* (Wright 1898)  
*Pleurobema taitianum* (Lea 1834)  
*Pleurobema troschelianum* (Lea 1852)  
*Pleurobema verum* (Lea 1860)  
*Popenaias popei* (Lea 1857)  
*Potamilus alatus* (Say 1817)  
*Potamilus amphichaenus* (Frierson 1898)  
*Potamilus capax* (Green 1832)  
*Potamilus inflatus* (Lea 1831)  
*Potamilus ohioensis* (Rafinesque 1820)  
*Potamilus purpuratus* (Lamarck 1819)  
*Ptychobranchus fasciolaris* (Rafinesque 1820)  
*Ptychobranchus greenii* (Conrad 1834)  
*Ptychobranchus jonesi* (van der Schalie 1934)  
*Ptychobranchus occidentalis* (Conrad 1836)  
*Ptychobranchus subtentum* (Say 1825)  
*Pyganodon cataracta* (Say 1817)  
*Pyganodon fragilis* (Lamarck 1819)  
*Pyganodon gibbosa* (Say 1824)  
*Pyganodon grandis* (Say 1829)  
*Pyganodon lacustris* (Lea 1852)  
*Quadrula apiculata* (Say 1829)  
*Quadrula asperata* (Lea 1861)  
*Quadrula aurea* (Lea 1859)  
*Quadrula couchiana* (Lea 1860)  
*Quadrula cylindrica cylindrica* (Say 1817)  
*Quadrula cylindrica stigillata* (Wright 1898)  
*Quadrula fragosa* (Conrad 1835)  
*Quadrula houstonensis* (Lea 1859)  
*Quadrula intermedia* (Conrad 1836)  
*Quadrula metanevra* (Rafinesque 1820)  
*Quadrula nodulata* (Rafinesque 1820)  
*Quadrula petrina* (Gould 1855)  
*Quadrula pustulosa mortoni* (Conrad 1835)  
*Quadrula pustulosa pustulosa* (Lea 1831)



**LIST OF MUSSELS (Continued)**

*Quadrula quadrula* (Rafinesque 1820)  
*Quadrula refulgens* (Lea 1868)  
*Quadrula rumphiana* (Lea 1852)  
*Quadrula sparsa* (Lea 1841)  
*Quadrula stapes* (Lea 1831)  
*Quadrula tuberosa* (Lea 1840)  
*Quincuncina burkei* Walker 1922  
*Quincuncina infucata* (Conrad 1834)  
*Quincuncina mitchelli* (Simpson 1896)  
*Simpsonaias ambigua* (Say 1825)  
*Strophitus connasaugaensis* (Lea 1857)  
*Strophitus subvexus* (Conrad 1834)  
*Strophitus undulatus* (Say 1817)  
*Toxolasma corvunculus* (Lea 1868)  
*Toxolasma cylindrellus* (Lea 1868)  
*Toxolasma lividus* (Rafinesque 1831)  
*Toxolasma mearnsi* (Simpson 1900)  
*Toxolasma parvus* (Barnes 1823)  
*Toxolasma paulus* (Lea 1840)  
*Toxolasma pullus* (Conrad 1838)  
*Toxolasma texasensis* (Lea 1857)  
*Tritogonia verrucosa* (Rafinesque 1820)  
*Truncilla cognata* (Lea 1860)  
*Truncilla donaciformis* (Lea 1828)  
*Truncilla macrodon* (Lea 1859)  
*Truncilla truncata* Rafinesque 1820  
*Uniomerus caroliniana* (Bosc 1801)  
*Uniomerus declivis* (Say 1831)  
*Uniomerus excultus* (Conrad 1838)  
*Uniomerus obesus* (Lea 1831)  
*Uniomerus tetralasmus* (Say 1831)  
*Utterbackia imbecillis* (Say 1829)  
*Utterbackia peggyae* (Johnson 1965)  
*Venustaconcha ellipsiformis* (Conrad 1836)  
*Venustaconcha pleasi* (Marsh 1891)  
*Villosa amygdala* (Lea 1843)  
*Villosa arkansasensis* (Lea 1862)  
*Villosa choctawensis* Athearn 1964  
*Villosa constricta* (Conrad 1838)  
*Villosa delumbis* (Conrad 1834)  
*Villosa fabalis* (Lea 1831)  
*Villosa iris* (Lea 1829)  
*Villosa lienosa* (Conrad 1834)  
*Villosa nebulosa* (Conrad 1834)  
*Villosa ortmanni* (Walker 1925)  
*Villosa perpurpurea* (Lea 1861)  
*Villosa taeniata* (Conrad 1834)  
*Villosa trabalis* (Conrad 1834)  
*Villosa vanuxemensis umbrans* (Lea 1857)

**LIST OF MUSSELS (Continued)**

*Villosa vanuxemensis vanuxemensis* (Lea 1838)  
*Villosa vaughaniana* (Lea 1838)  
*Villosa vibex* (Conrad 1834)  
*Villosa villosa* (Wright 1898)

Mexican mussels (concepts of Dan Bereza):

*Megaloniaias nickliniana* (Lea 1834)  
*Elliptio liebmanni* (Philippi 1847)  
*Elliptio plexus* (Conrad 1838)  
*Barynaia opacata* (Crosse and Fischer 1893)  
*Anodonta* sp. (two species known from this area)  
    *Anodonta dejecta* Lewis 1875 (known from northwestern Mexico)  
    *Anodonta impura* Say 1829 (known from Mexican Basin)  
*Frierersonia iridella* (Pilsbry and Frierson 1907)  
*Frierersonia semirasa* (Pilsbry 1909)  
*Frierersonia moctezumensis* (Pilsbry 1909)  
*Nephronaia coyensis* (Pilsbry 1909)  
*Nephronaia signata* (Pilsbry 1909)  
*Disconaias discus* (Lea 1838)  
*Disconaias purpuratus* (Say 1831)  
*Disconaias fimbriata* (Frierson 1907)  
*Disconaias undivaga* (Pilsbry 1907)  
*Disconaias signata coyensis undivaga* (see *Nephronaia signata*)  
*Disconaias coyensis* (see *Nephronaia signata*)  
*Popenaia metallica* (Say 1831)  
*Popenaia metallica ganina* (Pilsbry 1909)  
*Lampsilis rovirosai* (Pilsbry 1900)  
*Actinonaias sapatolensis* (Lea 1841)  
*Anodontites trapesialis glaucus* (Valenciennes 1833)

## LIST OF OTHER HOSTS

Mollusca: Bivalvia

*Corbicula fluminea* (Muller)

*Rangia cuneata* (Gray)

*Sphaerium simile* Say

Mollusca: Gastropoda: Viviparidae

*Campeloma decisum* (Say 1816)

*Campeloma geniculum* (Conrad 1834)

*Tulatoma magnifica* (Conrad 1834)

*Viviparus intertextus* (Say 1829)

*Viviparus subpurpureus* (Say 1829)

Mollusca: Gastropoda: Pilidae

*Pomacea paludosa* (Say 1824)

*Pomacea* spp.

Porifera: Spongillidae

*Dosilia radiospiculata* (Mills 1888)

*Ephydatia fluviatilis* (Linnaeus 1758)

*Spongilla lacustris* (Linnaeus 1758)

*Trochospongilla horrida* Weltner 1893

*Trochospongilla leidy* (Bowerbank 1863)

*Trochospongilla pennsylvanica* (Potts 1882)

## TAXONOMIC TREATMENT OF THE GENERA, SUBGENERA, AND SPECIES

All measurements are in micrometers (microns)  
unless otherwise stated

All bar-scales on figures equal 100 micrometers (0.1 mm)  
unless otherwise stated

Genus *Najadicola* Piersig 1897

Synonymy--

*Atax* Fabricius 1805 (in part) Wolcott 1899

*Najadicola* Piersig 1897

Etymology-- The term *Najades* (*Naiades*) historically referred to "freshwater mussels," and *icola* means "to dwell within," thus *Najadicola* means "to dwell within freshwater mussels."

Diagnosis-- Body weakly sclerotized with white vermiculate lines visible through the integument; no obvious dorsal plates--dorsum apparently soft; coxae in four groups; suture between third and fourth coxae incomplete; posterior apodemes of first coxa short; posterior apodemes of fourth coxa not apparent; genital acetabula numerous, usually 90-120 per plate; genital plates triangular and winglike in shape in both sexes; genital plates nearly twice as wide as long and rather closely appressed to the fourth coxae; a pair of larger acetabula occur on each plate about two-thirds of the distance from the median line and approximately in same relative position on the body as the nymphal pair of acetabula; no heavy setae associated with the genital plates in either sex; chelicera separated medially; capitulum with distinct anchoral process; pedipalp with reduced chaetotaxy and no spines or tubercles ventrally on the pedipalp Ti, but a single peg-like seta is present distally and laterally on the Ti; legs with no swimming hairs; legs comparatively short and stocky with peg-like setae, sometimes serrated at their tips; larvae with reddish tinge possessing a wider than long anal plate (typical of the Pionidae and different from the Unionicolidae); claws thick and simple.

Distribution-- North America and southeast Asia (Vidrine and Lieux 1980b).

Notes-- This is the only genus (monobasic) in the subfamily Najadicolinae in the family Pionidae (Simmons and Smith 1984). A single species is currently recognized in this genus; however, a thorough study of this mite species from varied hosts from two continents would probably reveal several species, *e. g.*, the specimens from southeast Asia (Thailand) appear to be a different species. The paucity of searching of mussels for mites in Asia is unfortunate; and the pollution of streams throughout Asia is quickly reducing the opportunity for the discovery of these mites. Simmons and Smith (1984) reported the larvae as parasites on chironomids.

*Najadicola ingens* (Koenike 1895)  
Plates 1-3 in Vidrine (1996a)

Synonymy--

*Atax ingens* Koenike 1895

*Atax (Najadicola) ingens* Koenike 1895 in Piersig (1897), Wolcott (1899), and Utterback (1916)  
*Najadicola ingens* (Koenike 1895), Simmons and Smith 1984, Vidrine 1980a, Piersig (1901), Viets (1936), Wolcott (1905), Humes and Jamnback (1950), Humes and Russell (1951), Humes and Harris (1952), Viets and Plate (1954), Viets (1956), Mitchell (1954, 1955, and 1965), Crowell (1961), Habeeb (1967), Cook (1974), Vidrine (1974a, 1974b, and 1977a), Vidrine *et al.* (1976), Vidrine and Bereza (1980), Vidrine and Lieux (1980b), Baker (1982), and Smith and Cook (1991).

Museum type number(s) and location-- Koenike's collection.

Type locality and host-- Meach Lake, Gatineau Park, Quebec, Canada

Etymology-- The term *ingens* means "large and remarkable." The name *Najadicola ingens* means "large and remarkable mite dwelling within mussels." The species is appropriately named.

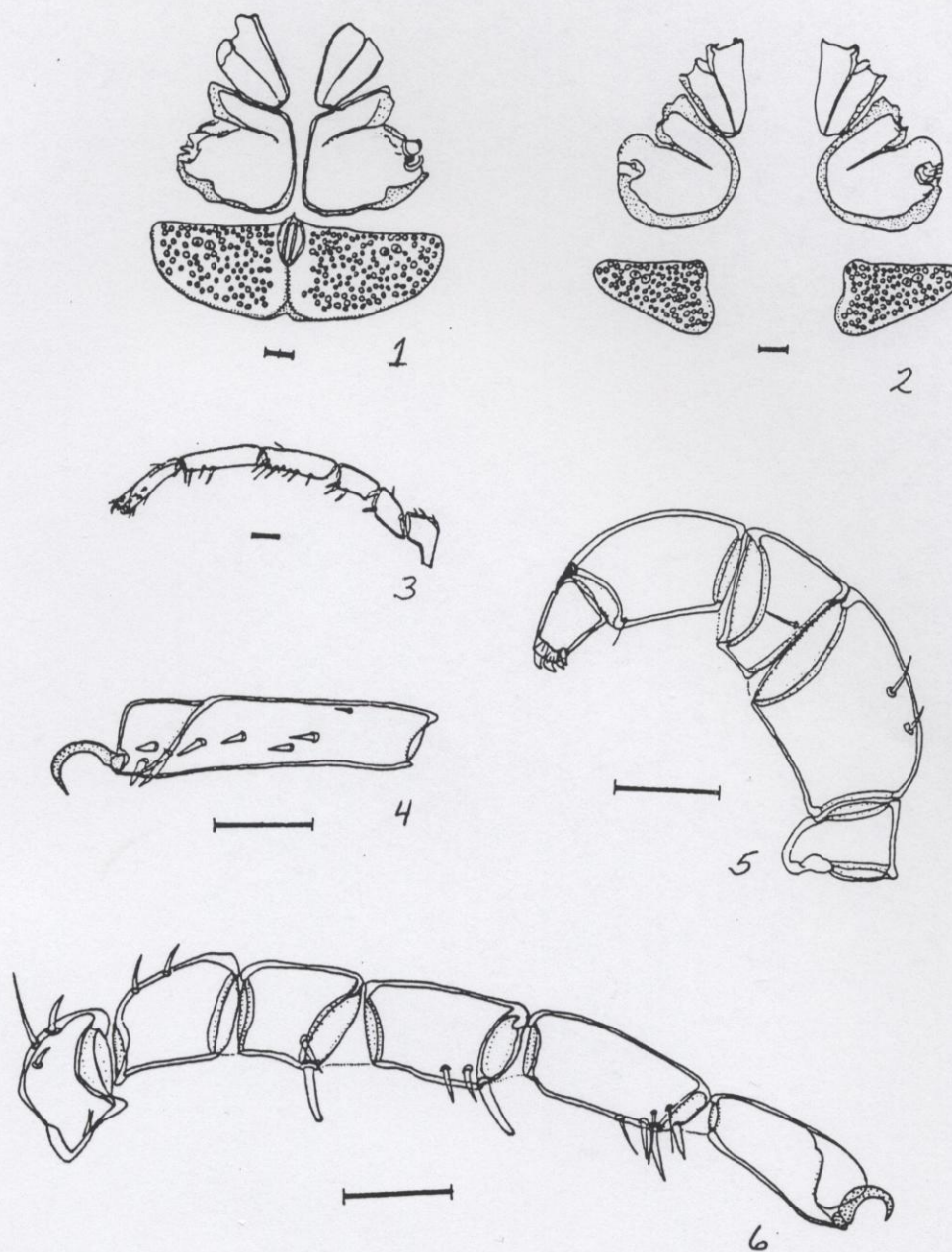
Diagnosis-- Character states of the genus.

Male (5 specimens)-- Dorsal lengths of pedipalp segments: Ge 140 (110-160); Ti 209 (175-240); Ta 78 (65-90); length of posterior coxal group 414 (290-500); dorsal lengths of segments of walking legs: leg I: TFe 158 (130-180); Ge 208 (180-220); Ti 230 (200-250); Ta 205 (190-215); leg IV: TFe 212 (190-240); Ge 346 (320-370); Ti 378 (360-400); Ta 302 (280-320).

Female (3 specimens)-- Dorsal lengths of pedipalp segments: Ge 163 (140-170); Ti 247 (200-280); Ta 97 (80-110); length of posterior coxal group 417 (370-480); dorsal lengths of segments of walking legs: leg I: TFe 197 (180-220); Ge 247 (240-260); Ti 267 (250-290); Ta 230 (220-240); leg IV: TFe 273 (270-280); Ge 423 (420-430); Ti 457 (440-480); Ta 347 (330-360).

Notes-- This species is also known from the Mekong River in Thailand (Vidrine and Lieux 1980b). Females in North American mussels reach sizes to 6.0 mm in length, while females from Asia reach sizes to 7.5 mm in length. These huge mites are found inside the gills of their hosts where they have been reported to physically tear the support structures of the gills and hamper the use of the mussel gill as brood chamber (marsupium). Baker (1982) reported these mites within the pericardial sac of mussel hosts. *Najadicola ingens* has such a wide host range and extensive distribution that it is very possible that several sibling species (an *Artenkreis*), which are currently unrecognized, exist.





Figures 1-6. *Najadicola ingens* (Koenike 1895). 1. Male venter. 2. Female venter. 3. Fourth walking leg. 4. Tarsus of fourth walking leg. 5. Pedipalp. 6. First walking leg. Scale equals 100 micrometers.



Map 1. Known distribution of *Najadicola ingens* (Koenike 1895) in North America.

*Najadicola* occurs in large number of species of mussels within several divergent groups. It appears to lack host specificity among these hosts; however, it can become locally abundant in one or two host species within a single locality. This behavior is currently unexplained. While *N. ingens* and *Unionicola* spp. commonly occupy the same hosts, no apparent competition between these mites was observed. Apparently each species is limited to a specific habitat within their mussel hosts.

#### Hosts:

*Alasmidonta heterodon* (Lea 1829): Massachusetts.

*Alasmidonta undulata* (Say): New York (Baker 1982).

*Amblema plicata plicata* Say: *Amblema perplicata* (Conrad), Louisiana (Vidrine *et al.* 1976 and Vidrine 1980a) (included *Amblema plicata perplicata* (Conrad)).

*Anodonta* sp.: Ontario, Canada (Marshall 1929).

*Elliptio complanata* (Lightfoot): *Unio complanatus* Lightfoot, Ottawa, Canada (Koenike, 1895, original description); *Unio complanatus* Solander, Michigan (Wolcott 1899) and *Elliptio violaceus* Spengler in Viets and Plate 1954; *Elliptio complanata* Solander, Quebec and New Brunswick, Canada, and Maine, Vermont, New Hampshire, Massachusetts, and Rhode Island (Humes and Jamnback (1950), Humes and Russell (1951), Humes and Harris (1952)); South Carolina and Rhode Island (Vidrine 1980a).

*Elliptio dilatata* Rafinesque: *Unio gibbosus* Barnes, Michigan (Wolcott 1899 and in Viets and Plate 1954).

*Fusconaia askewi* (Marsh): *Fusconaia lananensis* (Frierson), Texas (Vidrine 1980a) and Louisiana.

*Fusconaia cerina* (Conrad): *Fusconaia* sp., Mississippi (Vidrine 1980a).

*Fusconaia flava* (Rafinesque): *Fusconaia* sp., Louisiana and Ohio (Vidrine 1974a, Vidrine 1977a, Vidrine *et al.* 1976 and Vidrine 1980a).

*Lampsilis cardium* Rafinesque: *Lampsilis ovata* (Say), Arkansas (Vidrine 1977a and 1980a).

*Lampsilis hydiana* (Lea): *Lampsilis radiata* complex, Louisiana and Texas (Vidrine *et al.* 1976 and Vidrine 1980a).

*Lampsilis radiata radiata* (Gmelin): *Unio luteolus* Lamarck (some of these specimens may have been confused with *Lampsilis siliquoidea*), Michigan (Wolcott 1899) and *Ligumia fasciata* Rafinesque in Viets and Plate 1954; Quebec and New Brunswick, Canada, and Maine, Vermont, New Hampshire, Massachusetts, and Rhode Island (Humes and Jamnback (1950), Humes and Russell (1951), Humes and Harris (1952)); New York (Simmons and Smith 1984), and Massachusetts.

*Lampsilis siliquoidea* (Barnes): *Lampsilis radiata siliquoidea* (Barnes) (Vidrine 1980); Michigan (Mitchell 1955).

*Lampsilis straminea claibornensis* (Lea): *Lampsilis claibornensis* (Lea), Mississippi and Louisiana (Vidrine 1980a).

*Nephronaias coyensis* (Pilsbry): Mexico.

*Pleurobema beadleanum* (Lea): *Elliptio beadliana* (Lea), Louisiana (Vidrine 1980a).

*Pleurobema riddelli* (Lea): Louisiana.

*Popenaias* sp.: Mexico.

*Popenaias* sp.: *Popenaias* ?sp. nov., Panuco River system, Mexico (Vidrine 1980a).

*Popenaias popei* (Lea): Rio Grande, Mexico (Vidrine 1980a).

*Pyganodon cataracta* (Say): Quebec and New Brunswick, Canada, and Maine, Vermont, New Hampshire, and Massachusetts (Humes and Jamnback (1950), Humes and Russell (1951), Humes and Harris (1952)); *Anodonta marginata* Say (Viets and Plate 1954).

*Pyganodon fragilis* (Lamarck): *Anodonta fragilis*, Ottawa, Canada (Koenike 1895, original description); Michigan (Wolcott 1899); *Anodonta marginata* Say (Viets and Plate 1954).

*Pyganodon grandis* (Say): *Anodonta footiana* Lea, Michigan (Wolcott 1899); *Pyganodon grandis footiana* Lea in Viets and Plate 1954; and *Anodonta grandis* Say in Vidrine 1980a.

*Quadrula pustulosa mortoni* (Conrad): *Quadrula pustulosa* group variable, San Jacinto River, Texas, and Sabine River, Louisiana (Vidrine 1980a).

*Strophitus undulatus* (Say): *Strophitus edentulus*, Ohio (Kankakee River) (Wilson and Clark 1912).

*Toxolasma parvus* (Barnes): *Carunculina parva* (Barnes), Louisiana (Vidrine *et al.* 1976 and Vidrine 1980a).

*Tritogonia verrucosa* (Rafinesque): Louisiana and Mississippi (Vidrine 1980a).

*Uniomerus declivus* (Say): *Uniomerus tetralasmus* (Say) (in part), Louisiana (Vidrine 1977a), Texas and Louisiana (Vidrine 1980a).

*Uniomerus tetralasmus* (Say): Louisiana (Vidrine 1977a), Texas and Louisiana (Vidrine 1980a).

*Villosa amygdala* (Lea): Kissimmee River, Florida (Vidrine 1980a).

*Villosa villosa* (Wright): Florida (Vidrine 1980a).

Genus *Unionicola* Haldeman 1842

Synonymy--

*Atax* Fabricus 1805 (non *Atax* Duges 1834) (in part) Wolcott 1898 and 1899

*Hydrachna* Mueller 1776 (in part)

*Hexatax* Thor 1926

*Pentatax* Lundblad 1935

*Atacella* Lundblad 1937

*Heteratax* Lundblad 1941

*Vietsatax* Uchida and Imamura 1938

*Polyatacides* Lundblad 1941

*Unionicolopsis* Viets 1980

*Unionicola* Haldeman 1842

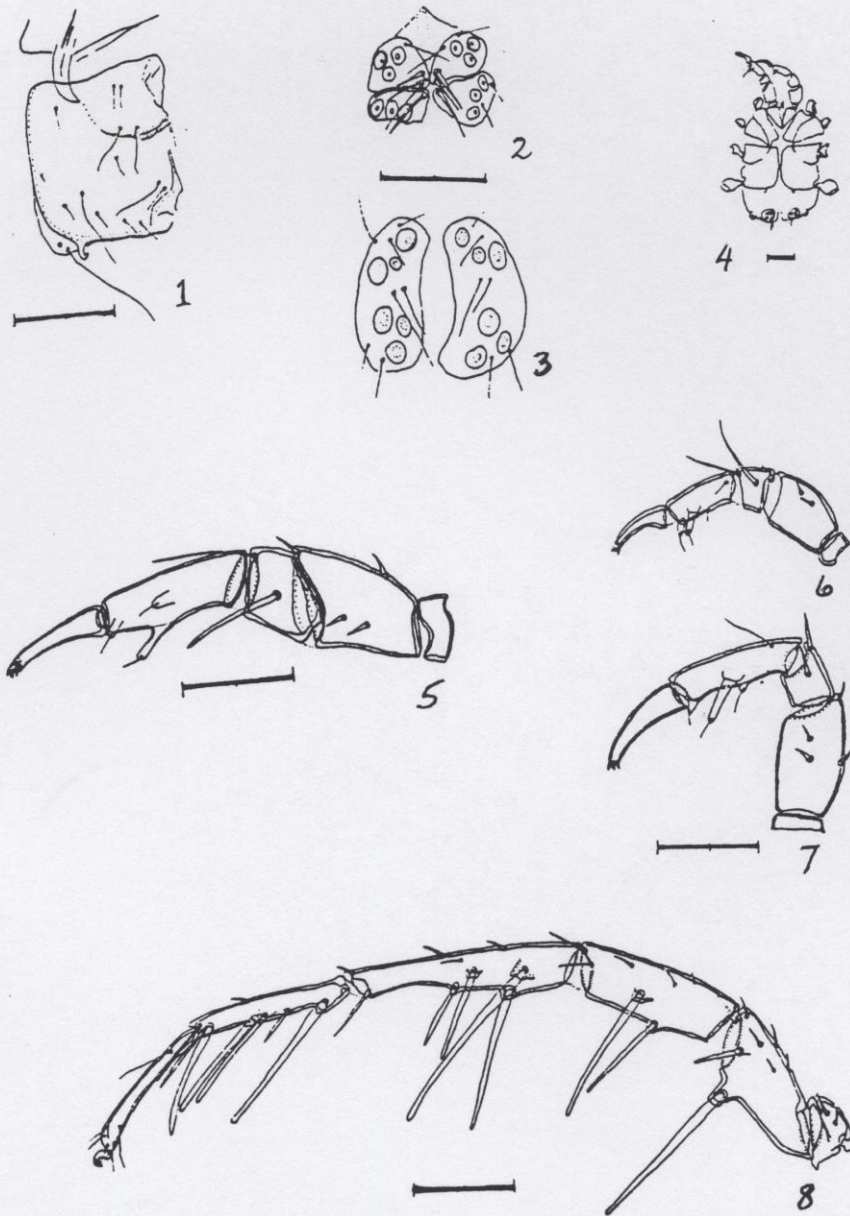
Etymology-- The term *Unio* (a European genus) refers to "freshwater mussels" and *icola* means "to dwell within," thus *Unionicola* means "to dwell within freshwater mussels." *Unio* is also the root word for the higher taxa of freshwater mussels worldwide including Unionoidea, Unionoidea, and Unionidae, thus *Unionicola* could be interpreted to mean "mites dwelling within worldwide freshwater mussels."

Diagnosis-- Body usually weakly sclerotized but occasionally with rather extensive secondary sclerotization; coxae typically in four groups, but occasionally fused by secondary sclerotization into a single group; suture lines between third and fourth coxae usually incomplete, but some molluscan parasites do have a complete suture; posterior apodemes (projections) of the first coxal group (epimera) relatively short; obvious setae usually along midline in female genital field, except in a divergent pair of subgenera (*Unionicolopsis* and *Bassatax*); male without obvious setae in genital field, except one subgenus (*Crowellatax*); males and females with one or two pairs of genital (acetabular) plates; legs variable, tending to be longer in free-swimming species and shorter in the molluscan parasites; legs with variable chaetotaxy, but usually with swimming hairs; tarsal claws present on all legs and extremely variable.

Distribution-- Reported from all continents except Antarctica.

Notes-- This is the only genus (monobasic) in the subfamily Unionicolinae in the family Unionicolidae. Two hundred and seven (207) species in fifty (50) subgenera are currently recognized and formally named. Any search of freshwater sponges, unionoid mussels, viviparid snails, and/or pilid snails may readily turn up new species. Sixty-nine species in 19 subgenera are known from North America.





Figures 1-8. *Unionicola laurentiana* Crowell and Davids 1979. 1. Posterior coxal plates. 2. Female genital field. 3. Male genital field. 4. Female venter. 5-7. Pedipalps. 8. First walking leg. Scale equals 100 micrometers.



## Subgenus *Unionicola* Haldeman 1842

TYPE SPECIES-- *U. crassipes* (Mueller 1776).

DIAGNOSIS-- Female genital field with 2 pairs of acetabular plates, and each plate similar in shape and apparently unmodified and bearing usually 2-3 acetabula; anterior female acetabular plates with 2, long, inner setae, posterior plates with a single, long, inner seta; all four female acetabular plates closely appressed to one another with setae forming a central mass; male genital field with a single pair of acetabular plates forming a nearly circular field that is on the venter or absolutely posterior by not extending up onto the dorsum and lacking thick setae or spines; pedipalps subcylindrical and well-sclerotized; male and female walking legs similar and lacking obvious sexual dimorphism; most species with large, moveable spines on tubercles.

HABITAT-- Most studied species are associated with Spongillidae and/or usually collected free-swimming. Occasionally transient specimens as well as encysted stages have been found in mollusks.

DISTRIBUTION-- Worldwide (freshwater habitats).

DISCUSSION-- There are 43 known species in this subgenus. This subgenus has species with relatively unmodified genital fields and legs. The lack of extensive modifications in body structures and great similarities between the type species and members of the Piontacininae indicate that this group is the least derived in the genus. All other subgenera are apparently derived from this body plan. *Unionicola nearctica* is here retained, as discussion continues concerning its validity (Conroy 1984, Crowell 1984, Proctor 1989, Vidrine 1987, Vidrine 1992a, and Davids *et al.* 1985). *Unionicola ovalis* Imamura 1954 is synonymized with *U. miyazakii* Imamura 1953b (Hevers 1984). *Unionicola unquiculata* Walter 1929a is a member of the subgenus *Heversatax* Vidrine 1988, and Lundblad (1969) suggested that *U. kantaka* Cook 1967 is a synonym. Smit's (1992a) new subgenus, *Australionicola* Smit, contains mites with unique pedipalp and tarsal claw structures. Its only known species is its type species, *Unionicola hammeni* Smit 1992. Smit (1992b) considers *Unionicola dresscheri sensu* Tuzovsky (1985) to be a new species, which is distinctive from *Unionicola crassipes dresscheri* Besseling in Europe. Many species are only known from their original descriptions. Many are apparently found with sponges. The diversity and scant knowledge of this worldwide group make this an excellent subgenus to study.

ADDITIONAL SPECIES INCLUDED--*Unionicola affinis* (Piersig 1906), *U. cyclophora* Viets 1913, *U. digitata* (Koenike 1898), *U. dresscheri* Besseling 1946, *U. figuralis* (Koch 1836), *U. fimbriata* Viets 1913, *U. finisbelli* Ramazzotti 1947, *U. gilani* Hevers 1984, *U. gracilipalpis* (Viets 1908), *U. graciliseta* (Viets 1935), *U. harpax* (Koenike 1898), *U. iheringi* (Koenike 1890), *U. inermis* Lundblad 1941, *U. laurentiana* Crowell and Davids 1979, *U. levipalpis* Besseling 1949, *U. lindrothi* Viets 1981, *U. longiseta* Walter 1915, *U. lyncea* (Koenike 1895), *U. megalopsis* Viets 1925, *U. mexicana* Cook 1980, *U. minor* (Soar 1900), *U. minuta* Viets 1916, *U. miyazakii* Imamura 1953, *U. motasi* Viets 1959, *U. nearctica* Crowell and Davids 1979, *U. necessaria* (Koenike 1906), *U. neoaffinis* Cook 1986, *U. niigata* Imamura 1954, *U. parvipora* (Lundblad 1920), *U. parvula* Lundblad 1954, *U. perpusilla* Viets 1954, *U. pollicigera* Viets 1921, *U. postmarginata* Viets 1925, *U. pugionipalpis* Viets 1954, *U. pusiligera* Viets 1954, *U. schmackeri* (Koenike 1895), *U. similis* (Viets 1935), *U. singalensis* (Daday 1898), *U. siolii* Viets 1954, *U. tenuis* (Lundblad 1935), *U. tridentifera* Viets 1921, and *U. uncata* Viets 1916.

*Unionicola (Unionicola) sp. near figuralis* (Koch 1836)  
*sensu* J. C. Conroy (personal communication 1994)  
Plate 4-5 in Vidrine (1996a)

Synonymy--

*Unionicola (Pentatax) figuralis* (Koch 1836), Habeeb 1967, Conroy (1974), Vidrine 1980a.  
*Unionicola (Unionicola) figuralis* (Koch 1836), Vidrine 1986e and 1992a (in part)

Museum type number(s) and location-- undescribed, J. C. Conroy's collection.

Type locality and host-- Canada.

Etymology-- From Latin, *figuralis* means "having form or figure."

Diagnosis-- Character states of the subgenus; usually 5 pairs of small acetabula on genital field; acetabula widely spread and smaller-sized in relation to the size of the genital field than in other species; setae in center of genital field rather stout; pedipalp Ta obviously longer than Ti.

Selected measurements from Conroy's specimens:

Female (2 specimens)-- Length of body 710 (700-720); length of posterior coxal group 240 (230-250); dorsal lengths of pedipalp segments: Ge 45 (40-50); Ti 95 (90-100); Ta 140; dorsal lengths of leg segments: leg I: TFe 340; Ge 500; Ti 490; Ta 370; leg IV: TFe 355 (340-370); Ge 470 (460-480); Ti 540; Ta 515 (500-530).

The Canadian mites were collected from:

1. Kinowa Lake, Prince Albert National Park, Saskatchewan. 30 August 1967.
2. Riding Mountain National Park, Manitoba. (Conroy 1974).

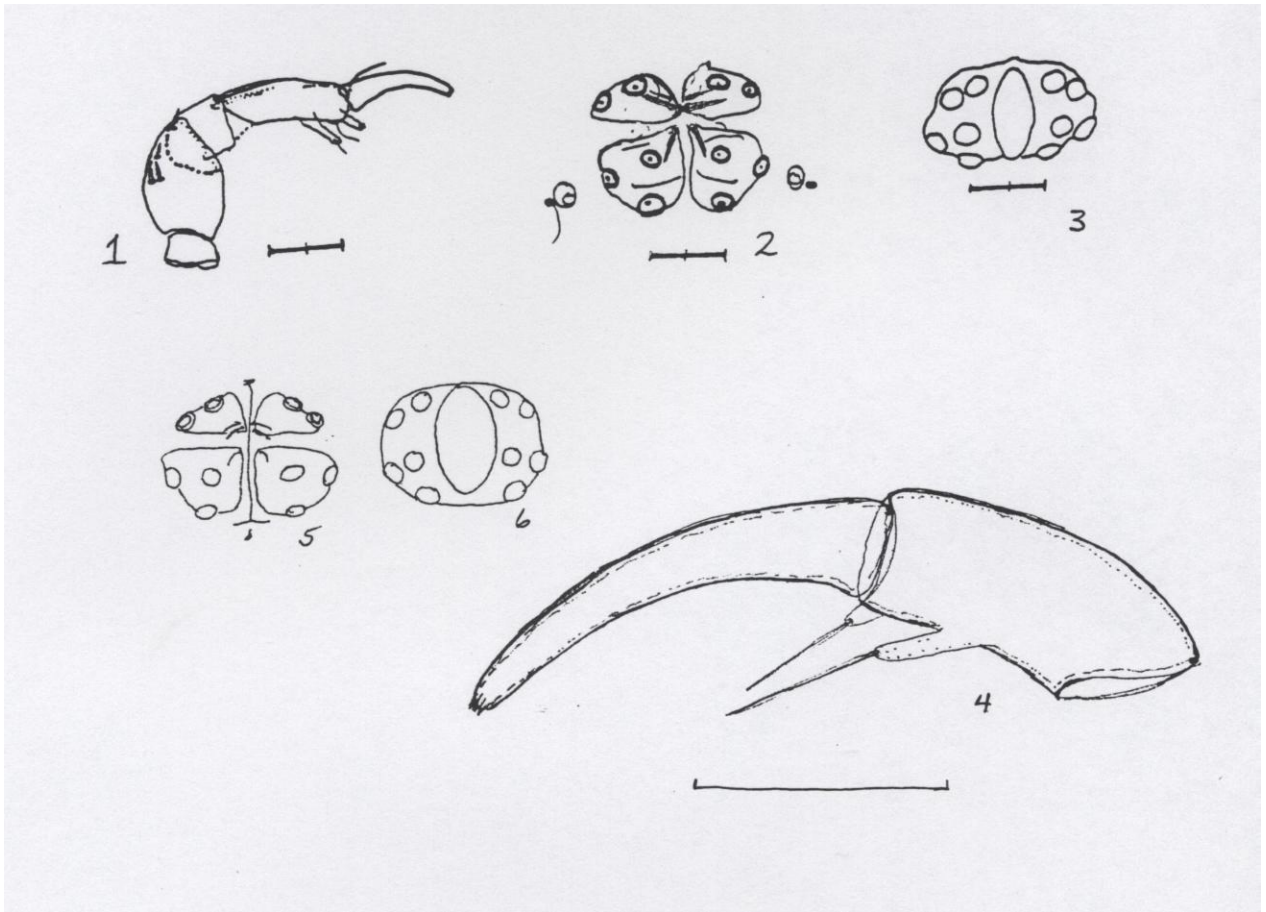
Selected measurements from Hevers (1978c) for German specimens of *Unionicola figuralis*:

Male (specimens)-- Length of posterior coxal group 331 (297-347); dorsal lengths of pedipalp segments: Ti 109 (105-111); Ta 108 (103-112); dorsal lengths of leg segments: leg I: TFe 296 (285-312); Ge 428 (395-448); Ti 341 (317-352); Ta 337 (315-347); leg IV: TFe 393 (374-413); Ge 505 (478-526); Ti 615 (581-641); Ta 543 (502-564).

Female (specimens)-- Length of posterior coxal group 417 (370-440); dorsal lengths of pedipalp segments: Ti 141 (132-158); Ta 130 (122-144); dorsal lengths of leg segments: leg I: TFe 355 (344-370); Ge 503 (480-532); Ti 380 (370-389); Ta 369 (346-389); leg IV: TFe 438 (426-456); Ge 574 (543-603); Ti 676 (637-699); Ta 630 (606-667).

Notes-- I have not viewed any *U. figuralis s. s.* from North America. Conroy (1974 (1975)) reported

this species from Canada, and he kindly lent the specimens to me for photographing. His specimens represent a species new to science, which is closely related to *U. figuralis*. Together with *U. cyclophora*, these three species represent a new subgenus, which is obviously divergent from the subgenus *Unionicola*. Marshall (1933b) reported *U. figuralis* from Wisconsin, but she illustrated a form of *U. aculeata*. Mitchell (1954) and Crowell (1961) both make reference to Marshall's record from North America. It should be obvious that no verified record of *U. figuralis* has yet surfaced for this continent, but this rather illusive species had also been reported from Europe, Africa, South America, and Asia (Viets and Plate 1954).



Figures 1-6. *Unionicola figuralis* (Koch 1836). 1. Pedipalp. 2. Female genital field. 3. Male genital field. (Figures 1-3 redrawn after Hevers (1978)). *Unionicola* sp. near *figuralis sensu* J. C. Conroy (personal communication, 1994). 4. Tibia and tarsus of pedipalp. *Unionicola figuralis* (Koch 1836). 5. Female genital field. 6. Male genital field. (Figures 5 and 6 redrawn after Sokolow (1931)). Scales equal 100 micrometers.



Map 2. Known distribution of *Unionicola* sp. near *figuralis* sensu J. C. Conroy (personal communication, 1994).

*Unionicola (Unionicola) gracilipalpis* (Viets 1908)  
Plates 6-8 in Vidrine (1996a)

Synonymy--

*Unionicola gracilipalpis gracilipalpis* (Viets 1908) in Hevers 1978, Conroy and Scudder 1975

*Unionicola (Unionicola) gracilipalpis* (Viets 1908), Vidrine 1987a, Vidrine 1992a

*Unionicola (Unionicola) gracilipalpis tenuis* (Lundblad 1935) in Vidrine *et al.* 1986.

Museum type number(s) and location-- Viets' Collection

Type locality and host-- Europe

Etymology-- From Latin, *gracil* refers to "slender," and *palpis* refers to the "pedipalps," thus *gracilipalpis* means "slender pedipalps." The pedipalps are indeed long and slender.

Diagnosis-- Character states of the subgenus; usually 6 pairs of acetabula on genital field; very similar to *U. crassipes* complex, but with extremely elongate legs and pedipalps. Tarsus of pedipalps exceeds 0.2 mm (200 micrometers) in dorsal length.

Selected measurements from J. C. Conroy's Canadian specimens:

Male (2 specimens)-- Length of body 875 (850-900); length of posterior coxal group 305 (300-310); dorsal lengths of pedipalp segments: Cx 30; Fe 230; Ge 120; Ti 300 (290-310); Ta 225 (220-230); dorsal lengths of leg segments: leg I: TFe 425 (420-430); Ge 575 (570-580); Ti 485 (480-490); Ta 355 (350-360); leg IV: TFe 400 (390-410); Ge 525 (520-530); Ti 625 (620-630); Ta 540 (520-560).

Female (2 specimens)-- Length of body 975 (900-1050); length of posterior coxal group 380 (370-390); dorsal lengths of pedipalp segments: Cx 40; Fe 230; Ge 155 (150-160); Ti 375 (360-390); Ta 285 (270-300); dorsal lengths of leg segments: leg I: TFe 515 (490-540); Ge 715 (710-720); Ti 595 (590-600); Ta 430 (420-440); leg IV: TFe 480; Ge 620; Ti 755 (750-760); Ta 625 (610-640).

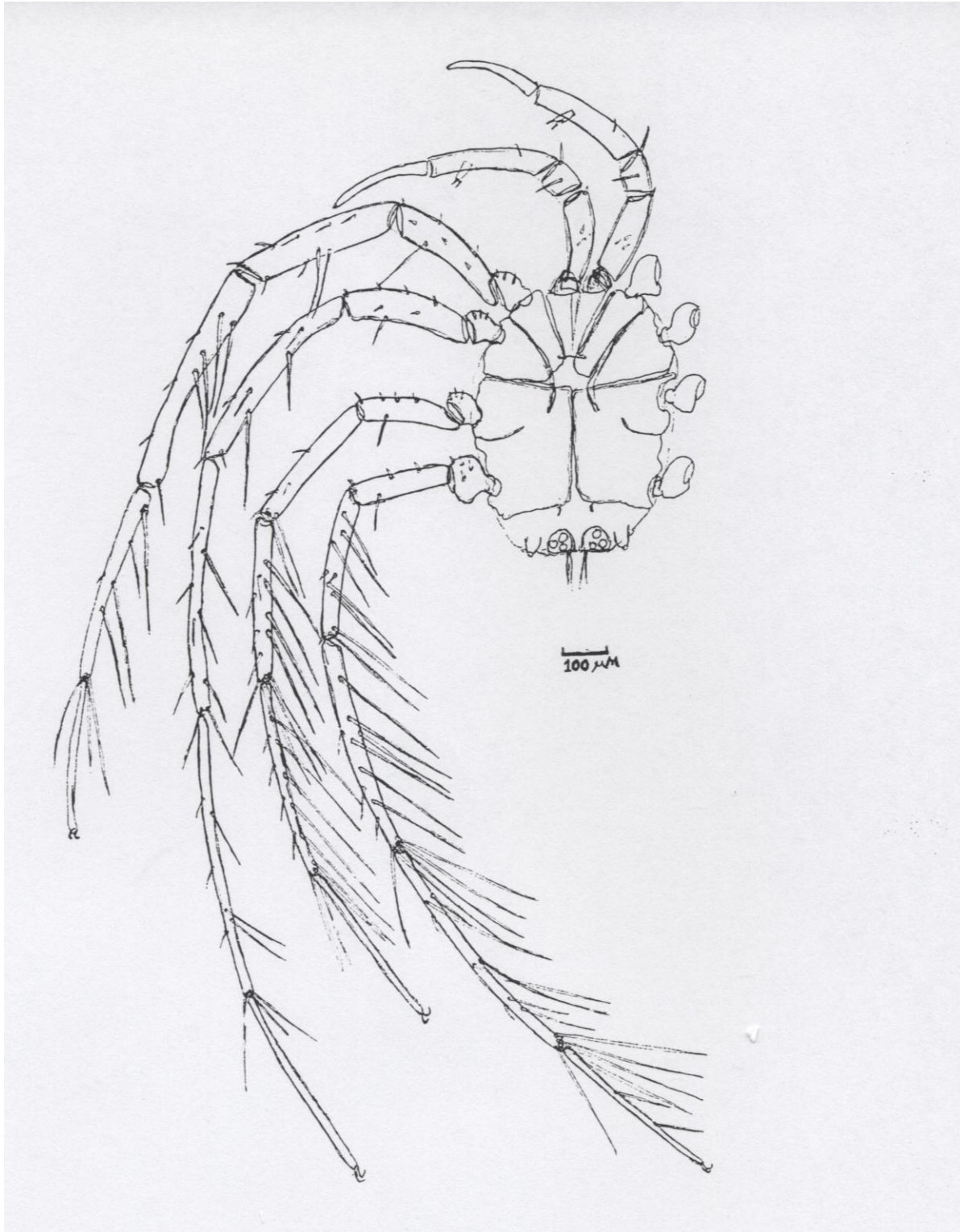
The Canadian mites were collected from:

1. Marion Lake, University of British Columbia Forest Reserve, British Columbia. 19 September 1966.
2. Hunt Lake, White Shell Provincial Park, Manitoba. 2 August 1973.

Selected measurements from Louisiana specimens (Vidrine *et al.* 1986):

Female (2 specimens from Louisiana)-- Length including capitulum 700; length of posterior coxal group 300; dorsal lengths of pedipalp segments: Ge 120 (110-130); Ti 325 (320-330); Ta 235 (230-240); dorsal lengths of leg segments: leg I: TFe 440 (430-450); Ge 590 (580-600); Ti 490 (480-500); Ta 370 (360-380); leg IV: TFe 420 (410-430); Ge 540 (530-550); Ti 690 (670-710); Ta 590 (570-610).





**Figure 1. *Unionicola gracilipalpis*, female. This specimen emerged from a sponge which was collected in the USL ponds, Lafayette, Louisiana.**





Map 3. Known distribution of *Unionicola gracilipalpis* (Viets 1908) in North America.

The two females that were measured were reared from encysted stages in the sponge, *D. radiospiculata*, from University of Southwestern Louisiana research ponds, Lafayette, Lafayette Parish, Louisiana, collected 21 September 1979.

Selected measurements from Hevers (1977c) for German specimens of *Unionicola gracilipalpis*:

Male (4 specimens)-- Length of posterior coxal group 345 (323-372); dorsal lengths of pedipalp segments: Ti 242 (221-259); Ta 196 (182-205); dorsal lengths of leg segments: leg I: TFe 410 (381-440); Ge 602 (566-640); Ti 495 (473-516); Ta 405 (390-431); leg IV: TFe 429 (405-463); Ge 581 (545-616); Ti 734 (679-772); Ta 595 (500-635).

Female (6 specimens)-- Length of posterior coxal group 398 (366-438); dorsal lengths of pedipalp segments: Ti 341 (317-377); Ta 261 (242-296); dorsal lengths of leg segments: leg I: TFe 552 (520-598); Ge 799 (761-856); Ti 609 (565-688); Ta 495 (460-535); leg IV: TFe 531 (491-584); Ge 700 (653-772); Ti 855 (798-958); Ta 747 (705-828).

Notes-- The Canadian and Louisiana specimens appear to be conspecific; however, they do not appear to match the description of Lundblad (1935) for Haitian specimens of *U. tenuis*, *i. e.* they are larger than specimens of *U. tenuis* from Haiti, from Mexico (Cook 1980), and from Guatemala (Viets 1975a). It is possible that a cline exists since a size gradient can be seen when comparing the Canadian, Louisiana, and Mexican specimens. However, the number of specimens is too small and is limited to too few localities through its North American range; thus, I continue to treat these specimens as two separate species.

*Unionicola gracilipalpis* has been reported from Michigan and western Canada (Cook 1980). Conroy and Scudder (1975) summarized reports of this mite from Lake Marion in Canada. J. C. Conroy kindly loaned the Canadian specimens to me for measuring and photographing.

Sponge hosts:

*Dosilia radiospiculata* (Mills): Louisiana (Vidrine *et al.* 1986).

*Spongilla lacustris* (Linnaeus): Canada (Conroy 1979).

*Unionicola (Unionicola) laurentiana*  
Crowell and Davids 1979  
Plates 9-14 in Vidrine (1996a)

Synonymy--

*Atax crassipes* (Mueller 1776) in Fabricius 1805, Bruzelius 1854, Wolcott 1899, and Kelly 1899  
*Unionicola crassipes* (Mueller 1776), Wolcott 1905, Marshall 1924, 1929, 1933a, 1933b, 1940, and 1943

*Unionicola (Unionicola) crassipes* (Mueller 1776) in Viets and Plate 1954, Mitchell 1954, Crowell 1961, Murray 1965, Habeeb 1967, Conroy 1968, Goldenstein and Boles 1970, Conroy and Scudder 1975, and Cook 1974

*Unionicola crassipes sensu* Proctor (1989) and Proctor and Pritchard (1990).

*Unionicola (Unionicola) laurentiana* Crowell and Davids 1979 in Vidrine 1987a

*Unionicola (Unionicola) crassipes laurentiana* Crowell and Davids 1979 in Vidrine, Bouchon and Poirrier 1986 and in Conroy 1984

*Unionicola (Unionicola) laurentiana* Crowell and Davids 1979 in Crowell 1984 and Vidrine 1987a, 1992a

*Unionicola (Unionicola) nearctica* Crowell and Davids 1979 in Crowell 1984 and Vidrine 1992a

*Unionicola crassipes sensu* Vidrine 1980a

*Unionicola minor sensu* Vidrine 1980a

*Unionicola* type P in Vidrine 1974a

*Unionicola* type M in Vidrine 1974a

General diagnosis-- Character states of the subgenus; genital fields with 6 pairs of genital acetabula; female genital field with 4 plates, the anterior two with 2 long, pointed setae and 3 acetabula each; male genital field with 2 lunate plates without obvious setae and 6 acetabula each; first walking legs with large, blunted, moveable setae inserted on tubercles; pedipalps elongate with Ta bearing small clawlets; pedipalp elongate and with tibia with enlarged distal tubercles with setae.

*Unionicola crassipes*: This Eurasian species has been studied in detail (Hevers 1977). Hevers (1975, 1977, 1978a, 1978b, 1978c, 1979, 1980a, 1980b, and 1984) described larvae, nymphs, adults, and mating behavior of this and related Eurasian mites. *Unionicola crassipes* is closely allied with another European entity, *U. minor* (Soar 1900), and thus selected measurements of both of these species follow.

Etymology-- "*Crass*" (Latin) refers to "thick," while "*minor*" (Latin) refers to "less or smaller." These names may refer to the relative sizes of the pedipalps or to the relative sizes of the bodies and legs.

Selected measurements from Hevers (1977) for German specimens of *Unionicola crassipes* (Mueller 1776):

Male (18 specimens)-- Length of posterior coxal group 386 (253-455); dorsal lengths of pedipalp segments: Ti 185 (139-217); Ta 157 (120-190); dorsal lengths of leg segments: leg I: TFe 367 (260-436); Ge 508 (370-606); Ti 392 (288-460); Ta 363 (276-430); leg IV: TFe 411 (294-499); Ge 548 (411-661); Ti 703 (519-860); Ta 620 (452-746).

Female (30 specimens)-- Length of posterior coxal group 445 (315-595); dorsal lengths of pedipalp segments: Ti 216 (159-305); Ta 181 (141-245); dorsal lengths of leg segments: leg I: TFe 425 (309-570); Ge 575 (440-780); Ti 422 (319-565); Ta 394 (291-533); leg IV: TFe 454 (330-599); Ge 596 (415-795); Ti 745 (545-980); Ta 665 (493-875).

Selected measurements from Hevers (1977) for German specimens of *Unionicola minor* (Soar 1900):

Male (18 specimens)-- Length of posterior coxal group 286 (223-330); dorsal lengths of pedipalp segments: Ti 114 (93-132); Ta 89 (77-103); dorsal lengths of leg segments: leg I: TFe 216 (182-247); Ge 310 (270-361); Ti 232 (193-308); Ta 221 (181-259); leg IV: TFe 244 (213-302); Ge 295 (258-335); Ti 399 (353-447); Ta 347 (294-393).

Female (30 specimens)-- Length of posterior coxal group 295 (214-378); dorsal lengths of pedipalp segments: Ti 123 (101-156); Ta 95 (79-115); dorsal lengths of leg segments: leg I: TFe 239 (205-312); Ge 341 (281-420); Ti 238 (193-309); Ta 234 (204-271); leg IV: TFe 254 (216-331); Ge 311 (248-400); Ti 415 (333-517); Ta 375 (291-474).

Specimens from North America apparently do not clearly match those of Eurasia, and Crowells and Davids (1979) and Cook (1980) have erected three species to represent the North American radiation of taxa: *U. laurentiana*, *U. nearctica*, and *U. mexicana*. Measurements and discussion of these taxa follow.

*Unionicola laurentiana*: Pedipalps of females average 382 (308-455) in length; male pedipalps average 388 (370-401) in length; ratio of breadth of male genital skeleton to length of genital plate greater than 0.9; posterior coxal plate (group) average 1.25 times longer than wide, while *U. minor* (Soar 1900) averages 1.33; ca. 10% smaller than the European *U. minor*; female pedipalp Ta with dorsal length averaging 86 (61-100); male pedipalp Ta with dorsal length averaging 90 (86-94) (after Crowell and Davids 1979); additional microscopic differences in characteristics of the tarsal claws of the first walking legs, and in the integumentary texture of the pedipalps, the epimera (coxal plates), and setae of the first basifemora are described by Crowell (1984).

Museum type number(s) and location-- Holotype and paratypes of this species are in the Field Museum of Natural History, Chicago, while paratypes are in the Royal Ontario Museum, Toronto.

Type locality and host-- Eagle River, Wisconsin, collected 27 August 1921 by Ruth Marshall; Oneida County, Wisconsin, collected 30 August 1921 by Ruth Marshall; Waupaca, Wisconsin, collected 10 August 1927 by Ruth Marshall; Joe Indian Lake, St. Lawrence County, New York, collected 5 July and 1 August, 1962; and Missisquoi Bay, Lake Champlain, Vermont, collected 8 August 1976.

Etymology-- The name was proposed in reference to its occurrence in the Laurentian Great Lakes and St. Lawrence River basins.

*Unionicola nearctica*: Pedipalps of females average 760 (612-893) in length; male pedipalps average 652 (589-756) in length; ratio of breadth of male genital skeleton to length of genital plate greater than 0.8; posterior coxal plate (group) average 1.20 times longer than wide, while *U. minor* (Soar 1900) averages 1.33; female pedipalp Ta with dorsal length averaging 182 (145-233); male pedipalp Ta with dorsal length averaging 158 (142-192); the proportions of the pedipalp Ti, being not more than 4 times longer than its dorsoventral dimension, distinguishes it from species other than *U. crassipes* (after Crowell and Davids 1979); additional microscopic differences in characteristics of the tarsal claws of the first walking legs, and in the integumentary texture of the pedipalps, the epimera, and setae of the first basifemora are described by Crowell (1984).

Museum type number(s) and location-- Holotype, allotype, and paratypes of this species are in the Royal Ontario Museum, Toronto. Paratypes are in the Field Museum of Natural History, Chicago.

Type locality and host-- Lake Winnebago, Wisconsin, collected in 1920 by F. C. Baker; Oneida County, Wisconsin, collected 30 August 1921 by Ruth Marshall; Waupaca, Wisconsin, collected 10 August 1927 by Ruth Marshall; Joe Indian Lake, St. Lawrence County, New York, collected 1 August, 1962; Sioux Narrows, Ontario, collected 17 August 1964 by D. Barr; Baysville, Ontario, collected 19 July 1966 by I. Smith; Marion Lake, British Columbia, collected 25 and 29 July 1969 by J. Conroy; and Windermere Lake, British Columbia, collected 2 August 1969 by R. O. M. Fld. Pty.

Etymology-- The name was proposed to reflect its widespread Nearctic distribution.

The following measurements are from Vidrine *et al.* (1986) and were obtained from adults reared from encysted stages in the mussel, *Anodonta* (= *Pyganodon*) *grandis* (Say) (in the suprabranchial chamber), and from four sponge species: *Dosilia radiospiculata* (Mills 1888) from University of Southwestern Louisiana research ponds, Lafayette, Lafayette Parish, Louisiana, collected 21 September 1979; *Trochospongilla horrida* (Weltner 1893) from Bayou Lacombe at Rte. LA 190, St. Tammany Parish, Louisiana, collected on 31 August 1979; *T. pennsylvanica* (Potts 1882) from Henderson Swamp ca. 1.0 km north of Rte. I-10, St. Martin Parish, Louisiana, collected 21 June 1978; and *T. leidyi* (Bowerbank 1863) from Bayou Peyronnet ca. 1.0 km north of Rte. I-10, St. Martin Parish, Louisiana, collected on 15 July 1979. The mussel host was obtained at the latter locality. Vidrine *et al.* (1986) treated all these specimens under the designation of *U. crassipes laurentiana* following the lead of Conroy (1984), where all known North American members of the

*U. crassipes* complex were placed in a single subspecies. The measurements follow:

Male (10 specimens)-- Length including capitulum 775 (600-900); length of posterior coxal group 346 (260-420); dorsal lengths of pedipalp segments: Ti 135 (90-160); Ta 91 (80-100); dorsal lengths of leg segments: leg I: TFe 274 (210-320); Ge 369 (280-450); Ti 266 (200-340); Ta 245 (180-280); leg IV: TFe 299 (220-330); Ge 379 (270-420); Ti 484 (350-570); Ta 384 (310-460).

Female (12 specimens)-- Length including capitulum 658 (500-850); length of posterior coxal group 322 (180-400); dorsal lengths of pedipalp segments: Ti 135 (80-180); Ta 95 (60-130); dorsal lengths of leg segments: leg I: TFe 275 (170-350); Ge 375 (230-470); Ti 260 (160-340); Ta 252 (150-340); leg IV: TFe 286 (170-370); Ge 354 (210-470); Ti 455 (270-580); Ta 383 (230-480).

Notes-- The North American members of the *U. crassipes* (Mueller 1776) complex were recently re-evaluated by Crowell and Davids (1979), Crowell (1984), Conroy (1979, 1984), Vidrine *et al.* (1986), and Vidrine (1987a). Arndt and Viets (1938) reviewed the sponge associations of the members of the complex and reported mostly European records. Incidental mussel hosts have been reviewed by Vidrine (1980a). In North America, Conroy (1979) and Old (1933) reported this mite from the sponge, *Spongilla lacustris* (Linnaeus). Dave Cook gave me a male and female of *U. laurentiana* from psammon in Oklahoma (Plates 9 and 10 in Vidrine 1996a).

Conroy (1984) provided a detailed study including measurements from nearly 2000 specimens from mainly western Canada. Conroy (1984) was not able to separate these into distinctly different morphological groups, and in fact, he shows a normal distribution among the measurements, and he further discounted the use of size as a reliable character for separating these species. Crowell (1984) used ultrastructure of chitinous parts of these mites to establish species level differences in addition to measurements. I have not seen mites with tarsal claws resembling those illustrated for the first walking legs of *U. nearctica* by Crowell (1984); thus, I followed Conroy's hypothetical North American subspecies (Vidrine *et al.* 1986) and later raised it to full species status (Vidrine 1987a). At this writing, the status of North American mites in the *U. crassipes* complex remains as a taxonomic enigma. Some recent workers on this group have returned to the use of the European name (Proctor 1989 and Proctor and Pritchard 1990). The occurrence of these mites in both sponges and mussels in order to undergo metamorphosis suggests a wide variety of niche utilizations. I suspect that several species occur in North America, but I suspect that currently defined taxa represent a cline. This area of research is ripe for anyone who wishes to travel far and wide in search of the solution to this biological question. At present, researchers working with this group, have used following options: two species *U. laurentiana* and *U. nearctica sensu* Crowell and Davids (1979) and Crowell (1984); a third species *U. mexicana sensu* Cook 1980 and Otero-Colina 1988; a single subspecies *U. crassipes laurentiana sensu* Conroy (1984); a single species *U. laurentiana sensu* Vidrine (1987a); and a single species *U. crassipes sensu* Proctor (1989) and Proctor and Pritchard (1990). In this paper, I have decided to use three species level names (*U. laurentiana*, *U. nearctica*, and *U. mexicana*). For the purposes of keying species, the key provided in this book separates *U. nearctica* from the other species based upon length of pedipalpal tarsus, *i. e.* the length of the tarsus exceeds 0.4 mm in this species, whereas other species possess shorter pedipalpal tarsi. The separation of *U. laurentiana*



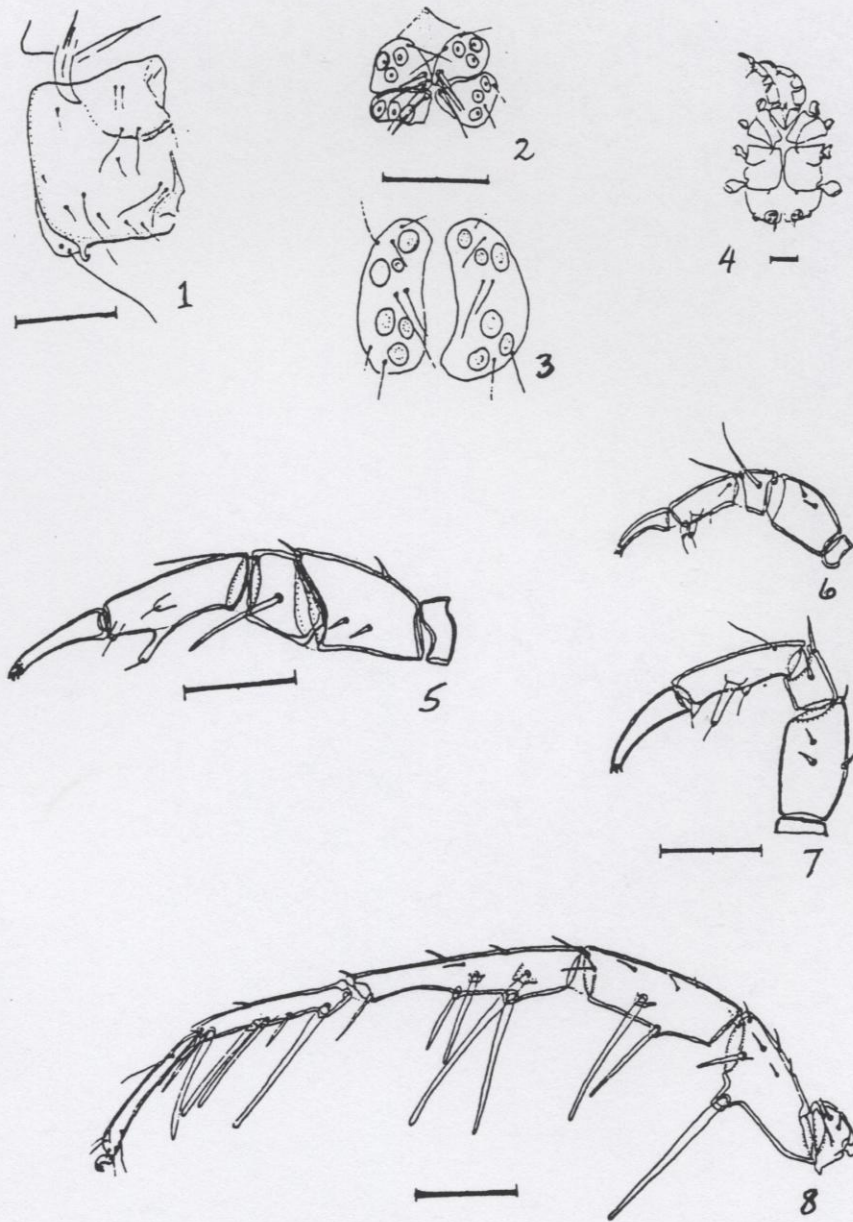
and *U. mexicana* is based upon geographic distribution. The taxonomic status of these species remains unresolved!

Hosts:

*Amblema plicata* Say: Louisiana (Vidrine 1980a).  
*Disconaias fimbriata* (Frierson): Panuco River system, Mexico (Vidrine 1980a).  
*Elliptio crassidens* (Lamarck): Tennessee (Vidrine and Wilson 1991).  
*Fusconaia askewi* (Marsh): *Fusconaia lananensis* (Frierson), Louisiana (Vidrine 1980a).  
*Lampsilis hydiana* (Lea): Louisiana (Vidrine 1989).  
*Lampsilis teres* (Rafinesque): Louisiana (Vidrine 1980a).  
*Leptodea fragilis* (Rafinesque): Louisiana (Vidrine 1980a).  
*Ligumia subrostrata* (Say): Louisiana (Vidrine 1974a).  
*Nephronaias* sp.: Panuco River system, Mexico (Vidrine 1980a).  
*Popenaias* sp.: Panuco River system, Mexico (Vidrine 1980a).  
*Popenaias popei* (Lea): Texas (Vidrine 1980a).  
*Pyganodon fragilis* (Lamarck): *Anodonta fragilis* Lamarck, Lake Michigan, Michigan (Wolcott 1899); *Anodonta marginata* Say in Viets and Plate 1954.  
*Pyganodon grandis* (Say): *Anodonta footiana* Lea, Lake Michigan, Michigan (Wolcott 1899); *Pyganodon grandis footiana* Lea in Viets and Plate 1954; *Anodonta grandis* Say, Iowa (Kelly 1899), Kansas (Murray 1965), and Louisiana (Vidrine 1980a).  
*Quadrula apiculata* (Say): Louisiana (Vidrine 1980a).  
*Quadrula pustulosa pustulosa* (Lea): Minnesota (Vidrine 1980a).  
*Sphaerium simile* Say: Lake Michigan, Michigan (Wolcott 1899 and in Viets and Plate 1954).  
*Toxolasma parvus* (Barnes): Louisiana (Vidrine 1989).  
*Tritogonia verrucosa* (Rafinesque): Wisconsin.  
*Unio merus tetralasmus* (Say): Louisiana (Vidrine 1989).  
*Villosa lienosa* (Conrad): Mississippi (Vidrine 1980a) and Louisiana.

Sponge hosts:

*Dosilia radiospiculata* (Mills): Louisiana (Vidrine *et al.* 1986)  
*Spongilla lacustris* (Linnaeus): Michigan (Old 1933, Marshall 1933a) and British Columbia, Canada (Conroy 1974).  
*Trochospongilla horrida* (Weltner): Louisiana (Vidrine *et al.* 1986)  
*Trochospongilla leidyi* (Bowerbank): Louisiana (Vidrine *et al.* 1986)  
*Trochospongilla pennsylvanica* (Potts): Louisiana (Vidrine *et al.* 1986)



Figures 1-8. *Unionicola laurentiana* Crowell and Davids 1979. 1. Posterior coxal plates. 2. Female genital field. 3. Male genital field. 4. Female venter. 5-7. Pedipalps. 8. First walking leg. Scale equals 100 micrometers.



Map 4. Known distribution of *Unionicola laurentiana* Crowell and Davids 1979 in North America.

*Unionicola (Unionicola) mexicana* Cook 1980

Synonymy--

*Unionicola (Unionicola) mexicana* Cook 1980, Vidrine 1986e, 1987a, 1992a, Otero- Colina 1988

Museum type number(s) and location-- Dave Cook Collections.

Type locality and host-- Adult female from a roadside pond on Rte. 186 (at kilometer marker 67), east of Villahermosa, Tabasco State, Mexico, collected 19 March 1972.

Etymology-- Named for country in which it was collected.

Diagnosis-- Character states of the subgenus; dorsum soft; tips of second and third coxae (coxal plates) rounded; apodemes of anterior coxal groups extending well beyond anterior margins of third coxae; fourth coxae with short projections posteriorly and a fused pair of glandularia immediately medial to these projections; six pairs of genital acetabula, these located on 2 pairs of separated platelets; the three pairs of heavy setae on the genital field relatively long; ventral surface of pedipalp Ti with one short and one long tubercle bearing small setae; the distal peg-like seta inserted on a moderately sized tubercle, the latter originating slightly proximal to the end of the segment (after Cook 1980).

Male (forma typica)-- Length including capitulum 735-819; length of entire coxal group 436-493; dorsal lengths of pedipalp segments: Ge 44-52; Ti 93-108; Ta 76-86; dorsal lengths of leg segments: leg I: Ge 305-325; Ti 217-239; Ta 227-249; leg IV: Ge 297-336; Ti 399-451; Ta 327-368.

Female (holotype)-- Length including capitulum 700; length of entire coxal group 482; dorsal lengths of pedipalp segments: Ge 66; Ti 118; Ta 89; dorsal lengths of leg segments: leg I: TFe 266; Ge 350; Ti 258; Ta 273; leg IV: Ge 349; Ti 471; Ta 394.

Notes-- Otero-Colina (1988) described three forms of this species: "forma typica," "forma chiapaneca," and "forma veracruzana." Forma typica was found in Cenote Azul, Bacalar, Quintana Roo, Mexico. Forma Chiapaneca was found in Laguna Tzicao, Trinitara, Chiapas, Mexico. Forma veracruzana was found in Laguna Catemaco, Catemaco, Veracruz, Mexico. The male was also formally described from the above station where forma typica was found.

This species is related to four species described from South America: *U. inermis* Lundblad (austral Argentina), *U. siolii* Viets (Brazil), *U. unidens* Lundblad (Brazil), and *U. iheringi* (Koenike) (Brazil). The major differences appear to be in the relative sizes of the species and the proportions of the parts of the pedipalps (Cook 1980). *Unionicola mexicana* is part of the North American *U. crassipes* complex and also a part of a South American complex, and the separation of these species remains a major concern. The measurements of this species agree well with those of *U. laurentiana*, and ready separation of all of these species continues to be difficult.





Figures 1-3. *Unionicola mexicana* Cook 1980. 1. First walking leg (female). 2. Female pedipalp. 3. Female venter. Redrawn after Cook (1980).



Map 5. Known distribution of *Unionicola mexicana* Cook 1980 in North America.



*Unionicola (Unionicola) nearctica*  
Crowell and Davids 1979

This species is discussed under *Unionicola (Unionicola) laurentiana* Crowell and Davids 1979 and *U. mexicana* Cook 1980. The following information is repeated here for clarity.

*Unionicola nearctica*: Pedipalps of females average 760 (612-893) in length; male pedipalps average 652 (589-756) in length; ratio of breadth of male genital skeleton to length of genital plate greater than 0.8; posterior coxal plate (group) average 1.20 times longer than wide, while *U. minor* (Soar 1900) averages 1.33; female pedipalp Ta with dorsal length averaging 182 (145-233); male pedipalp Ta with dorsal length averaging 158 (142-192); the proportions of the pedipalp Ti, being not more than 4 times longer than its dorsoventral dimension, distinguishes it from species other than *U. crassipes* (after Crowell and Davids 1979); additional microscopic differences in characteristics of the tarsal claws of the first walking legs, and in the integumentary texture of the pedipalps, the epimera, and setae of the first basifemora are described by Crowell (1984).

Museum type number(s) and location-- Holotype, allotype, and paratypes of this species are in the Royal Ontario Museum, Toronto. Paratypes are in the Field Museum of Natural History, Chicago.

Type locality and host-- Lake Winnebago, Wisconsin, collected in 1920 by F. C. Baker; Oneida County, Wisconsin, collected 30 August 1921 by Ruth Marshall; Waupaca, Wisconsin, collected 10 August 1927 by Ruth Marshall; Joe Indian Lake, St. Lawrence County, New York, collected 1 August, 1962; Sioux Narrows, Ontario, collected 17 August 1964 by D. Barr; Baysville, Ontario, collected 19 July 1966 by I. Smith; Marion Lake, British Columbia, collected 25 and 29 July 1969 by J. Conroy; and Windermere Lake, British Columbia, collected 2 August 1969 by R. O. M. Fld. Pty.

Etymology-- The name was proposed to reflect its widespread Nearctic distribution.



Map 6. Known distribution of *Unionicola nearctica* Crowell and Davids 1979 in North America.

*Unionicola (Unionicola) tenuis* (Lundblad 1935)

Synonymy--

*Unionicola (Unionicola) tenuis* (Lundblad 1935) in Vidrine 1992a

*Unionicola (Unionicola) gracilipalpis tenuis* (Lundblad 1935) in Cook 1980, K. O. Viets 1975, and Gliwicz and Biesiadka 1975

*Atax gracilipalpis tenuis* Lundblad 1935

Museum type number(s) and location-- Lundblad's collection.

Type locality and host-- Haiti.

Etymology-- The name is apparently from Latin *tenu*, which means "slender or thin" and is probably in reference to the legs and pedipalps.

Diagnosis-- Character states of the subgenus; rather inconspicuous projection on the distal end of the tibia of the pedipalp; usually 6 pairs of acetabula on genital field; very similar to *U. crassipes* complex, but with elongate, thin legs and pedipalps. Measurements are used to currently separate this species from the larger, but nearly identical, *U. gracilipalpis*. Tarsi of pedipalps are less than 0.2 mm (200 micrometers) in dorsal length.

Lundblad's Haiti specimen (holotype female):

Pedipalp measurements: Cx 12; Fe 146; Ge 60; Ti 143 (the shortness of this segment is not reflected in Lundblad's drawing); Ta 175. In the drawing, the tarsus is shorter than the tibia; the lengths of the last two segments may have been inadvertently switched.

Viets' (1975) Guatemalan specimen (allotype male)

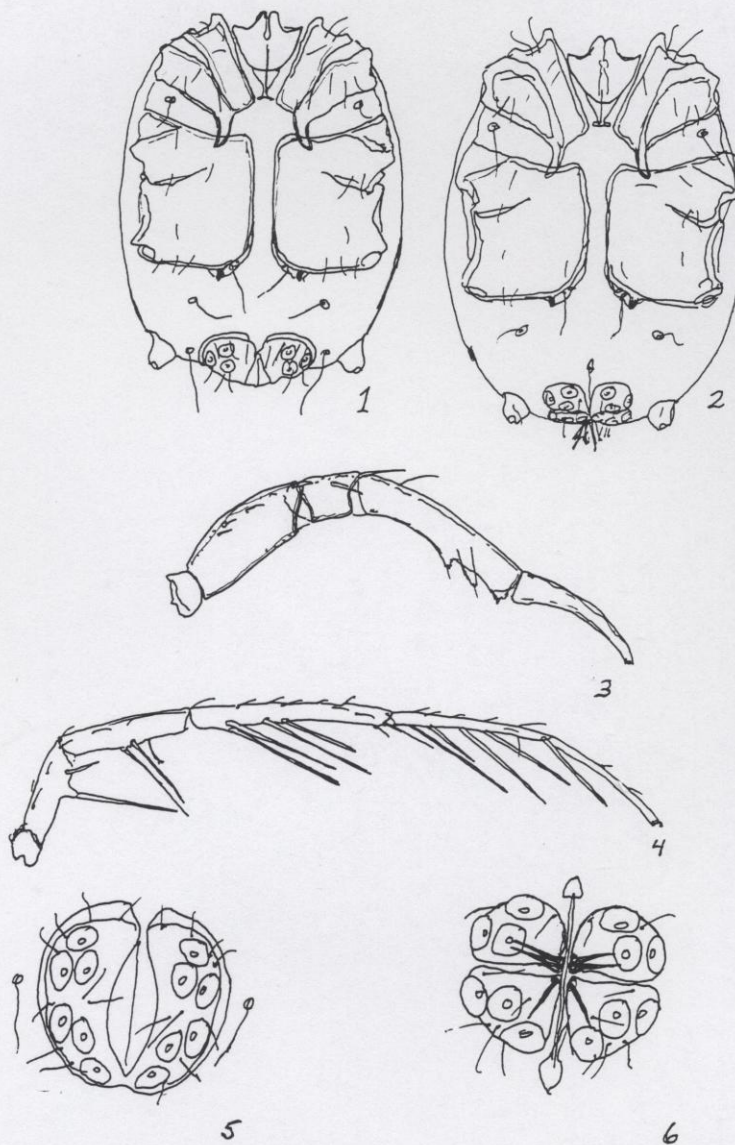
Pedipalp measurements: Cx 17; Fe 158; Ge 81; Ti 191; Ta 160.

Measurements of Mexican specimens from Cook (1980)--ranges only are provided:

Male (2 specimens)-- Length including capitulum 699-729; dorsal lengths of pedipalp segments: Ge 81-85; Ti 192-211; Ta 148-170; dorsal lengths of leg segments: leg I: TFe 288-349; Ge 433-486; Ti 350-395; Ta 304-342; leg IV: Ge 434-471; Ti 532-586; Ta 441-502.

Female (2 specimens)-- Length including capitulum 805; dorsal lengths of pedipalp segments: Ge 103-111; Ti 241-251; Ta 187-192; dorsal lengths of leg segments: leg I: TFe 364-380; Ge 501-532; Ti 410-444; Ta 349-365; leg IV: Ge 479-502; Ti 601-638; Ta 510-532.

Notes-- Cook's (1980) measurements are from specimens from a small pond beside Rte. 185 (near Laguna 8), approximately 37 km north of La Ventosa, Oaxaca State, Mexico, collected 28 February 1972 and from a water filled roadside ditch on Rte. 186 (at kilometer marker 181), 11 km west of bridge over Rio Chumpan, Campeche State, Mexico, collected on 16 March 1972. The specimens from Mexico are larger than the type material from Haiti but agree well with those reported by K. O. Viets from Guatemala (Cook 1980).



Figures 1-6. *Unionicola tenuis* (Lundblad 1935). 1. Male venter. 2. Female venter. 3. Female pedipalp. 4. Female first walking leg. 5. Male genital field. 6. Female genital field (redrawn after Cook 1980).





Map 7. Known distribution of *Unionicola tenuis* (Lundblad 1935) in North America.

Cook (1980) suspects that *Atax dentipalpis* (Stoll 1886), described using diagrammatic drawings, from Guatemala is this same species. If true, the name *dentipalpis* has priority (Cook 1980). Both Viets' (1975a) and Cook's (1980) lots contained specimens that are very similar in measurements of legs and pedipalps and are apparently equipped with longer segments on the pedipalps than Haitian specimens, but neither of their lots contained individuals as large as specimens of *U. gracilipalpis*. The differences, if any exist, between this austral species and the preceding boreal species have not been ascertained for North American specimens. *Unionicola tenuis* has also been reported from the Panama Canal Zone (Gliwicz and Biesiadka 1975).

Apparently at least a dozen mite species in North America are possible sponge mites. The species include:

*Unionicola laurentiana*

*Unionicola nearctica*

*Unionicola mexicana*

*Unionicola gracilipalpis*

*Unionicola tenuis*

*Unionicola furcula*

*Unionicola furculopsis*

*Unionicola poirrieri*

*Unionicola pectinata* (?)

*Unionicola* sp. nr. *figuralis* (?)

*Unionicola conjuncta* (?)

*Neumania* sp. (Unionicolidae: Piontacinae)

Collectively, these species make up a very poorly known community with freshwater Spongillidae. Many species are yet to be discovered, and some of the species are part of a community known as psammon (living among sand-grains) (David Cook, personal communication). Sadly, the global community of these sponge associates and psammon are not only poorly understood taxonomically but also known only from scattered samples. Many of the species of *Unionicola* which are not known from mollusks are probably members of these communities. Any survey including searches within sponges and sand-grain substrates would possibly yield not only an interesting community but also new species. A global review of these communities is necessary. The last review is more than 50 years old (Arndt and Viets 1938).



Subgenus *Everittatax* Vidrine 1992a

TYPE SPECIES-- *U. pectinata* (Wolcott 1898)

ETYMOLOGY-- Named to honor Betty Everitt.

DIAGNOSIS-- Male and female genital fields similar to those of subgenus *Unionicola*; first walking legs less setose than those of subgenus *Unionicola*; claws of first walking leg laterally flattened and pectinate.

HABITAT-- Free-swimming.

DISTRIBUTION-- North America.

DISCUSSION-- Wolcott (1898 and 1899) described this species in some detail. It is divergent in tarsal claw structure of the walking legs and in setal patterns of the legs. *Unionicola dresscheri* Besseling 1946 *sensu* Tuzovsky 1985 also has uniquely serrated claws and is possibly related.

*Unionicola (Everittatax) pectinata* (Wolcott 1898)

Synonymy--

*Atax pectinatus* Wolcott 1898, 1899

*Unionicola pectinata* (Wolcott 1898) in Marshall 1933b, Habeeb 1967, and Crowell 1961

*Unionicola (Unionicola) pectinata* (Wolcott 1898), Vidrine 1986e

*Unionicola (Everittatax) pectinata* (Wolcott 1898), Vidrine 1992a

Museum type number(s) and location-- Field Museum of Natural History, Chicago, Illinois.

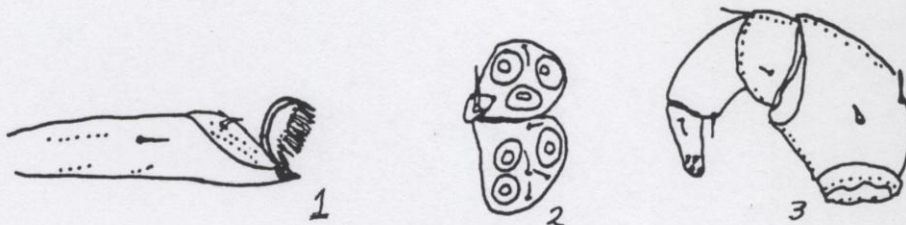
Type locality and host-- taken in a dredge sample at Lake St. Clair, September 1, 1893, and also collected in the vicinity of New Baltimore, Michigan (6 specimens) collected by R. Wolcott.

Etymology-- Named for the unusual pectinate tarsal claws on the first walking legs. Pectinate refers to "comblike."

Diagnosis-- Character states of the subgenus; genital field similar to *U. crassipes* complex, but with the legs relatively shorter and with the pedipalps very thick, considerably thicker than the base of the first walking legs; body length: males 700-800 and females 800-1000; pedipalps of females more than two-fifths the body length, while the males have shorter pedipalps, but with their smaller bodies the pedipalps appear to be longer than two-fifths of the body length; no moveable spines on the first walking leg and they are less numerous than in the *U. crassipes* complex, but the individual spines are not set into sockets and they are shorter and more slender and taper to a sharp point; tarsal claws of the first walking legs are expanded dorsoventrally and flattened laterally, forming a broad plate of which the dorsal margin is strongly arched, the flexor margin deeply pectinate, the pectinations, about 16 in number, reaching nearly three-fourths the distance to the opposite margin, and with a slight curvature toward the base of the claw; tarsal claws of the remaining legs are slender, strongly curved at the base, more moderately beyond, and again more strongly toward the sharply pointed tip with a very inconspicuous tooth (prong) on the middle of the flexor margin;

genital field circular in outline and near the posterior end of the body; female with 4 acetabular plates with 3 acetabula each, male with two plates with 6 acetabula each (after Wolcott 1899).

Notes-- Wolcott (1898) described this species as a free-swimming mite from collections within a bed of *Chara*, a luxuriant alga. It probably is a sponge-mite. Conroy's (1968) Canadian specimens were loaned to me, and they are *U. poirrieri*. Thus, *U. pectinata* is known only from Michigan and Wisconsin (Marshall 1933b). It apparently has not been collected in more than a half century. I have not had an opportunity to view this remarkable mite.



Figures 1-3. *Unionicola pectinata* (Wolcott 1898). 1. Tarsal claw of first walking leg. 2. Female genital field (one half). 3. Pedipalp. Redrawn from Wolcott (1899).



Map 8. Known distribution of *Unionicola pectinata* (Wolcott 1898) in North America.

Subgenus *Lasalleatax* Vidrine 1992a

TYPE SPECIES--*U. brasiliensis* (Lundblad 1936)

ETYMOLOGY-- Named to honor Mark W. LaSalle.

DIAGNOSIS-- Male and female genital fields with 5-6 pairs of acetabula and resembling *Unionicola*; pedipalps slightly elongate and resembling *Unionicolides*; first walking leg with distinctive setal pattern that is less setose than those of the subgenus *Unionicola*.

HABITAT--Free-swimming.

DISTRIBUTION--North America (Mexico) and South America.

DISCUSSION-- The species are adequately figured in Lundblad (1942), Viets (1954a), and Cook (1980). This subgenus appears intermediate in character states between members of subgenera *Unionicola*, *Wilsonatax*, and *Unionicolides*.

ADDITIONAL SPECIES INCLUDED--*U. conjuncta* Viets 1954a and *U. unidens* Lundblad 1942.

*Unionicola (Lasalleatax) conjuncta* Viets 1954a

Synonymy--

*Unionicola (Unionicola) conjuncta* Viets 1954a in Vidrine 1986e

*Unionicola (Pentatax) conjuncta* Viets 1954a in Cook 1980

*Unionicola longidens conjuncta* Viets 1954a

*Unionicola (Lasalleatax) conjuncta* Viets 1954a in Vidrine 1992a

Museum type number(s) and location-- Viets' Collections.

Type locality and host-- Eastern Brazil.

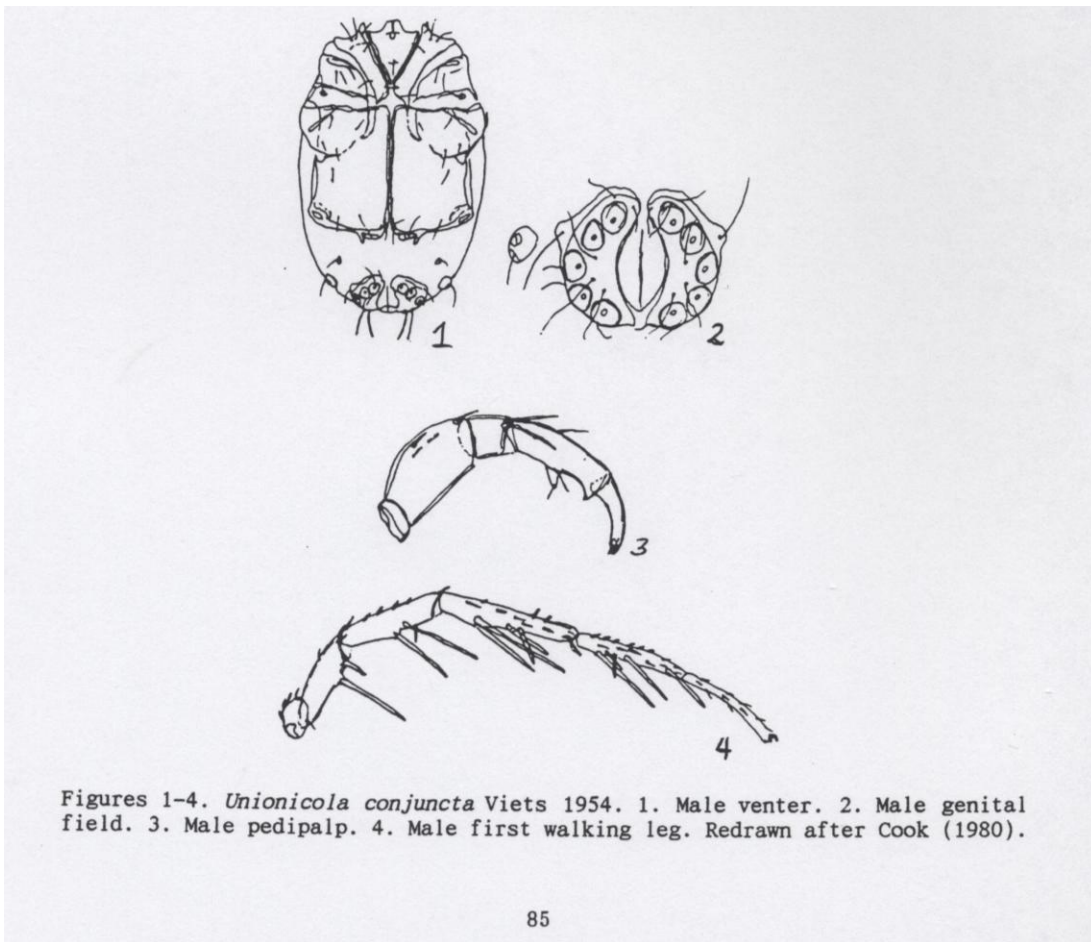
Etymology-- "Con" means "with," and "junc" means "reed/rush." Thus it is possibly named for its free-swimming nature and its collection among reeds/rushes.

Diagnosis-- Character states of the subgenus; dorsum soft, body with moderately developed glandularia tubercles at posterior end; tips of second and third coxae rounded; apodemes of the anterior coxal group long, extending far beyond anterior ends of the third coxae; fourth coxae very close together medially and truncate posteriorly; fourth coxae with short projections posteriorly and a pair of fused glandularia immediately medial to these projections; genital field terminal; acetabular plates separated ventrally; five pairs of acetabula; the pair of setae, normally free and flanking the genital field, joined to the acetabular plates by secondary sclerotization; morphology of pedipalps and legs illustrated. (after Cook 1980).

Male (1 specimen)-- Length including capitulum 714; length of entire coxal group 532; dorsal lengths of pedipalp segments: Ge 61; Ti 118; Ta 81; dorsal lengths of leg segments: leg I: TFe 243; Ge 330; Ti 243; Ta 228; leg IV: Ge 358; Ti 494; Ta 440.

Notes-- Measurements are from a single male from a small stream at bridge between the city of Palenque and the Maya Ruins, Chiapas State, Mexico, collected 16 March 1972 (Cook 1980). This species is more closely related to *U. brasiliensis* Lundblad than to *U. longidens* Lundblad (Cook 1980). The moderately reduced setae on the first walking leg is used to separate this species from the subgenus *Unionicola sensu stricto* (Vidrine 1992a). Since the female is unknown in this species, it is possible that it may belong to another subgenus. The key character of this species is the attachment of the lateral setae to the genital field by secondary sclerotization. It is otherwise reminiscent of *U. aculeata*, especially the form with the elongated pedipalpal tarsus.

Like so many of the South American species of *Unionicola* described from early collections, little is known of this species other than the basic anatomy. Few specimens were usually collected, and thus variation was difficult to ascertain. I have divided many of these species into separate subgenera in order to better delineate the varied clades (Vidrine 1988a and 1992a). Next to nothing is known of their natural history and ecology.



Figures 1-4. *Unionicola conjuncta* Viets 1954. 1. Male venter. 2. Male genital field. 3. Male pedipalp. 4. Male first walking leg. Redrawn after Cook (1980).





Map 9. Known distribution of *Unionicola conjuncta* Viets 1954 in North America.



Subgenus *Wilsonatax* Vidrine 1992a

SYNONYMY-- *Wilsonatax* (sic) and *Wilsonatax* Vidrine 1992a

TYPE SPECIES--*U. plaumanni* Lundblad 1937

ETYMOLOGY-- Named to honor James L. Wilson.

DIAGNOSIS--Male and female genital fields similar to those of subgenus *Unionicola*; pedipalps somewhat elongate and typical of *Unionicola*; first walking legs less setose than those of subgenus *Unionicola*; first walking leg with few, thickened, rather blunt setae on Ge and Ti, with tarsus rather undifferentiated.

HABITAT--Free-swimming.

DISTRIBUTION--North America and South America.

DISCUSSION--Lundblad (1942) and Vidrine (1984b) illustrated these species. Based on the occurrence of *U. poirrieri* in sponges, the other species are probable sponge mites. Collectively, they represent a distinctively divergent group, apparently distributed from Canada to southern Brasil.

ADDITIONAL SPECIES INCLUDED-- *U. poirrieri* Vidrine 1984b and *U. viciniseta* (Lundblad 1936).

*Unionicola (Wilsonatax) poirrieri* Vidrine 1984b  
Plates 15-16 in Vidrine (1996a)

Synonymy--

*Unionicola* sp. nov. type 3 in Vidrine 1980a

*Unionicola (Unionicola) poirrieri* Vidrine 1984b

*Unionicola (Wilsonatax) poirrieri* Vidrine 1984b, Vidrine 1986e, 1992a

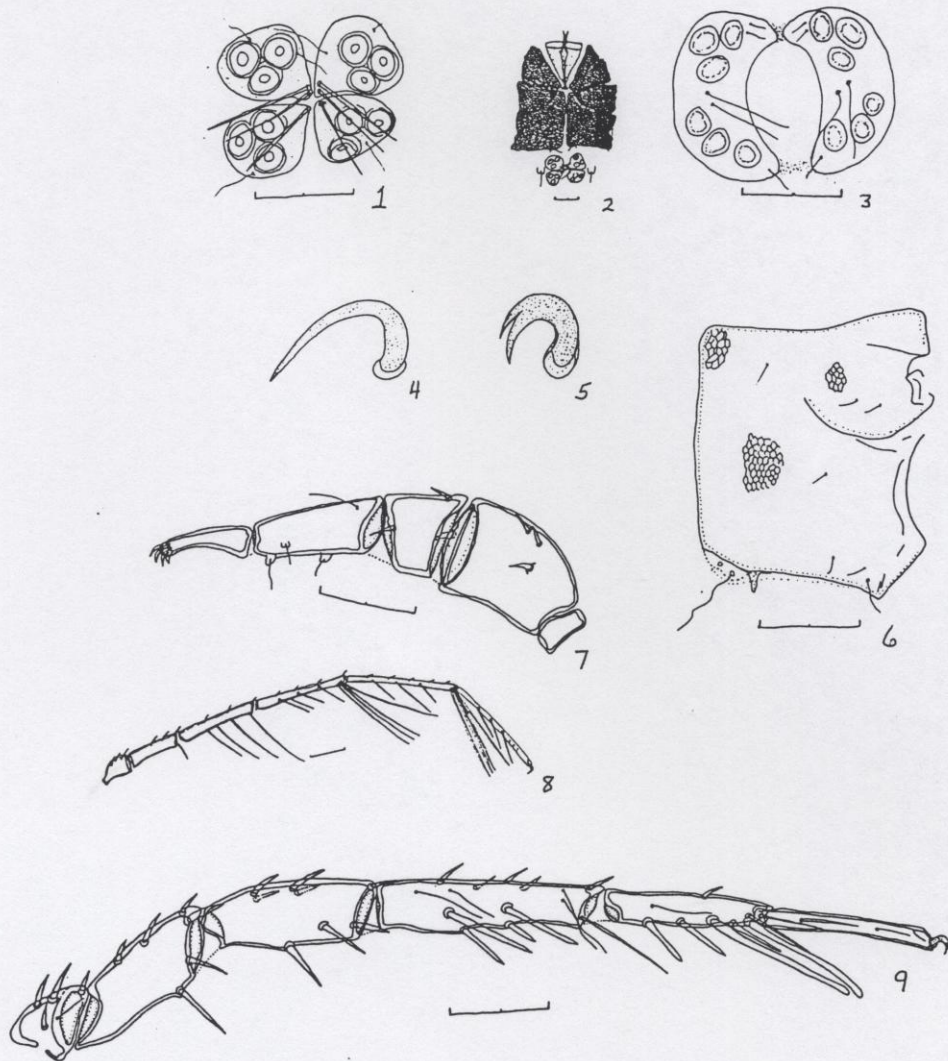
*Unionicola pectinata* (Wolcott 1898) in Conroy 1968

Museum type number(s) and location-- CNC 18409, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) reared from encysted tritonymphs in the tissues of the sponge, *Trochospongilla leidyi* (Bowerbank) from Bayou Peyronnet ca. 1.0 km north of its intersection with Rte. I-10, St. Martin Parish, Louisiana, collected 15 July 1979 by M. F. Vidrine.

Etymology-- Named to honor Mike Poirrier.

Diagnosis-- Character states of the subgenus; palps thicker than walking legs; distal segment of palps slightly elongate and bearing 4 small prongs; coxal plates reticulate; genital fields posterior with a large tubercle and seta flanking the genital field on either side; female genital field with four plates, each bearing 3 acetabula; anterior female plates with two long setae on the inner margin, posterior plates with a single seta; male genital field with 2 plates joined anteriorly and posteriorly, each bearing 6 acetabula; first pair of walking legs thicker than the 3 posterior pairs of legs and bearing a pair of bifid claws; second, third, and fourth walking legs long and bearing a pair of simple claws; first and second coxal plates with long posterior projections; fourth coxal plate with a small but distinct posterior projection; fourth and fifth segments of fourth walking leg with 4, long, distal setae; no dorsal shield apparent.



Figures 1-9. *Unionicola poirrieri* Vidrine 1984. 1. Female genital field. 2. Female venter. 3. Male genital field. 4. Tarsal claw of fourth walking leg. 5. Tarsal claw of first walking leg. 6. Posterior coxal plates. 7. Pedipalp. 8. Fourth walking leg. 9. First walking leg. Scale equals 100 micrometers. Used with permission from Proceedings of the Louisiana Academy of Sciences: Vidrine 1984.



Map 10. Known distribution of *Unionicola poirrieri* Vidrine 1984 in North America.

Male (3 specimens)-- Length including capitulum 667 (650-700); length of posterior coxal group 238 (225-250); dorsal lengths of pedipalp segments: Ge 65 (60-70); Ti 115 (110-120); Ta 75 (70-80); dorsal lengths of leg segments: leg I: TFe 150 (140-160); Ge 203 (180-220); Ti 158 (145-170); Ta 153 (150-160); leg IV: TFe 215 (200-225); Ge 252 (230-265); Ti 317 (290-330); Ta 288 (265-300).

Female (2 specimens)-- Length including capitulum 700; length of posterior coxal group 260 (250-270); dorsal lengths of pedipalp segments: Ge 65 (60-70); Ti 143 (140-145); Ta 83 (80-85); dorsal lengths of leg segments: leg I: TFe 183 (180-185); Ge 240 (230-250); Ti 188 (175-200); Ta 185 (180-190); leg IV: TFe 245 (240-250); Ge 300 (290-310); Ti 365 (350-380); Ta 355 (325-345).

Notes-- John Conroy's specimens were kindly loaned to me for examination. His specimens are from Long Pine Creek, Loch Lomond, Cypress Hills Provincial Park, Saskatchewan, Canada, collected 7 June 1965. This range extension demonstrates how little we really know about the *Unionicola* which are associated with sponges. No sponge host was recorded for the Canadian specimens. The sponge mite community in North America and worldwide is poorly known (Arndt and Viets 1938).

Hosts:

*Trochospongilla leidy* (Bowerbank): Louisiana (Vidrine 1984b).

Subgenus *Lundbladatax* Vidrine 1988a

TYPE SPECIES--*U. furcula* (Lundblad 1935)

ETYMOLOGY-- Named to honor O. Lundblad.

DIAGNOSIS--Male and female genital fields closely resemble those of the subgenus *Unionicola*; walking legs with few setae; male and female walking legs not apparently sexually dimorphic; pedipalp Ta elongate and bearing 2 large clawlets.

HABITAT--Free-swimming, but parasitic on sponges and once recorded from Unionidae.

DISTRIBUTION--North and South America.

DISCUSSION--The large distinctive pedipalpal tarsi indicate that this is a divergent group. This group of species also parasitizes sponges, and it constitutes a significant portion of the sponge community in the Americas.

ADDITIONAL SPECIES INCLUDED--*U. furculopsis* Cook 1980 and *U. fissipalpis* Lundblad 1942.

*Unionicola (Lundbladatax) furcula* (Lundblad 1935)

Plates 17-20 in Vidrine (1996a)

Synonymy--

*Pentatax furcula* Lundblad 1935

*Unionicola (Unionicola) furcula* (Lundblad 1935), Vidrine *et al.* 1986, and Vidrine 1986e

*Unionicola (Lundbladatax) furcula* (Lundblad 1935), Vidrine 1988a

Museum type number(s) and location-- Lundblad collection.

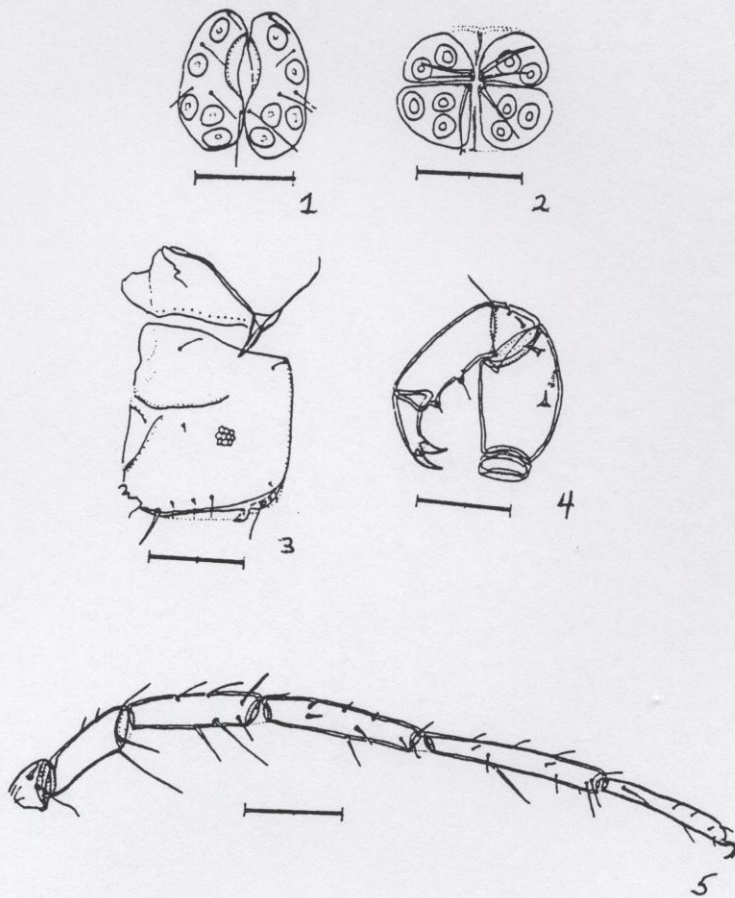
Type locality and host-- Haiti.

Etymology-- *Furc* (Latin) refers to a fork, which describes the diagnostic nature of the forked, pedipalp tarsal clawlets.

Diagnosis-- Character states of the subgenus; dorsum soft, body with moderately developed glandularia tubercles at posterior end; posterior apodemes of anterior coxal groups of moderate length and extending to the anterior margins of the third coxae; five pairs of genital acetabula on two plates in male genital field and on 4 plates in female genital field; female genital field with 6 long, central spines, as typical of genital fields in the subgenus *Unionicola*; chaetotaxy of first leg reduced and unusual with fine, pointed setae, not on tubercles; pedipalps unusually large and with 2 large clawlets on the Ta.

Male (3 specimens)-- Length including capitulum 537 (460-650); length of posterior coxal group 170 (160-180); dorsal lengths of pedipalp segments: Ti 130; Ta 70; dorsal lengths of leg segments: leg I: TFe 130; Ge 157 (150-160); Ti 187 (180-190); Ta 130; leg IV: TFe 160; Ge 210; Ti 246 (240-250); Ta 243 (240-250).





Figures 1-5. *Unionicola furcula* (Lundblad 1935). 1. Male genital field. 2. Female genital field. 3. Posterior coxal plates. 4. pedipalp. 5. First walking leg. Scale equals 100 micrometers.





Map 11. Known distribution of *Unionicola furcula* (Lundblad 1935) in North America.

Female (7 specimens)-- Length including capitulum 657 (550-800); length of posterior coxal group 196 (180-210); dorsal lengths of pedipalp segments: Ti 163 (150-180); Ta 81 (70-90); dorsal lengths of leg segments: leg I: TFe 161 (140-180); Ge 193 (170-220); Ti 223 (190-250); Ta 157 (140-180); leg IV: TFe 196 (180-220); Ge 239 (210-270); Ti 287 (260-330); Ta 227 (230-320).

Notes-- Mites that were measured were obtained as emergent imagoes from encysted stages from five sponge species: *Ephydatia fluviatilis* (Linnaeus 1758) from New Orleans City Park ponds, Orleans Parish, Louisiana, collected 28 August 1978; *Dosilia radiospiculata* (Mills 1888) from University of Southwestern Louisiana research ponds, Lafayette, Lafayette Parish, Louisiana, collected 21 September 1979; *Trochospongilla horrida* (Weltner 1893) from Bayou Lacombe at Rte. LA 190, St. Tammany Parish, Louisiana, collected on 31 August 1979; *T. pennsylvanica* (Potts 1882) from Henderson Swamp ca. 1.0 km north of Rte. I-10, St. Martin Parish, Louisiana, collected 21 June 1978; and *T. leidy* (Bowerbank 1863) from Bayou Peyronnet ca. 1.0 km north of Rte. I-10, St. Martin Parish, Louisiana, collected on 15 July 1979. These mites match the measurements of those in Lundblad (1935) from Haiti and are smaller than the types of *U. furculopsis* Cook 1980 from Mexico. A single nymph of this species was obtained in the mussel, *Anodonta* (= *Pyganodon*) *grandis* (Say) from St. Croix River, Wisconsin (Vidrine 1980a). This species has been also reported from the Panama Canal Zone (Gliwicz and Biesiadka 1975) and Guatemala (Viets 1975a). Female specimens from Guatemala match pedipalp and first leg measurements of *U. furculopsis* and not those of Lundblad's type. However, Louisiana specimens agree well with the type both in measurements and in length of setae on the first walking legs.

Lundblad's (1935) measurements of type's (female) pedipalp segment lengths:  
Cx 14; Fe 178; Ge 66; Ti 161; Ta 95.

Hosts:

*Pyganodon grandis* (Say): *Anodonta grandis* Say, Wisconsin (Vidrine *et al.* 1986).

Sponge hosts:

*Dosilia radiospiculata* (Mills): Louisiana (Vidrine *et al.* 1986)

*Ephydatia fluviatilis* (Linnaeus): Louisiana (Vidrine *et al.* 1986)

*Trochospongilla horrida* (Weltner): Louisiana (Vidrine *et al.* 1986)

*Trochospongilla leidy* (Bowerbank): Louisiana (Vidrine *et al.* 1986)

*Trochospongilla pennsylvanica* (Potts): Louisiana (Vidrine *et al.* 1986)

*Unionicola (Lundbladatax) furculopsis* Cook 1980

Synonymy--

*Unionicola (Pentatax) furculopsis* Cook 1980, Otero-Colina 1988

*Unionicola (Unionicola) furculopsis* Cook 1980, Vidrine 1986e

*Unionicola (Lundbladatax) furculopsis* Cook 1980, Vidrine 1988a

Museum type number(s) and location-- Dave Cook's Collections.

Type locality and host-- Male (holotype), allotype, and paratypes from a small pond beside Rte. 185 (near Laguna 8). approximately 37 km north of La Ventrosa, Oaxaca State, Mexico, collected 28 February 1972.

Etymology-- Named for its later finding and similar appearance to *U. furcula*.

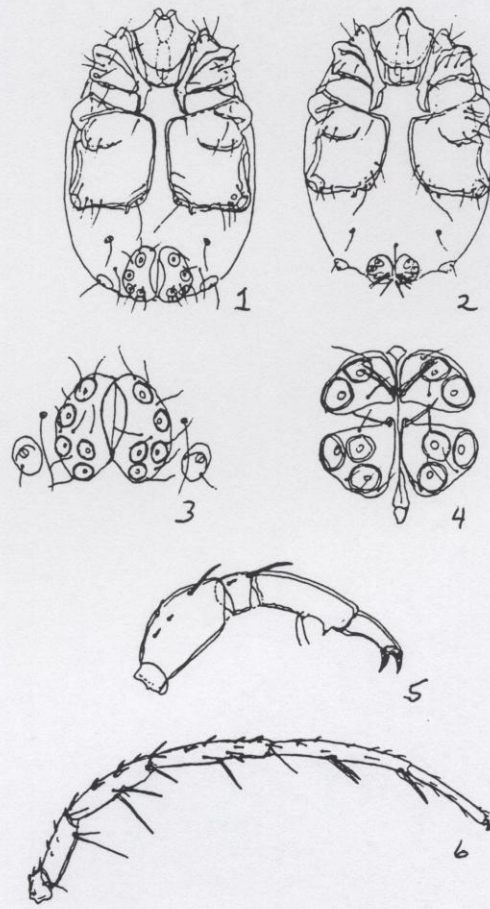
Diagnosis-- Character states of the subgenus; dorsum soft, body with moderately developed glandularia tubercles at posterior end; posterior apodemes of anterior coxal groups of moderate length and extending to the anterior margins of the third coxae; five pairs of genital acetabula on two plates in male genital field and on 4 plates in female genital field; female genital field with 6 long, central spines, as typical of genital fields in the subgenus *Unionicola*; chaetotaxy of first leg reduced and unusual with fine, pointed setae, not on tubercles; pedipalps unusually large and with 2 very large clawlets on the Ta.

Male (holotype)-- Length including capitulum 547; length of entire coxal group 401; dorsal lengths of pedipalp segments: Ge 67; Ti 162; Ta 103; dorsal lengths of leg segments: leg I: TFe 167; Ge 213; Ti 236; Ta 163; leg IV: Ge 251; Ti 304; Ta 304.

Female (allotype)-- Length including capitulum 760; length of entire coxal group 403; dorsal lengths of pedipalp segments: Ge 81; Ti 194; Ta 125; dorsal lengths of leg segments: leg I: TFe 212; Ge 258; Ti 278; Ta 186; leg IV: Ge 297; Ti 349; Ta 350.

Notes-- This species is related to two species, *U. fissipalpis* Lundblad and *U. furcula* (Lundblad). This species differs from the first of the two in having a more swollen pedipalp Fe and lacking lateral indentations between the anterior and posterior acetabular groups in the male. It differs from the second of the two in that *U. furcula* has a much narrower pedipalp Ta (which is only slightly enlarged proximally), much shorter posterior apodemes of the anterior coxal groups. Also, the segments and associated setae of the first leg are much shorter in Haitian specimens (*U. furcula*) (Cook 1980). Viets (1975a) provided measurements of specimens of Guatemalan *U. furcula* (females) which apparently match Cook's measurements of this species.

Otero-Colina (1988) also found this species in the Mexican states of Tabasco and Quintana Roo. The differences between *U. furculopsis* and *U. furcula* appear to be reduced with the examination of larger lots of these species-groups. Future work may well result in these being considered conspecific (Otero-Colina 1988). *Unionicola furculopsis*, much like its sister species, is probably a sponge-mite.



Figures 1-6. *Unionicola furculopsis* Cook 1980. 1. Male venter. 2. Female venter. 3. Male genital field. 4. Female genital field. 5. Male pedipalp. 6. Male first walking leg. Redrawn after Cook (1980).





Map 12. Known distribution of *Unionicola furculopsis* Cook 1980 in North America.



### Subgenus *Pentatax* Thor 1922

TYPE SPECIES-- *U. bonzi* (Claparede 1869)

ETYMOLOGY-- Named for having 5 acetabula pairs.

DIAGNOSIS-- Female genital field with 2 pairs of acetabular plates closely appressed, with each plate usually bearing 2-3 acetabula; female anterior plates modified with an inner flap with one or 2, short, thick, spinous setae; female posterior plate apparently unmodified; setae nearly centrally located in genital field; male genital field with a single pair of acetabular plates with only small, inconspicuous setae; pedipalps subcylindrical and well-sclerotized, with the Ta usually slightly elongate and bearing obvious, but usually not large, clawlets; male and female legs similar. Leg I in some species resembles those of the subgenus *Unionicola*.

HABITAT-- Most studied species are parasites of Unionidae and/or Viviparidae, but several species are usually free-swimming and only employ the hosts as sites of oviposition and encystment (Vidrine *et al.* 1986).

DISTRIBUTION-- Europe, Asia and North America.

DISCUSSION-- *Pentatax* is separated from *Unionicola* by the modified anterior genital (acetabular) plates in the female genital field. *Unionicola inusitata* is far less striking in appearance with the anterior genital plates of the female being somewhat less modified, but this is the least derived species of the group. The remaining species included are apparently a rather cohesive unit; however, differences in the shape and setal patterns of the first walking in varied species may suggest two distinctive groups. *Unionicola bonzi*, *U. thaiensis*, *U. imamurai*, *U. rezvoi*, *U. setipes*, and *U. tricuspis* are apparently the members of a single radiation. However, *Unionicola aculeata* represents a separate radiation and may constitute several currently unrecognized species. The two groups also have very distinctively different life history patterns. However, in this paper, I retain all the species in the single subgenus. Interestingly several recent taxa have been erected which require mention in order to update these taxa in relation to the subgenus *Pentatax*. Smit's (1992a) new species, *Unionicola (Pentatax) davidsi* Smit, is a member of the subgenus *Smithatax* Vidrine, since it is related to the two species already included in that subgenus. The subgenera *Majumderatax* Vidrine 1993b and *Heversatax* Vidrine 1988a are apparently related to *Pentatax*, but the two are distinctive and separated based upon the morphology of the pedipalpal tarsi and the chaetotaxy of the first walking legs.

ADDITIONAL SPECIES INCLUDED-- *U. aculeata* (Koenike 1890), *U. imamurai* Hevers 1978, *U. inusitata* (Koenike 1914), *U. rezvoi* Sokolow 1931, *U. setipes* Sokolow 1931, *U. thaiensis* Vidrine 1985b, and *U. tricuspis* (Koenike 1895).

*Unionicola (Pentatax) aculeata* (Koenike 1890)  
Plates 21-26 in Vidrine (1996a)

Synonymy--

*Atax aculeatus* Koenike 1890a in Wolcott 1899 and Piersig 1901

*Unionicola aculeata* (Koenike 1890) in Marshall 1933b, Conroy 1968, Vidrine 1977a, Mitchell 1954 and 1955, Crowell 1961, Habeeb 1967, Calnan 1976, Hevers 1975, 1978c, and 1979 and Vidrine *et al.* 1986.

*Unionicola* type J in Vidrine 1974a

*Unionicola* type O in Vidrine 1974a

*Unionicola sayi* Piersig 1901

Museum type number(s) and location-- Koenike's collection.

Type locality and host-- Germany.

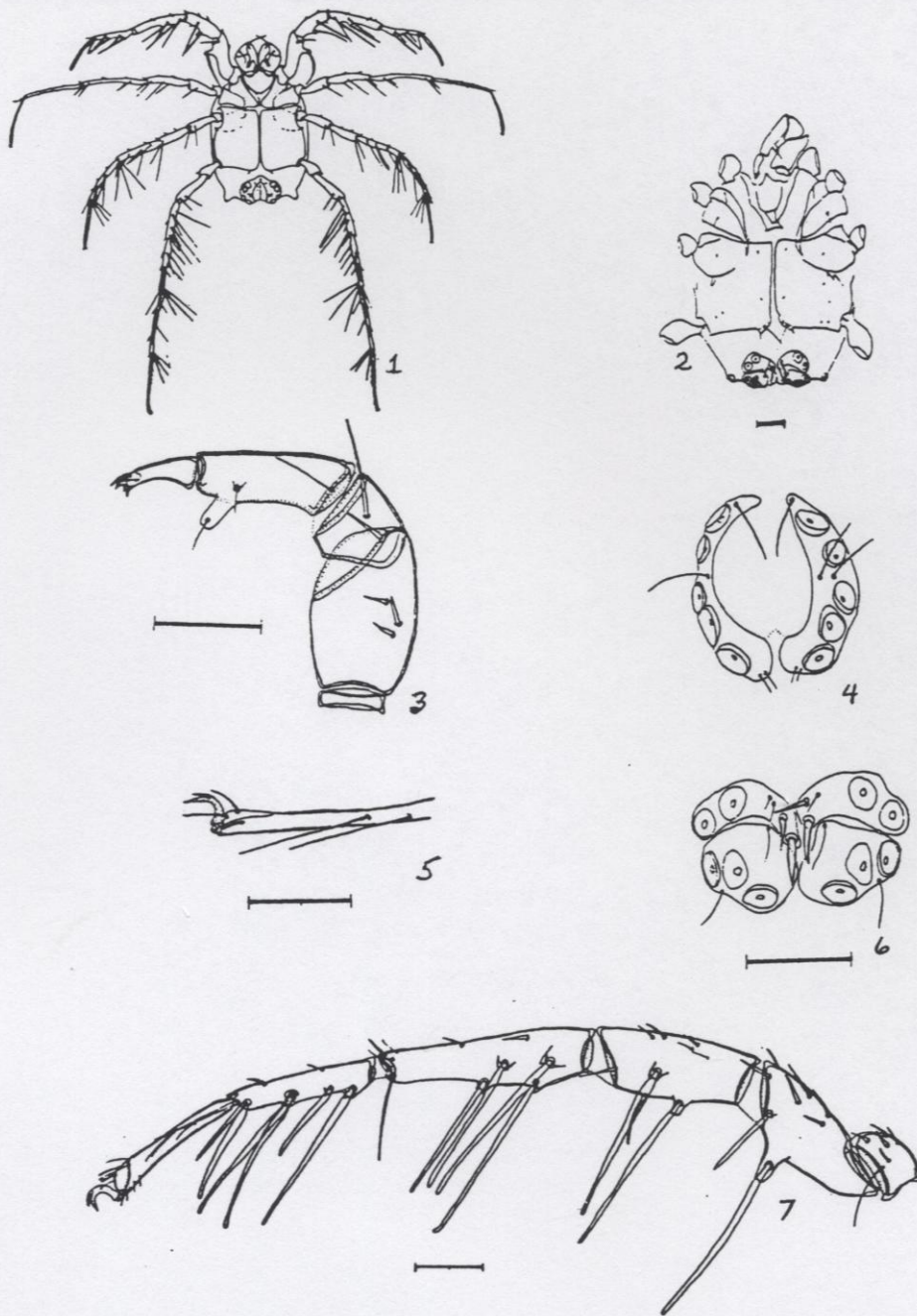
Etymology-- *Aculeata* refers to a sting or thorn.

Diagnosis-- Character states of the subgenus; genital field of female distinctive with 4 plates, the anterior plates bearing two small setae on inner flap and 2 acetabula each, the posterior plates bearing a single short hairlike seta and 3 acetabula each; male genital field with 2 lunate plates, each without obvious central setae and bearing 5 acetabula; first walking legs distinctive with moveable large setae on tubercles; pedipalps with small, but distinctive, tarsal clawlets, the dorsal clawlet being somewhat more obvious; tarsal claws of walking legs rather deeply bifid.

Male (11 specimens)-- Length including capitulum 783 (700-900); length of posterior coxal group 332 (300-370); dorsal lengths of pedipalp segments: Ti 137 (100-170); Ta 72 (60-90); dorsal lengths of leg segments: leg I: TFe 235 (190-280); Ge 325 (270-390); Ti 223 (180-270); Ta 214 (180-260); leg IV: TFe 265 (210-340); Ge 326 (260-400); Ti 397 (330-490); Ta 352 (300-420).

Female (15 specimens)-- Length including capitulum 932 (750-1300); length of posterior coxal group 398 (320-470); dorsal lengths of pedipalp segments: Ti 173 (130-210); Ta 89 (70-110); dorsal lengths of leg segments: leg I: TFe 293 (210-370); Ge 409 (290-540); Ti 270 (180-350); Ta 253 (180-330); leg IV: TFe 305 (220-390); Ge 366 (260-460); Ti 451 (320-560); Ta 389 (270-480).

Notes-- Adults were both collected and reared from encysted stages in freshwater mussels. The resting stages are usually found attached to the siphonal mantle in mussels. Vidrine (1977a and 1980a) reported 21 genera of freshwater mussels as hosts. The mites that were measured are from several North American lots including two lots from Mexico from *Cyrtonaias tampicoensis* (Lea) and *Disconaias discus* (Lea) from Rio Guayalejo at Rte. MX 80 near Maxcoltzin, Tamaulipas, Mexico, collected 28 January 1982 by D. J. Bereza, S. V. Hensley, and M. F. Vidrine. Mitchell (1955) discussed the anatomy and life history of this mite. This species is usually found encysted in mussels during the late spring and early summer in the southern United States (Vidrine *et al.* 1986). These mites are the traditional example of "transients" as defined by Treat (1975) and elaborated upon by Vidrine (1989a).



Figures 1-7. *Unionicola aculeata* (Koenike 1890). 1. Male venter (redrawn after Mitchell 1955). 2. Female venter. 3. Pedipalp. 4. Male genital field. 5. Tarsus of fourth walking leg. 6. Female genital field. 7. First walking leg. Scale equals 100 micrometers.



Map 13. Known distribution of *Unionicola aculeata* (Koenike 1890) in North America.

For the purposes of comparison with North American specimens, the following measurements of European specimens are provided. Selected measurements from Hevers (1978c) for German specimens of *Unionicola aculeata*:

Male (specimens)-- Length of posterior coxal group 349 (325-371); dorsal lengths of pedipalp segments: Ti 154 (147-160); Ta 100 (97-105); dorsal lengths of leg segments: leg I: TFe 257 (248-276); Ge 378 (358-399); Ti 247 (235-266); Ta 245 (235-261); leg IV: TFe 281 (270-300); Ge 346 (329-370); Ti 412 (393-440); Ta 361 (347-388).

Female (specimens)-- Length of posterior coxal group 375 (360-400); dorsal lengths of pedipalp segments: Ti 178 (170-193); Ta 105 (97-111); dorsal lengths of leg segments: leg I: TFe 276 (267-295); Ge 409 (380-435); Ti 258 (242-285); Ta 256 (226-288); leg IV: TFe 292 (276-305); Ge 358 (341-389); Ti 453 (415-493); Ta 400 (371-445).

North American specimens generally agree in measurements with German specimens (Hevers 1978c). If, however, the populations from the west are different from those of Eurasia, *Unionicola sayi* Piersig 1901 may be name with priority for North American specimens.

The large number of host species (mussels and snails) reported for this species in North America (Vidrine 1980a) and the large geographic range of this species suggest that an *Artenkreis* of species is probably involved rather than a single species. As a further indication of this probability, the measurements provided above suggest a wide range of differences in size. To date, little effort has been made to sort these specimens either based upon geographical distribution or based upon host preferences. Differences in the ratios of leg and pedipalp segments hint at the possibility that the North American specimens represent not only species different from the European *U. aculeata sensu stricto* but also a radiation of sibling species. For example, among my specimens are male and female examples of an obviously different form with an elongate tarsus on the pedipalp. Its pedipalp tarsus also has an obvious, long setae extending from the base to the tip of the segment. It is depicted on plates 25-26 in Vidrine (1996a). It was found in *Pyganodon grandis* at Ramah, Louisiana. This population may be an undescribed species different from the more typical North American form.

There are a number of early records for this rather common mite, but it also has been misidentified on a number of occasions. For example, Marshall's (1933b) figures of *U. figuralis* are *U. aculeata* with slightly longer pedipalp tarsi.

#### Hosts:

*Actinonaias ligamentina* (Lamarck): *Unio ligamentinus* Lamarck, Michigan (Wolcott 1899); *Ortmanniana carinata* (Barnes) in Viets and Plate 1954.

*Alasmidonta viridis* (Rafinesque): *Unio pressus* Adams and Adams, Michigan (Wolcott 1899); *Platynaias viridis* Rafinesque in Viets and Plate 1954.

*Amblema plicata plicata* Say: *Unio undulatus* Barnes, Michigan (Wolcott 1899 and in Viets and Plate 1954); Louisiana (Vidrine 1980a). (includes *Amblema plicata perplicata* (Conrad)).

*Anodonta implicata* Say: Maryland (Vidrine 1977a).

*Anodonta suborbiculata* Say: Louisiana (Vidrine 1974a, 1977a, and 1977b).

*Anodonta* sp.: Rio Turbio, Mexico.



*Campeloma decisum* Say: North Carolina (Chandler, 1934) (Viets 1956 considered this mite to be *Unionicola campelomaicola*). However, there are records of *U. aculeata* from snails (*Viviparus viviparus* (Linnaeus)) in Europe (Boettger 1972a). The mite species in this American record remains uncertain.

*Cyrtoneias tampicoensis* (Lea): Mexico (Vidrine *et al.* 1986).

*Disconaias discus* (Lea): Mexico (Vidrine *et al.* 1986).

*Disconaias fimbriata* (Frierson): Mexico.

*Disconaias purpuratus* (Say): Mexico.

*Ellipsaria lineolata* (Rafinesque): Iowa, Illinois, and Missouri (Vidrine 1980a).

*Elliptio buckleyi* (Lea): Florida (Vidrine 1980a).

*Elliptio complanata* (Lightfoot): New Jersey and Delaware (Vidrine 1977a and 1980a).

*Elliptio congaraea* (Lea): North Carolina (Vidrine 1980a).

*Elliptio dilatata* Rafinesque: *Unio gibbosus* Barnes, Michigan (Wolcott 1899 and in Viets and Plate 1954).

*Elliptio icterina* (Conrad): Florida (Vidrine 1980a).

*Elliptio lanceolata* (Lea): Maryland and North Carolina (Vidrine 1980a).

*Elliptio liebmanni* (Philippi): Mexico.

*Elliptio (Canthyria) spinosa* (Lea): Georgia (Vidrine 1977a).

*Elliptio* sp. : Florida (Vidrine 1980a).

*Friersonia irridella* (Pilsbry and Frierson): Mexico.

*Friersonia semirasa* (Pilsbry): Mexico.

*Fusconaia askewi* (Marsh): *Fusconaia lananensis* (Frierson), Louisiana (Vidrine 1980a).

*Fusconaia cerina* (Conrad): Louisiana (Vidrine 1989a).

*Fusconaia cuneolus* (Lea): Tennessee (Vidrine 1980a).

*Fusconaia flava* (Rafinesque): *Unio coccineus* Hild., Michigan (Wolcott 1899 and Viets and Plate 1954); Louisiana and Wisconsin (Vidrine 1980a).

*Lampsilis cardium* Rafinesque: *Unio occidens* Lea and *Unio ventricosus* Barnes, Michigan (Wolcott 1899); *Lampsilis ovata cardium* Rafinesque in Viets and Plate 1954; Minnesota (Vidrine 1980a).

*Lampsilis hydiana* (Lea): Louisiana (Vidrine 1977a).

*Lampsilis radiata radiata* (Gmelin): *Unio luteolus* Lamarck, Michigan (Wolcott 1899); *Ligumia fasciata* Rafinesque in Viets and Plate 1954; Delaware and New Jersey (Vidrine 1980a). Some of these records may actually represent *Lampsilis siliquoidea* (Barnes).

*Lampsilis satur* (Lea): Louisiana (Vidrine 1980a).

*Lampsilis siliquoidea* (Barnes): Michigan (Mitchell 1955); *Lampsilis radiata siliquoidea* (Barnes), Minnesota and Ohio (Vidrine 1980a).

*Lampsilis s. claibornensis* (Lea): Louisiana (Vidrine 1989a).

*Lampsilis teres* (Rafinesque): *Lampsilis anodontoides* (Lea), Texas (Calnan 1976), Louisiana and Texas (Vidrine 1977a and 1980a).

*Leptodea fragilis* (Rafinesque): Louisiana, Minnesota, and Wisconsin (Vidrine 1980a).

*Ligumia nasuta* (Say): Delaware (Vidrine 1977a).

*Ligumia recta* (Lamarck): *Unio rectus* Lamarck, Michigan (Wolcott 1899 and in Viets and Plate 1954).

*Ligumia subrostrata* (Say): Louisiana (Vidrine 1980a).  
*Megaloniais nervosa* (Rafinesque): *Amblema gigantea* (Barnes), Louisiana (Vidrine 1989a).  
*Nephronaias signata* (Pilsbry): Mexico.  
*Obliquaria reflexa* Rafinesque: Minnesota (Vidrine 1980a).  
*Obovaria jacksoniana* (Frierson): *Obovaria castenea* (Lea), Louisiana (Vidrine 1980a).  
*Plectomerus dombeyanus* (Valenciennes): *Amblema dombeyana* (Valenciennes), Arkansas and Louisiana (Vidrine 1980a).  
*Pleurobema riddelli* (Lea): Texas (Vidrine 1989a).  
*Potamilus alatus* (Say): *Unio alatus* Say, Michigan (Wolcott 1899).  
*Potamilus ohiensis* (Rafinesque): *Proptera laevis* (Lea), Louisiana (Vidrine 1980a).  
*Potamilus purpuratus* (Lamarck): Louisiana (Vidrine 1989a).  
*Ptychobranhus occidentalis* (Conrad): *Ptychobranhus fasciolaris* (Rafinesque), Arkansas (Vidrine 1980a).  
*Pyganodon cataracta* (Say): *Anodonta cataracta* Say, New Jersey and South Carolina (Vidrine 1980a).  
*Pyganodon grandis* (Say): *Anodonta plana* Lea, Michigan (Wolcott 1899); Viets and Plate 1954; *Anodonta grandis* Say, Louisiana, Texas, Tennessee, Minnesota, and Mississippi (Calnan 1976, Vidrine 1974a, 1977b, and 1980a).  
*Quadrula apiculata* (Say): Louisiana (Vidrine 1989a).  
*Quadrula cylindrica cylindrica* (Say): Tennessee (Vidrine 1977a).  
*Quadrula nodulata*: Louisiana (Vidrine 1989a).  
*Quadrula pustulosa mortoni* (Conrad): Louisiana.  
*Quadrula pustulosa pustulosa* (Lea): Minnesota (Vidrine 1980a).  
*Quadrula quadrula* (Rafinesque): Louisiana (Vidrine 1980a).  
*Strophitus undulatus* (Say): *Anodonta edentula* Say, Michigan (Wolcott 1899).  
*Toxolasma parvus* (Barnes): *Carunculina parva* (Barnes) (in part), Texas (Calnan 1976), Louisiana, Texas, Mississippi, and Arkansas (Vidrine 1974a, 1977a, and 1980a).  
*Toxolasma texasensis* (Lea): *Carunculina parva* (Barnes) (in part), Texas (Calnan 1976), Louisiana, Texas, Mississippi, and Arkansas (Vidrine 1974a, 1977a, and 1980a).  
*Tritogonia verrucosa* (Rafinesque): Louisiana (Vidrine 1989a).  
*Truncilla donaciformis* (Lea): Minnesota and Wisconsin (Vidrine 1980a).  
*Truncilla truncata* Rafinesque: Minnesota (Vidrine 1980a).  
*Uniomerus declivus* (Say): Louisiana and Arkansas (Vidrine 1980a).  
*Uniomerus tetralasmus* (Say): Louisiana (Vidrine 1980a).  
*Utterbackia imbecillis* (Say): *Anodonta imbecillus* Say, Texas (Calnan 1976), Louisiana, Texas, Mississippi, and Arkansas (Vidrine 1974a, 1977a, and 1980a).  
*Venustaconcha ellipsiformis* (Conrad): *Unio spatulatus* Lea, Michigan (Wolcott 1899); Viets and Plate 1954.  
*Villosa amygdala* (Lea): Florida (Vidrine 1980a).  
*Villosa iris* (Lea): *Unio Novi-eboraci* Lea, Michigan (Wolcott 1899); *Ligumia nervosa novi-eboraci* Lea in Viets and Plate 1954.  
*Villosa lienosa* (Conrad): Louisiana (Vidrine 1989a).  
*Villosa villosa* (Wright): Florida (Vidrine 1980a).

Subgenus *Anodontinatax* Vidrine 1986a

TYPE SPECIES-- *U. intermedia* (Koenike 1882)

ETYMOLOGY-- Named for their host group of mussels (Anodontinae).

DIAGNOSIS-- Female genital field with 2 pairs of acetabular plates that are similar to those of *Pentatax* and *Vietsatax*; male genital field similar to those of *Pentatax*; pedipalps similar to those of *Pentatax*; male fourth walking leg sexually dimorphic with groups of serrated setae on the distal Ge and mesial Ti; all walking legs with deeply bifid tarsal claws with dorsal prong longer than ventral prong.

HABITAT-- All are parasites of Unionidae, but the males are at times collected free-swimming.

DISTRIBUTION-- North America, Asia and Europe.

DISCUSSION-- *Anodontinatax* is intermediate in morphology between the subgenera *Pentatax* and *Vietsatax*. All three subgenera are considered as mantle mites, since they oviposit in the mantle epithelia of their hosts, and this may account for some convergence. While the females of the three subgenera are difficult to separate, the males are separated based upon leg morphology and genital field morphology.

ADDITIONAL SPECIES INCLUDED--*U. belli* Vidrine 1986a, *U. clarki* Vidrine 1986a, *U. mitchelli* Conroy 1982, *U. smithae* Vidrine 1986a, and *U. wolcotti* (Piersig 1900).

*Unionicola (Anodontinatax) belli* Vidrine 1986a  
Plate 27 in Vidrine (1996a)

Synonymy--

*Atax intermedius* sensu Wolcott 1899 (in part)

*Unionicola* type G in Vidrine 1974a

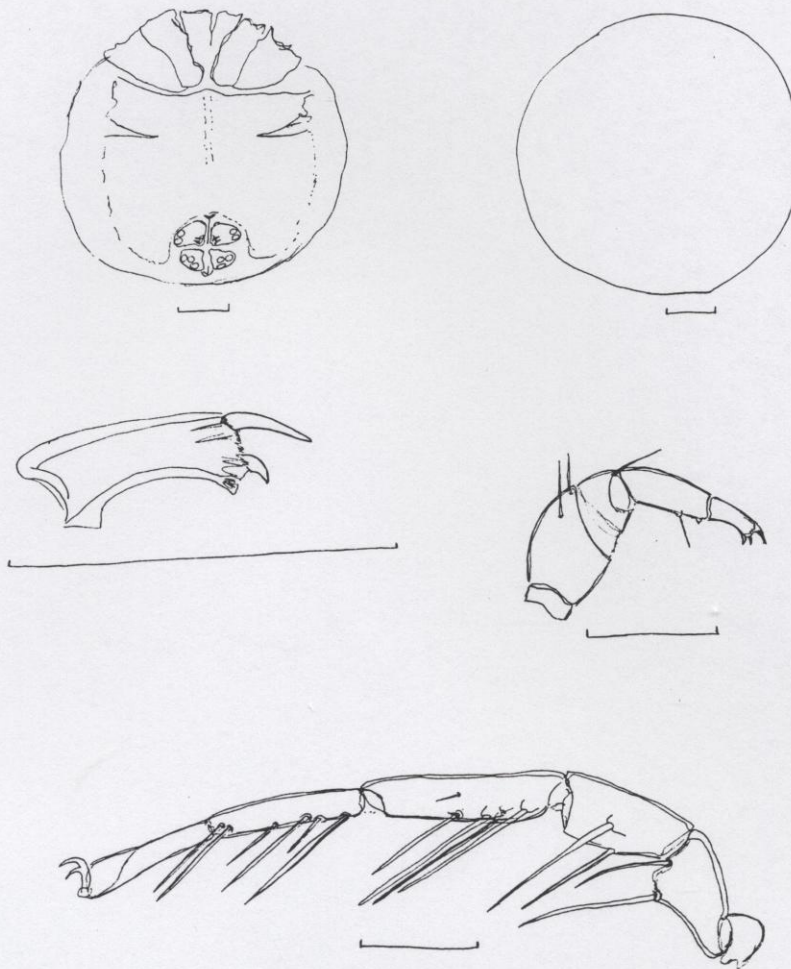
*Unionicola (Anodontinatax) belli* Vidrine 1986a

Museum type number(s) and location-- CNC 19111, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (female) found in *Arcidens confragosus* (Say) from Bayou Wauksha at Rte. LA 10, LeBeau, St. Landry Parish, Louisiana collected 7 July 1984 by Macky and M. F. Vidrine. Males remain unknown.

Etymology-- Named to honor Bill Bell.

Diagnosis-- Character states of the subgenus; female dorsum covered by a large dorsal plate; posterior coxal groups fused along midline and lacking well defined borders; body somewhat dorsoventrally flattened; female anterior genital (acetabular) plates with 2, short, stout setae on inner flap; pedipalp Ta with 2 clawlets that are widely separated by a gap; first walking leg Ge with 2 pairs of long setae.



Figures 1-5. *Unionicola belli* Vidrine 1986a. 1. Female venter (reticulations not drawn). 2. Female dorsal plate (reticulations not drawn). 3. Tarsus of pedipalp. 4. Pedipalp. 5. First walking leg. Scales equal 100 micrometers.



Map 14. Known distribution of *Unionicola belli* Vidrine 1986 in North America.



Female (12 specimens)-- Length including capitulum 826 (760-950); length of posterior coxal group 466 (440-520); dorsal lengths of pedipalp segments: Ti 106 (95-112); Ta 57 (50-63); dorsal lengths of leg segments: leg I: TFe 155 (140-170); Ge 211 (190-230); Ti 174 (150-200); Ta 139 (130-150); leg IV: TFe 194 (170-210); Ge 229 (200-250); Ti 282 (240-320); Ta 205 (180-225).

Notes-- *Unionicola belli* were measured from: *A. confragosus* from backwater pools of Neches River at Rte. U. S. 96, Jasper County, Texas, collected 2 June 1978 by M. F. Vidrine; *L. costata* from Strawberry River at Rte. U. S. 167, Evening Shade, Sharp County, Arkansas, collected 13 August 1985 by Gail, Macky, and M. F. Vidrine; *Lasmigona complanata complanata* (Barnes) from Big Darby Creek below Mount Sterling Bridge, Pickaway County, Ohio, collected 27 August 1975 by Ed Stern; *Arkansia wheeleri* (Ortmann and Walker) from Kiamichi River ca. 2.0 km southeast of Clayton at Rte. U. S. 271 bridge, Pushmataha County, Oklahoma, collected 22 August 1971 by Dave Stansbery; and Little Sioux River, Okoboji, Iowa, collected 11 August 1924 (MC-FMNH). The females of this species appear to be intermediate in morphology between the females of *U. clarki* and *U. mitchelli*. The tarsal clawlets of the pedipalps and the genu of the first walking leg resemble *U. mitchelli*, while the dorsum and venter resemble those of female *U. clarki*. I have returned to the type locality a number of times in the hopes of obtaining males, but each visit has yielded no males.

Hosts:

*Arcidens confragosus* (Say): Louisiana (Vidrine 1974a), Texas (Calnan 1976), Louisiana and Texas (Vidrine 1980a).

*Arkansia wheeleri* Ortmann and Walker: Oklahoma (Vidrine 1980a).

*Lasmigona complanata complanata* (Barnes): *Margaritana complanata* Barnes, Nebraska (Wolcott 1899); *Pterosnya complanata* Barnes in Viets and Plate 1954; Ohio (Vidrine 1980a).

*Lasmigona costata* (Rafinesque): Arkansas (Vidrine 1986a).

*Unionicola (Anodontinatax) clarki* Vidrine 1986a  
Plates 28-30 in Vidrine (1996a)

Synonymy--

*Atax intermedius sensu* Wolcott 1899 (in part)

*Unionicola (Anodontinatax) clarki* Vidrine 1986a in Vidrine 1986e

Museum type number(s) and location-- CNC 19110, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Lasmigona costata* (Rafinesque) from Ouachita River at Rte. U. S. 270, Montgomery County, Arkansas, collected 12 August 1978 by Darryl Clark, Bill Bell and M. F. Vidrine.

Etymology-- Named to honor Darryl R. Clark.

Diagnosis-- Character states of the subgenus; male and female dorsum covered by a large dorsal plate that is fused to the coxae by secondary sclerotization; posterior coxal groups fused along midline; body strongly dorsoventrally flattened; female anterior acetabular plates with 3, short, stout setae on inner flap; pedipalp Ta with 2 clawlets that are not widely separated by a gap; first walking leg Ge with a pair of long setae and a pair of short setae; male fourth walking leg Ge bearing 6-8, pectinate setae distally, and Ti bearing 11-19, short, pectinate setae in a ventral mass.

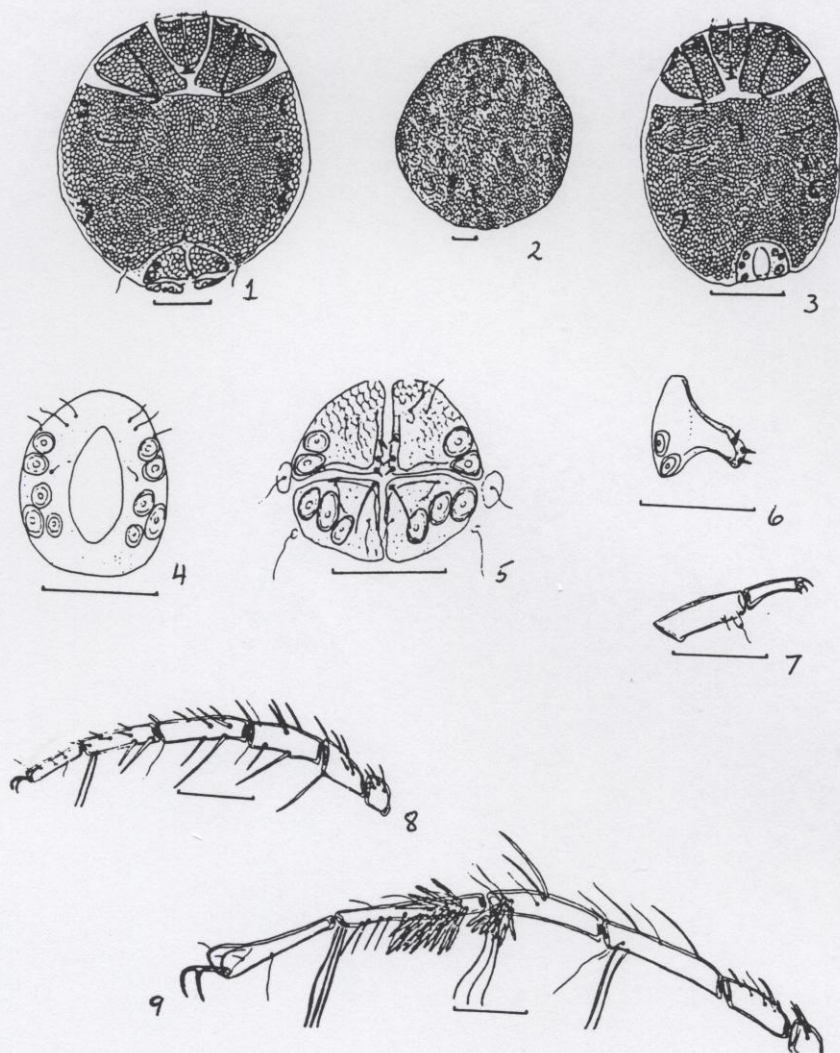
Male (5 specimens)-- Length including capitulum 493 (450-600); length of posterior coxal group 255 (225-300); dorsal lengths of pedipalp segments: Ti 63 (55-75); Ta 38 (35-45); dorsal lengths of leg segments: leg I: TFe 120 (110-150); Ge 162 (150-200); Ti 148 (115-260); Ta 108 (95-140); leg IV: TFe 184 (170-230); Ge 156 (140-200); Ti 189 (170-240); Ta 139 (130-150).

Female (7 specimens)-- Length including capitulum 609 (475-680); length of posterior coxal group 360 (300-400); dorsal lengths of pedipalp segments: Ti 83 (55-95); Ta 54 (35-55); dorsal lengths of leg segments: leg I: TFe 115 (95-130); Ge 151 (130-170); Ti 119 (100-130); Ta 94 (75-110); leg IV: TFe 139 (115-150); Ge 170 (135-190); Ti 221 (180-240); Ta 154 (115-170).

Notes-- *Unionicola clarki* was also measured from: *L. costata* from Grand River, Grand Rapids, Michigan (Marshall Collection--Field Museum of Natural History, Chicago (MC-FMNH)), collected July and August, 1895 by Robert Wolcott; *Strophitus undulatus* (Say) from Glover River at Rte. OK 3 and 7, McCurtain County, Oklahoma, collected 12 August 1978 by Darryl Clark, Bill Bell, and M. F. Vidrine; and in a rice field ca. 3.0 km south of Welsh, Jefferson Davis Parish, Louisiana, collected July 1984 by M. F. Vidrine (Vidrine *et al.* 1987). This species is distinctive and has extensive secondary sclerotization. The structures of the first walking legs, pedipalps, dorsum and venter are combined to form a diagnosis. The similarity in secondary sclerotization to members of the subgenus *Neoatax* is possibly a case for parallel evolution.



Map 15. Known distribution of *Unionicola clarki* Vidrine 1986 in North America.



Figures 1-9. *Unionicola clarki* Vidrine 1986. 1. Female venter. 2. Female dorsal plate. 3. Male venter. 4. Male genital field. 5. Female genital field. 6. Female anterior plate of genital field. 7. Tibia and tarsus of pedipalp. 8. First walking leg. 9. Male fourth walking leg. Scale equals 100 micrometers. Reprinted with permission from the International Journal of Acarology: Vidrine 1986a.

Hosts:

*Actinonaias ligamentina* (Lamarck): *Actinonaias carinata* (Barnes), Arkansas (Vidrine 1980a).

*Lasmigona costata* (Rafinesque): *Margaritana rugosa* Barnes, Michigan (Wolcott 1899 and Viets and Plate 1954); Arkansas (Vidrine 1986a).

*Strophitus undulatus* (Say): Oklahoma (Vidrine 1986a).



*Unionicola (Anodontinatax) mitchelli* Conroy 1982  
Plates 31-35 in Vidrine (1996a)

Synonymy--

*Atax intermedius sensu* Wolcott 1899 (in part)

*Unionicola (Anodontinatax) mitchelli* Conroy 1982, Vidrine 1986a, 1986e

Museum type number(s) and location-- Numbers FWA-145-01 (holotype) and FWA-141-01 in J. Conroy's collection.

Type locality and host-- Pond 3, Fort Whyte Nature Reserve, Manitoba, Canada, collected 8 August 1978. Two males were collected swimming over soft mud.

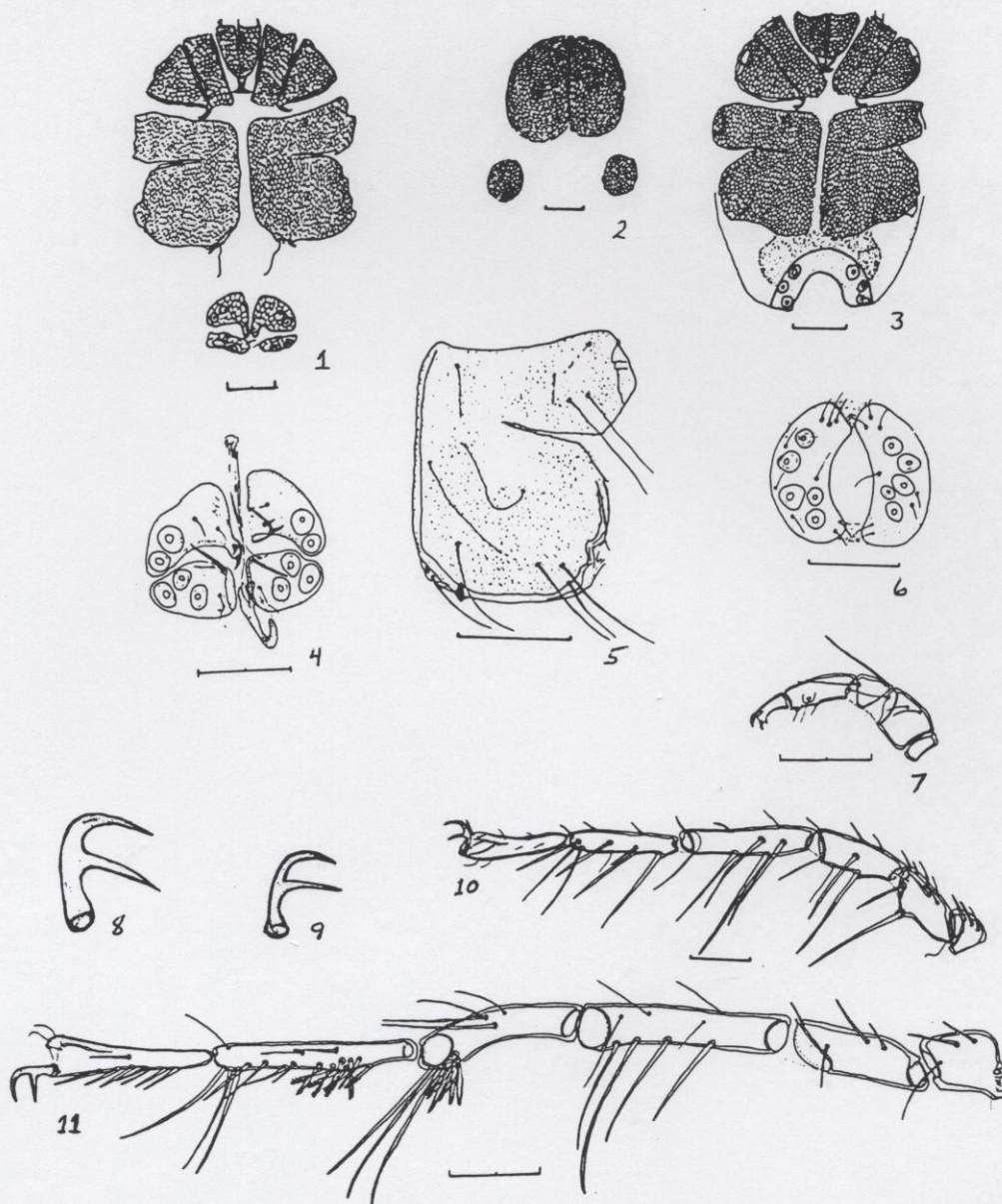
Etymology-- Named to honor Rodger Mitchell.

Diagnosis-- Character states of the subgenus; male with a large, lightly sclerotized plate; female dorsum with 3 plates, the anterior plate appearing as 2 fused plates; posterior coxal group of female with distinct borders; posterior coxal group of male with distinct borders and fused by secondary sclerotization to the genital field; anterior female acetabular plates bearing 2, short, stout setae on inner flap; Ta of pedipalps with 2, widely separated clawlets, the dorsal clawlet distinctly longer than the ventral clawlet; first walking leg Ge with 2 pairs of long setae; fourth walking leg of male with Ge bearing a dense, distal cluster of 6-9 pectinate setae, and with Ti bearing 9-13 pectinate setae in a ventral mass.

Male (7 specimens)-- Length including capitulum 579 (500-625); length of posterior coxal group 241 (200-280); dorsal lengths of pedipalp segments: Ti 81 (75-86); Ta 39 (32-50); dorsal lengths of leg segments: leg I: TFe 119 (100-130); Ge 159 (135-170); Ti 140 (125-150); Ta 128 (110-140); leg IV: TFe 203 (180-220); Ge 169 (150-180); Ti 206 (185-225); Ta 172 (160-185).

Female (12 specimens)-- Length including capitulum 923 (700-1100); anterior dorsal plate 231 (180-270) long, 328 (270-390) wide; length of posterior coxal group 302 (250-350); dorsal lengths of pedipalp segments: Ti 124 (105-140); Ta 59 (50-65); dorsal lengths of leg segments: leg I: TFe 176 (140-200); Ge 251 (200-290); Ti 216 (180-250); Ta 185 (150-200); leg IV: TFe 252 (205-280); Ge 288 (230-320); Ti 372 (300-420); Ta 274 (230-310).

Notes-- Conroy (1982) provided measurements for two males in his original description. Those measurements agree rather well with those provided here. *Unionicola mitchelli* were measured from: Lincoln, Nebraska (MC-FMNH), collected October 1894 by Robert Wolcott; from *Anodonta* (= *Pyganodon*) *grandis* from an irrigation canal off Rte. U. S. 190, Kinder, Allen Parish, Louisiana, collected 3 July 1976 by Blake and M. F. Vidrine; from *Anodonta* (= *Pyganodon*) *grandis* from St. Croix River, Peirce County, Wisconsin, collected July 1978 by S. L. H. Fuller; *Anodonta* (= *Utterbackia*) *imbecillis* from Bayou Dorcheat at Rte. LA 2, Webster Parish, Louisiana, collected 14 August 1978 by Darryl Clark, Bill Bell, and M. F. Vidrine; and from *Anodonta hallenbecki* Lea (= ?



Figures 1-11. *Unionicola mitchelli* Conroy 1982. 1. Female venter. 2. Female dorsal plates. 3. Male venter. 4. Female genital field. 5. Female posterior coxal plates. 6. Male genital field. 7. Pedipalp. 8. Tarsal claw of fourth walking leg. 9. Tarsal claw of first walking leg. 10. First walking leg. 11. Male fourth walking leg. Scale equals 100 micrometers. Reprinted with permission from the International Journal of Acarology: Vidrine 1986a.



Map 16. Known distribution of *Unionicola mitchelli* Conroy 1982 in North America.

*Pyganodon grandis* complex) from Mosquito Creek at Rte. U. S. 90, Gadsden County, Florida, collected 19 July 1977 by D. J. Bereza and M. F. Vidrine. The female of this species was first described by Vidrine (1986a). It is apparently different from *U. wolcotti*, especially in the structure of the dorsal plates in addition to the pedipalpal tarsal clawlets. These species are apparently sibling species.

Hosts:

*Pyganodon grandis* (Say): *Anodonta hallenbecki* (Lea), Florida (Vidrine 1986a); *Anodonta grandis* Say, Louisiana and Wisconsin (Vidrine 1986a).

*Utterbackia imbecillis* (Say): *Anodonta imbecillus* Say, Louisiana (Vidrine 1986a).

*Unionicola (Anodontinatax) smithae* Vidrine 1986a  
Plate 36 in Vidrine (1996a)

Synonymy--

*Atax intermedius* sensu Wolcott 1899 (in part)

*Unionicola (Anodontinatax) smithae* Vidrine 1986a, 1986e

Museum type number(s) and location-- CNC 19112, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Lasmigona costata* from Cox Creek at Highway 86, E. Zubers Corners, Waterloo County, Ontario, Canada, collected 6 June 1970 by B. T. Kidd.

Etymology-- Named to honor Muriel Smith and Ian Smith.

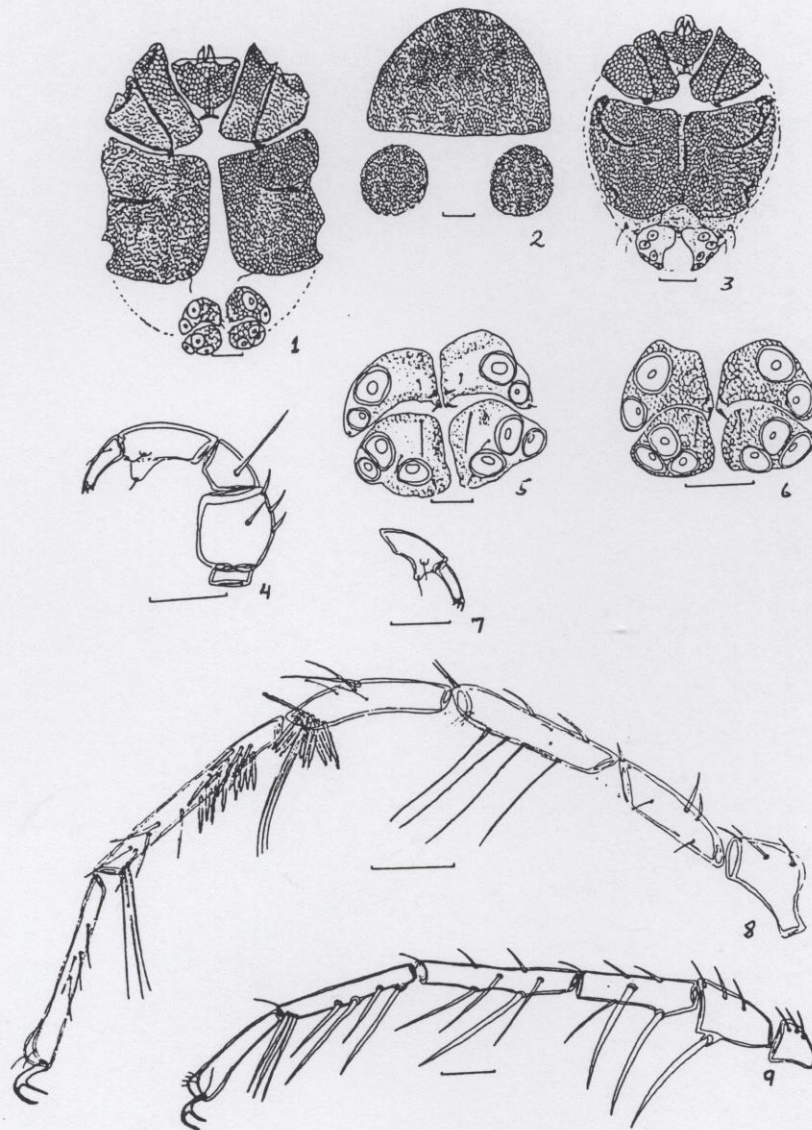
Diagnosis-- Character states of the subgenus; male with a single, large, sclerotized plate; female dorsum with 3 plates, the anterior plate greatly enlarged; posterior coxal group with distinct borders; male posterior coxal group fused along midline and with the genital field by secondary sclerotization; anterior female acetabular plates bearing 2, short, stout setae on inner flap; Ta of pedipalps with 2 clawlets that are not widely separated and are nearly equal in size; first walking leg Ge with 2 pairs of long setae; fourth walking leg of male with Ge bearing a dense, distal cluster of 10-11 pectinate setae, and with Ti bearing 15-16 pectinate setae in a ventral mass.

Male (2 specimens)-- Length including capitulum 675 (650-700); length of posterior coxal group 303 (280-325); dorsal lengths of pedipalp segments: Ti 100; Ta 55; dorsal lengths of leg segments: leg I: TFe 185 (180-190); Ge 270; Ti 205 (190-220); Ta 200; leg IV: TFe 228 (225-230); Ge 210; Ti 323 (320-325); Ta 275.

Female (9 specimens)-- Length including capitulum 1022 (1000-1200); anterior dorsal plate 375 (280-420) long, 608 (560-700) wide; length of posterior coxal group 378 (350-400); dorsal lengths of pedipalp segments: Ti 145 (135-150); Ta 86 (80-95); dorsal lengths of leg segments: leg I: TFe 239 (220-250); Ge 332 (320-350); Ti 281 (270-290); Ta 224 (210-240); leg IV: TFe 333 (310-350); Ge 422 (410-440); Ti 569 (550-580); Ta 436 (420-450).

Notes-- *Unionicola smithae* was also measured from: *L. costata* from Little South Fork, Cumberland River, Kentucky, collected on 21 October 1978; *L. costata* from Ouachita River at Rte. U. S. 270, Montgomery County, Arkansas, collected 12 August 1978 and 15 August 1985 by Darryl Clark, Bill Bell, Gail Macky, and M. F. Vidrine; and from Grand River, Grand Rapids, Michigan, collected during July and August 1895 by Robert Wolcott. This species can be separated from all the other similar species by its large size, dorsal morphology, and modifications of the male fourth walking leg morphology.





Figures 1-9. *Unionicola smithae* Vidrine 1986. 1. Female venter. 2. Female dorsal plates. 3. Male venter. 4. Pedipalp. 5-6. Female genital fields. 7. Tibia and tarsus of pedipalp. 8. Male fourth walking leg. 9. First walking leg. Scale equals 100 micrometers. Reprinted with permission from the International Journal of Acarology: Vidrine 1986a.



Map 17. Known distribution of *Unionicola smithae* Vidrine 1986 in North America.

Hosts:

*Lasmigona costata* (Rafinesque): Arkansas, Kentucky, and Tennessee (Vidrine 1986a, Vidrine and Clark 1993, and Vidrine and Wilson 1991).

*Pyganodon grandis* (Say): Tennessee (Vidrine and Wilson 1991).

*Unionicola (Anodontinatax) wolcottii* (Piersig 1900)  
Plate 37 in Vidrine (1996a)

Synonymy--

*Atax intermedius* sensu Wolcott 1899 (in part)

*Atax intermedius wolcottii* Piersig 1900, 1901

*Unionicola intermedia wolcottii* (Piersig 1900), Marshall 1926 and 1933b

*Unionicola (Pentatax) intermedia wolcottii* (Piersig 1900), Viets 1956, Mitchell 1954, and Crowell 1961

*Unionicola (Pentatax) intermedia* (Koenike 1882), Viets and Plate 1954

*Unionicola (Pentatax) wolcottii* (Piersig 1900), Mitchell 1957b, Habeeb 1967, Dobson 1966, Murray 1965, Vidrine and Bereza 1978, Vidrine 1980a.

*Unionicola (Anodontinatax) wolcottii* (Piersig 1900) in Vidrine 1986a, 1986e

Museum type number(s) and location-- The types in the Marshall Collection in the Field Museum of Natural History, Chicago, Illinois.

Type locality and host-- Males and females from Twin Lakes, Charlevoix, Michigan, collected 6 August 1894 by Robert Wolcott are here designated the types.

Etymology-- Named to honor Robert Wolcott.

Diagnosis-- Character states of the subgenus; male lacking an obvious dorsal plate; female dorsal shield with 4 plates; male and female with posterior coxal group distinctly bordered and not elongate; male and female genital fields not fused with posterior coxal plates; Ta of pedipalps with 2 clawlets of near equal size and not separated by a wide gap; fourth walking leg of male with Ge bearing 2, elongate setae and a dense, distal cluster of 6-8 pectinate setae, and with Ti bearing 9-11 pectinate setae in a ventral mass.

Male (2 specimens)-- Length including capitulum 625 (600-650); length of posterior coxal group 230 (220-240); dorsal lengths of pedipalp segments: Ti 85; Ta 50; dorsal lengths of leg segments: leg I: TFe 155 (150-160); Ge 210 (200-220); Ti 175 (170-180); Ta 160; leg IV: TFe 205 (190-220); Ge 180 (170-190); Ti 240; Ta 180.

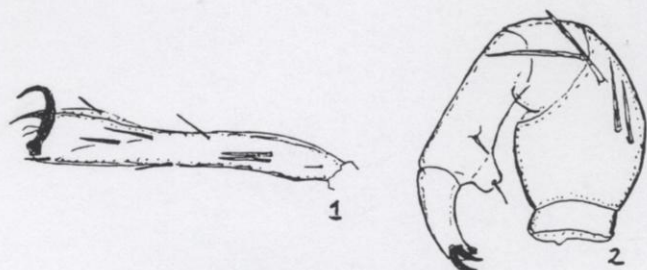
Female (8 specimens)-- Length including capitulum 886 (750-1000); anterior dorsal plates 87 (80-100) in diameter; length of posterior coxal group 276 (230-280); dorsal lengths of pedipalp segments: Ti 132 (125-145); Ta 73 (65-82); dorsal lengths of leg segments: leg I: TFe 178 (160-210); Ge 256 (230-310); Ti 219 (190-260); Ta 188 (160-210); leg IV: TFe 234 (190-280); Ge 299 (260-350); Ti 384 (330-475); Ta 291 (250-350).

Notes-- *Unionicola wolcottii* was re-evaluated by Mitchell (1957). I have examined Wolcott's type lots, and 5 species were in those lots (Vidrine 1986). This species is amply figured in Wolcott



(1899), Marshall (1933b), and Mitchell (1957b). Males and females were measured from Twin Lakes, Charlevoix, Michigan, collected 6 August 1894 by Robert Wolcott. Additional females were measured from my lots from: *Anodontoides ferussacianus* (Lea) from Muskingum River at Lowell, Washington County, Ohio, collected 24 September 1969; *Anodonta* (= *Utterbackia*) *imbecillis* (Say), *Anodonta couperiana* Lea, and *Anodonta* (= *Pyganodon*) *cataracta* (Say) from Savannah River, South Carolina; *Anodonta* (= *Pyganodon*) *grandis* (Say) from Ouachita River at Ink, Polk County, Arkansas, collected 12 August 1978 by Darryl Clark, Bill Bell, and M. F. Vidrine; *Anodonta kennealyi* Lea from Laird Lake ca. 18 km north of Princeton, British Columbia, Canada, collected 5 August 1972 by A. H. Clarke; and *Anodonta wahlamatensis* Lea (= *Anodonta nutalliana* Lea) from Cultus Lake, British Columbia, Canada, collected 15 March 1960 by A. B. Rudlich.

*Unionicola wolcotti* is a sibling species with *U. intermedia* (Marshall 1933b, Mitchell 1957b, and Vidrine 1986a). The latter species commonly parasitizes species of *Anodonta* in Europe and Asia (Mitchell and Pitchford 1953, Mitchell 1957b, and Hevers 1978c). The females of both species are apparently indistinguishable, while the males are separated based upon the structure of the fourth walking legs (Mitchell 1957b and Vidrine 1986a). *Unionicola intermedia* is adequately figured in Hevers (1978c), but the female dorsum is figured in Vidrine (1986a), based upon specimens from Holland and Poland. Hevers (1978c) also provided rather extensive series of measurements of German specimens of this latter species.



Figures 1-2. *Unionicola wolcotti* (Piersig 1900). 1. Tarsus of fourth walking leg. 2. Pedipalp. Redrawn after Wolcott (1899).





Map 18. Known distribution of *Unionicola wolcotti* (Piersig 1900) in North America.

Hosts:

*Anodonta kennerlyi* Lea: British Columbia, Canada.

*Anodonta nutalliana* Lea: British Columbia, Canada.

*Anodonta suborbiculata* Say: Louisiana (Vidrine 1980a).

*Anodontoides ferussacianus* (Lea): *Anodonta subcylindracea* Lea, Michigan (Wolcott 1899 and Viets and Plate 1954).

*Pyganodon cataracta* (Say): New Brunswick, Canada (Gordon, Swan, and Paterson 1979), North Carolina and South Carolina (Vidrine 1980a).

*Pyganodon gibbosa* (Say): *Anodonta couperiana* (Lea), South Carolina (Vidrine 1980a).

*Pyganodon grandis* (Say): *Anodonta ovata* Lea, *Anodonta footiana* Lea, and *Anodonta marryatana* Lea, Michigan (Wolcott 1899); *Anodonta plana* Lea, *Anodonta decora* Lea, and *Anodonta grandis* Say, Nebraska (Wolcott 1899); *Pyganodon grandis footiana* Lea, *Pyganodon grandis lugubris* Say, and *Pyganodon grandis* Say in Viets and Plate 1954; *Anodonta grandis* Say, Tennessee (Najarian 1955, this mite was called *Unionicola* sp. near *intermedia*), Kansas (Murray 1965), Louisiana, Wisconsin, Illinois, Arkansas, and Minnesota (Vidrine 1980a).

*Strophitus undulatus* (Say): *Anodonta edentula* Say, Michigan (Wolcott 1899 and Viets and Plate 1954), Louisiana (Vidrine 1980a).

*Utterbackia imbecillis* (Say): *Anodonta imbecillus* Say, Apalachicola (Dobson 1966), Louisiana and South Carolina (Vidrine 1980a).

Mite species uncertain:

*Lampsilis radiata radiata* (Gmelin): *Unio luteolus* Lamarck, Michigan (Wolcott 1899); *Ligumia fasciata* Rafinesque in Viets and Plate 1954.

*Lampsilis siliquoidea* (Barnes): *Lampsilis luteola*, Lake Okoboji, Iowa (Marshall 1926).

*Ligumia subrostrata* (Say): *Unio subrostratus* Say, Nebraska (Wolcott 1899); *Ligumia nervosa* Rafinesque in Viets and Plate 1954; Tennessee (Najarian 1955).

*Pyganodon fragilis* (Lamarck): *Anodonta fragilis* Lamarck, Michigan (Wolcott 1899); *Anodonta marginata* Say in Viets and Plate 1954.

*Pyganodon gibbosa* (Say): *Anodonta gibbosa* Say, Apalachicola (Dobson 1966).

*Utterbackia peggyae* (Johnson): *Anodonta peggyae* Johnson, Apalachicola (Dobson 1966).

*Unio merus tetralasmus* (Say): *Unio Jamesianus* Lea, Nebraska (Wolcott 1899 and Viets and Plate 1954).

## Subgenus *Unionicolides* Lundblad 1937

TYPE SPECIES--*U. sica* Lundblad 1937

ETYMOLOGY-- Named to signal the similarity in form to members of the typical genus and subgenus.

DIAGNOSIS--Genital acetabula usually 4-6 pairs; female genital field with a single pair of acetabular plates; each plate with at least one seta on the inner margin resulting in a central complex of setae in the genital field; male genital field similar to *Unionicola*; pedipalps subcylindrical and well-sclerotized; male and female legs similar, except for minor chaetotaxic differences in the first walking legs of some species; tarsal claws vary from simple to deeply bifid; an obvious inflated setae extending dorsally over the tarsal claws of the walking legs, similar to other subgenera including *Atacella*, *Berezatax*, and *Australatax*.

HABITAT--Parasites of Hyriidae, Unionidae, and Mycetopodidae.

DISTRIBUTION--North and South America.

DISCUSSION--*Unionicolides* is similar to *Berezatax*, *Atacella*, and *Australatax* (Vidrine 1985a). These subgenera are apparently derived from ancestral groups that might have resembled the South American species, *U. procurvipes* and *U. brasiliensis* (Vidrine 1992a). *Unionicola pachyscelus* Lundblad 1941, a rather divergent South American species, is returned to the subgenus *Unionicolella* Lundblad 1941, which is here resurrected (see description in Cook 1974). The first walking legs and its tarsal claw are too divergent for this species to remain among the *Unionicolides*, and it represents a distinctive divergence from a common ancestor with the *Unionicolides*.

ADDITIONAL SPECIES INCLUDED-- *U. alleni* Vidrine 1987b, *U. amandita* Mitchell and Wilson 1965, *U. bakeri* Vidrine 1986d, *U. bogani* Vidrine 1987b, *U. bonariensis* Mauri and Alzuet 1972, *U. burchi* Vidrine 1986d, *U. calnani* Vidrine 1986d, *U. conroyi* Vidrine 1986d, *U. fossulata* (Koenike 1895), *U. fulleri* Vidrine 1986d, *U. gailae* Vidrine 1987b, *U. gordonii* Vidrine 1987b, *U. gowani* Vidrine 1987b, *U. guilloryi* Vidrine 1987b, *U. hendrixii* Vidrine 1987b, *U. hoesei* Vidrine 1986d, *U. lasallei* Vidrine 1986d, *U. kavanaghi* Vidrine 1987b, *U. parkeri* Vidrine 1987b, *U. poundsi* Vidrine 1986d, *U. sakantaka* Mitchell and Wilson 1965, *U. scutella* Vidrine 1986d, *U. stansberyi* Vidrine 1986d, *U. stricta* (Wolcott 1898), *U. tupara* Mitchell and Wilson 1965, *U. vamana* Mitchell and Wilson 1965, *U. vikitra* Mitchell and Wilson 1965, and *U. vikitrella* Vidrine 1987b.

*Unionicola (Unionicolides) alleni* Vidrine 1987b  
Plates 38-41 in Vidrine (1996a)

Synonymy--

*Unionicola vamana* group variable 3 (in part) in Vidrine (1980).

*Unionicola (Unionicolides) alleni* Vidrine 1987b

*Unionicola (Unionicolides) vamana* Mitchell and Wilson 1965 in Vidrine 1986d, 1986e (in part)

Museum type number(s) and location-- CNC 19664, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Found in *Elliptio crassidens* (Lamarck 1819) from East Fork Amite River ca. 15 km west of Gilsburg and ca. 2 km north of Louisiana border, Amite County, Mississippi, collected on 8 November 1981 by D. R. Clark and M. F. Vidrine.

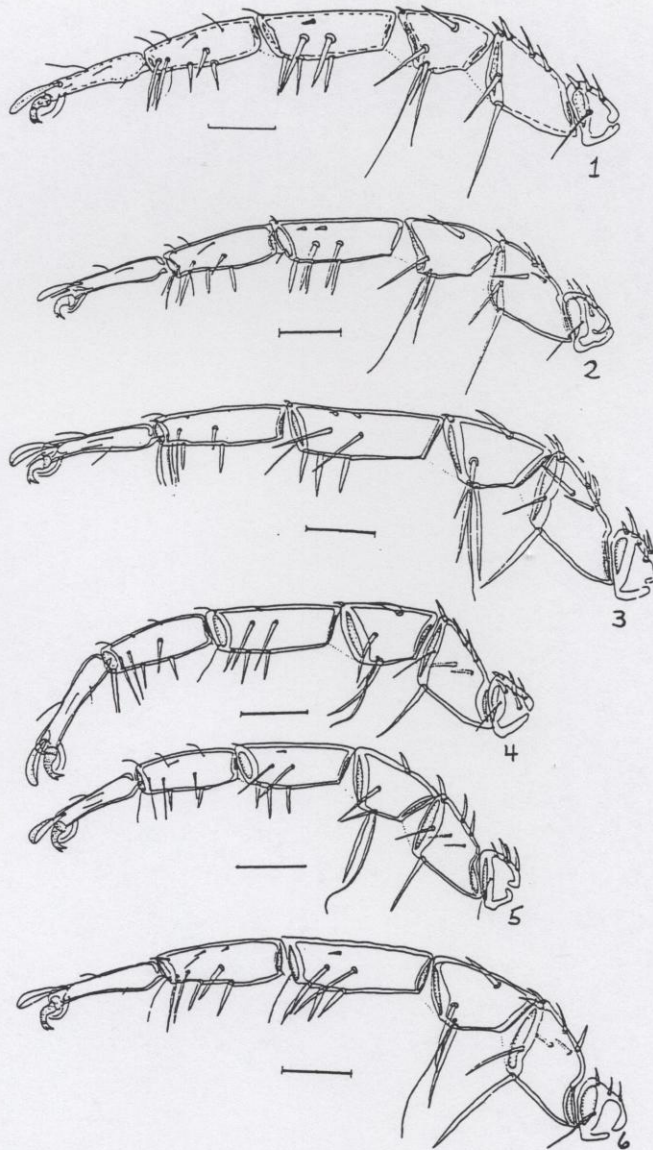
Etymology-- Named to honor Charles M. Allen.

Diagnosis-- Character states of the subgenus; chaetotaxy and leg segment ratios of the first walking leg distinctive; Ta of the first walking leg equal to or shorter than Ti; ventral spines on the Ti shorter than the width of Ti; dorsal setae on Ge usually two short blunted setae; ventral setae on Ge equal to or shorter than width of Ge; usually two setae in central row on Ge; central and ventral rows of setae on Ge pointed at tips; male and female legs nearly identical.

Male (holotype)-- Length including capitulum 1000; length of posterior coxal group 350; dorsal lengths of pedipalp segments: Ti 130; Ta 65; dorsal lengths of leg segments: leg I: Ge 210; Ti 190; Ta 160; leg IV: Ge 260; Ti 360; Ta 350.

Female (allotype)-- Length including capitulum 1150; length of posterior coxal group 390; dorsal lengths of pedipalp segments: Ti 160; Ta 80; dorsal lengths of leg segments: leg I: Ge 240; Ti 215; Ta 170; leg IV: Ge 290; Ti 400; Ta 365.

Notes-- It is also known from *E. strigosus* (Lea 1840), *E. buckleyi* (Lea 1843), *E. icterina* (Conrad 1834), *E. jayensis* (Lea 1838), and *Uniomerus obesus* (Lea). Its range includes Alabama, Florida, Georgia, Louisiana, and Mississippi. *Unionicola parkeri*, *U. gowani*, and *U. alleni* are apparently sibling species with very minor differences (Vidrine 1987b).



Figures 1-6. *Unionicola alleni* Vidrine 1987. 1. Male first walking leg (from *Elliptio crassidens*) Reprinted with permission from the International Journal of Acarology: Vidrine 1987b. 2. Male first walking leg (from *Elliptio crassidens*). 3. Female first walking leg (from *Elliptio crassidens*). 4. Male first walking leg (from *Elliptio buckleyi*). 5. Male first walking leg (from *Elliptio strigosus*). 6. Female first walking leg (from *Uniomerus* sp.). Scale equals 100 micrometers.





Map 19. Known distribution of *Unionicola alleni* Vidrine 1987 in North America.

Hosts:

*Elliptio arctata* (Conrad): Florida (Vidrine 1980a).

*Elliptio buckleyi* (Lea): Florida (Vidrine 1980a).

*Elliptio crassidens* (Lea): Louisiana and Mississippi (Vidrine 1980a).

*Elliptio icterina* (Conrad): Florida (Vidrine 1980); *Elliptio* sp., Burnt Corn Creek, Alabama (Vidrine 1980a).

*Elliptio jayensis* (Lea): Florida (Vidrine 1980a).

*Elliptio mcMichaeli* Clench and Turner: Florida (possible *U. vamana* in Dobson 1966).

*Elliptio strigosus* (Lea): Georgia, Florida, and Alabama (Vidrine 1980a).

*Uniomerus obesus* (Lea): *Uniomerus tetralasmus* (Say), Alabama and Florida (Vidrine 1980a). (The host may be *Uniomerus caroliniana* (Bosc)).

*Unionicola (Unionicolides) amandita* Mitchell and Wilson 1965  
Plates 42-46 in Vidrine (1996a)

Synonymy--

*Unionicola (Pentatax) amandita* Mitchell and Wilson 1965, Habeeb 1967, Vidrine 1979a

*Unionicola* type H in Vidrine 1974a

*Unionicola (Unionicolides) amandita* Mitchell and Wilson 1965, Vidrine 1986d, 1986e, 1989

*Unionicola (Unionicolella) amandita* Mitchell and Wilson 1965 in Vidrine 1980a

*Unionicola amandita* (western morph) in Vidrine 1980a

Museum type number(s) and location-- Field Museum of Natural History, Chicago, Illinois.

Type locality and host-- Found in *Amblema costata* (Rafinesque) (*A. plicata*) from 35.35N/86.47W, Duck River, Marshall County, Tennessee, collected on 25 August 1956 by J. L. Wilson.

Etymology-- From Sanskrit "amandita" meaning "unadorned" for the large size of the mites and few setae on the legs (Mitchell and Wilson 1965)

Diagnosis-- Character states of the subgenus; dorsum with 2 pairs of short, linear apodemes; posterior coxal group usually divided by an incomplete suture; pedipalps well sclerotized; genital field lightly sclerotized; legs moderately setose, but the first walking leg has few setae or hairs; tarsal claws of first walking legs bifid at tip; tarsal claws of posterior three pairs of walking legs appear simple; male and female walking legs similar.

Male (10 specimens)-- Length including capitulum 915 (700-1100); length of posterior coxal group 320 (290-400); dorsal lengths of pedipalp segments: Ti 112 (100-140); Ta 61 (50-70); dorsal lengths of leg segments: leg I: TFe 121 (100-170); Ge 178 (150-240); Ti 136 (120-180); Ta 143 (130-160); leg IV: TFe 144 (120-190); Ge 223 (200-290); Ti 262 (220-370); Ta 249 (210-340).

Female (11 specimens)-- Length including capitulum 1073 (900-1200); length of posterior coxal group 333 (300-430); dorsal lengths of pedipalp segments: Ti 119 (100-140); Ta 65 (60-70); dorsal lengths of leg segments: leg I: TFe 123 (100-170); Ge 187 (160-250); Ti 137 (120-170); Ta 147 (130-160); leg IV: TFe 147 (120-190); Ge 232 (200-300); Ti 263 (230-380); Ta 252 (220-340).

Notes-- Apalachicolan specimens match the Tennessee types, while more western specimens are smaller and have hairs instead of spines on the first walking legs. Vidrine (1980a) discussed this species under the names: *U. amandita* and *U. amandita* (western morph). The western morph possesses tarsi that are longer than the tibia on the first walking legs. There is probably a good case for suspecting that two species are here represented, but no action is here taken to separate them as such. This species is apparently host specific for species belonging to a single genus, *Amblema*. A single infested host usually contains a single male and one or two females. *Unionicola amandita*

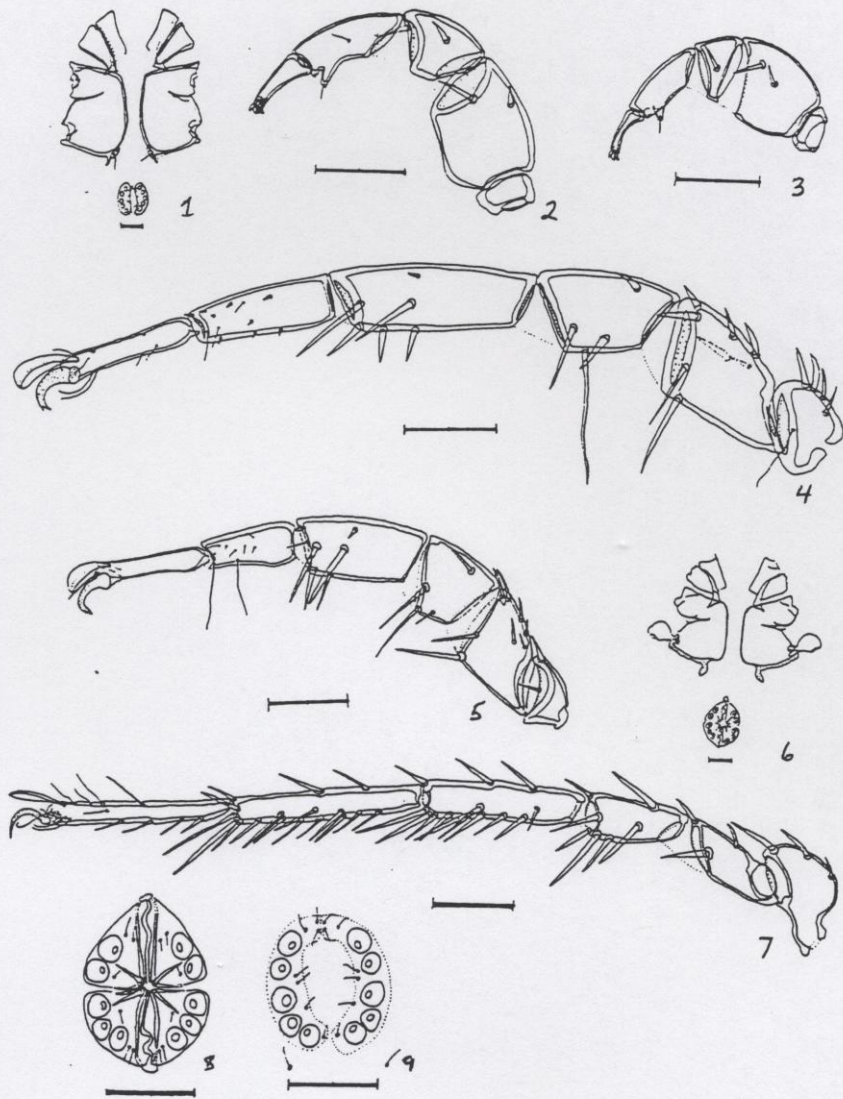
closely resembles *U. tupara*, especially in tarsal claw structure and leg chaetotaxy, but the former species has the distinctive combination of large size and an incomplete suture between the third and fourth coxae in the posterior coxal group.

Hosts:

*Amblema plicata plicata* Say: *Amblema costata* (Rafinesque), Tennessee (Mitchell and Wilson 1965, Vidrine and Wilson 1991), Virginia, Texas, Louisiana, Oklahoma, Arkansas, Wisconsin, Minnesota, and Tennessee (Vidrine 1980a). This obviously includes the two subspecies of *Amblema plicata*: *A. p. plicata* and *A. p. perplicata* (Conrad).

*Elliptoideus sloatianus* (Lea): Georgia (Vidrine 1980a). This is the only host with this mite known from the Apalachicolan region.

*Plectomerus dombeyanus* (Valenciennes): *Amblema dombeyana* (Valenciennes), Texas (Vidrine 1980a).



Figures 1-9. *Unionicola amandita* Mitchell and Wilson 1965. 1. Male venter (Tennessee). 2. Male pedipalp (Tennessee). 3. Female pedipalp (Louisiana). 4. Male first walking leg (Tennessee). 5. Female first walking leg (Louisiana). 6. Female venter (Louisiana). 7. Male fourth walking leg (Texas). 8. Female genital field (Louisiana). 9. Male genital field (Texas). Scale equals 100 micrometers.





Map 20. Known distribution of *Unionicola amandita* Mitchell and Wilson 1965 in North America.

*Unionicola (Unionicolides) bakeri* Vidrine 1986d  
Plates 47-49 in Vidrine (1996a)

Synonymy--

*Unionicola (Unionicolella) fossulata sensu stricto* in Vidrine 1980a

*Unionicola (Unionicolides) bakeri* Vidrine 1986d, Vidrine 1986e

Museum type number(s) and location-- CNC 19100, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Found in *Actinonaias carinata* (Barnes) (= *Actinonaias ligamentina* Lamarck 1819) (holotype = female) from Ouachita River at Rte. U. S. 270, Rocky Shoals Park, Montgomery County, Arkansas, collected on 15 August 1985 by Gail, Macky, and M. F. Vidrine.

Etymology-- Named to honor R. A. Sardy Baker.

Diagnosis-- Character states of the subgenus; dorsum with 2 pairs of short, linear apodemes; posterior coxal group with an incomplete suture; genital field somewhat expanded posteriorly with each plate bearing 5 acetabula, with the 2, posteriad acetabula usually lying side-by-side; pedipalps thick; all legs setose; first walking leg Ge with three rows of moderately long, heavy, blunt setae, and Ti with 2 rows of short, stout setae; all tarsal claws bifid, especially the first walking leg's claws; tarsal claws of the posterior walking legs nearly straight, tapered evenly but slightly expanded at the tip where the claws are finely bifid with the dorsal prong equal to the ventral prong; female walking legs more setigerous than male walking legs, especially noticeable in the first walking legs.

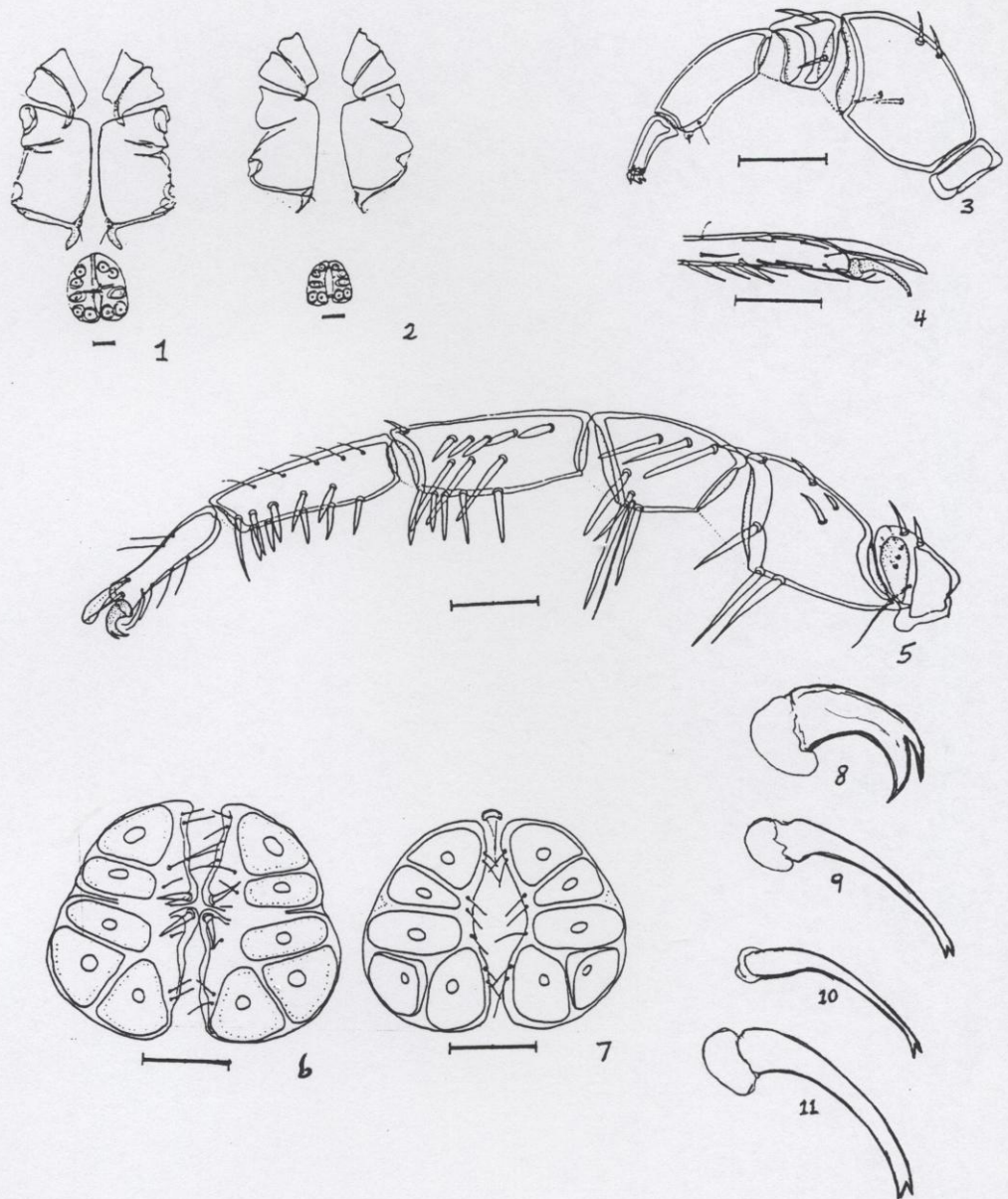
Male (6 specimens)-- Length including capitulum 1300 (1000-1600); length of posterior coxal group 463 (400-540); dorsal lengths of pedipalp segments: Ti 173 (160-190); Ta 72 (70-80); dorsal lengths of leg segments: leg I: TFe 182 (160-200); Ge 250 (220-280); Ti 225 (200-250); Ta 167 (160-170); leg IV: TFe 212 (190-240); Ge 338 (300-380); Ti 465 (420-530); Ta 432 (410-460).

Female (7 specimens)-- Length including capitulum 1307 (1000-1750); length of posterior coxal group 446 (380-550); dorsal lengths of pedipalp segments: Ti 167 (150-190); Ta 74 (70-80); dorsal lengths of leg segments: leg I: TFe 189 (160-230); Ge 246 (220-300); Ti 230 (200-280); Ta 179 (170-190); leg IV: TFe 221 (200-260); Ge 353 (320-410); Ti 464 (410-550); Ta 436 (390-490).

Notes-- Usually a single male and one or two females occur in each host. This species is only known from *A. ligamentina* from Arkansas and Tennessee. *Unionicola bakeri* closely resembles *U. fossulata*, but the structure of the claws of the posterior walking legs is sufficient to separate them. The two species are apparently sibling species, and their ranges overlap.

Hosts:

*Actinonaias ligamentina* (Lamarck): *Actinonaias carinata* (Barnes), Tennessee and Arkansas (Vidrine 1980a), Strawberry River, Arkansas (V. Board, pers. comm.).



Figures 1-11. *Unionicola bakeri* Vidrine 1986d. 1. Female venter. 2. Male venter. 3. Pedipalp. 4. Tip of tarsus of fourth walking leg. 5. Male first walking leg. 6. Female genital field. 7. Male genital field. 8. Tarsal claw of first walking leg. 9. Tarsal claw of second walking leg. 10. Tarsal claw of third walking leg. 11. Tarsal claw of fourth walking leg. Scales equal 100 micrometers.





Map 21. Known distribution of *Unionicola bakeri* Vidrine 1986 in North America.

*Unionicola (Unionicolides) bogani* Vidrine 1987b  
Plates 50-51 in Vidrine (1996a)

Synonymy--

*U. vamana* group variable 3 (in part) in Vidrine (1980a).

*Unionicola (Unionicolides) vamana* Mitchell and Wilson 1965 in Vidrine 1986d, 1986e

*Unionicola (Unionicolides) bogani* Vidrine 1987b

Museum type number(s) and location-- CNC 19665, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype found in *Fusconaia cuneolus* (Lea 1840) from Powell River at junction with Rte TN 2353, ca. 15 km northeast of Tazewell, Claiborne County, Tennessee, collected on 3 July 1971 by D. J. Bereza and J. Homziak. Allotype found in *Fusconaia cor* (Conrad 1834) from North Fork Holston River at Rte. VA 633, ca. 1.5 km east southeast of North Holston and ca. 15 km northeast of Marion, Smyth County, Virginia, collected on 23 August 1973 by D. J. Bereza and R. T. Hensley Sr.

Etymology-- Named to honor A. E. "Art" Bogan.

Diagnosis-- Character states of the subgenus; chaetotaxy and leg segment ratios of the first walking leg distinctive; Ta of first walking leg shorter than Ti; ventral setae on Ti shorter than width of Ti; ventral setae on Ge equal in length or shorter than width of Ge; dorsal setae on Ge usually two somewhat elongate blunted setae; usually two setae in central row on Ge; central and ventral setae on Ge pointed at tips; male and female legs nearly identical.

Male (holotype)-- Length including capitulum 1000; length of posterior coxal group 360; dorsal lengths of pedipalp segments: Ti 150; Ta 65; dorsal lengths of leg segments: leg I: Ge 220; Ti 185; Ta 150; leg IV: Ge 270; Ti 360; Ta 350.

Female (allotype)-- Length including capitulum 1100; length of posterior coxal group 360; dorsal lengths of pedipalp segments: Ti 150; Ta 65; dorsal lengths of leg segments: leg I: Ge 225; Ti 190; Ta 155; leg IV: missing.

Notes-- It is also known from *F. flava* and *F. barnesiana* (Lea 1838). Its range includes Tennessee and Virginia in the upper Tennessee River system (Vidrine 1987). The upper Tennessee River system contains a unique assemblage of freshwater mussels, and two species of *Unionicola* appear to be restricted to this geographic region. In addition to *U. bogani*, *U. hendrixi* is so restricted. Another species is only found in this drainage and in the Ozarkian province: *U. bakeri*. Relatively few populations of this once vast mussel assemblage, the most diverse in the world, have been searched for mites. James L. Wilson made significant collections in central Tennessee in the early 1960's, and his collections provided the impetus for much of my research (Mitchell and Wilson



1965 and Vidrine and Wilson 1991). Dan Bereza, Robie Hensley, Steve Hensley, and I made collections during the 1970's among these highly threatened communities. Many of the mussel species either had no mites or they were occasionally parasitized. The difference between Wilson's collections and ours indicates the rapid decline in both the mussel and mite faunal assemblages. Extinction of both assemblages is a real possibility!

Hosts:

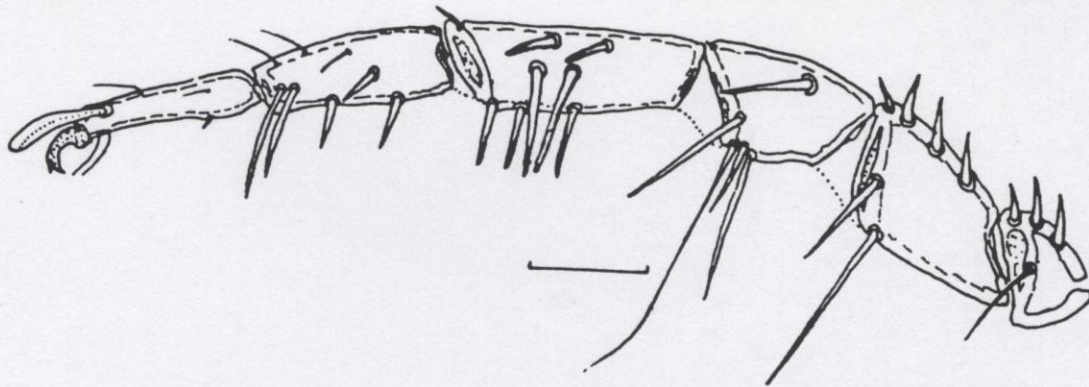
*Fusconaia barnesiana* (Lea): Tennessee and Virginia (Vidrine 1980a).

*Fusconaia cor* (Conrad): Tennessee and Virginia (Vidrine 1980a).

*Fusconaia cuneolus* (Lea): Tennessee and Virginia (Vidrine 1980a).

*Fusconaia flava* (Rafinesque): Tennessee and Virginia (Vidrine 1980a).

All of these *Fusconaia* may turn out to be the same species, and the former name in the list would be probably the most correct. However, at the time of host sorting, I was convinced that several species were involved.



Figures 1. *Unionicola bogani* Vidrine 1987. 1. Male first walking leg. Scale equals 100 micrometers. Reprinted with permission from the International Journal of Acarology: Vidrine 1987b.



Map 22. Known distribution of *Unionicola bogani* Vidrine 1987 in North America.

*Unionicola (Unionicolides) burchi* Vidrine 1986d  
Plate 52 in Vidrine (1996a)

Synonymy--

*Unionicola (Unionicolides) burchi* Vidrine 1986d, Vidrine 1986e

Museum type number(s) and location-- CNC 19105, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (female) found in *Anodonta* sp. from Rio Turbio ca. 12 km east of Penjamo at Highway 110 crossing, Guanajuato, Mexico, collected 10 June 1969 by C. D. Barbour and R. J. Douglass.

Etymology-- Named to honor John (Jack) Burch.

Diagnosis-- Character states of the subgenus; dorsum with 2 pairs of short, linear apodemes; posterior coxal group with an incomplete suture; genital field well sclerotized; pedipalps well sclerotized; all legs setose; first walking leg Ge with 10-12, large setae, and Ti with 6-8, thick setae; all tarsal claws of walking legs very deeply bifid; male and female walking legs similar.

Male (3 specimens)-- Length including capitulum 1000; length of posterior coxal group 386 (380-400); dorsal lengths of pedipalp segments: Ti 135; Ta 65; dorsal lengths of leg segments: leg I: TFe 163 (160-170); Ge 216 (210-230); Ti 190 (180-200); Ta 143 (140-150); leg IV: TFe 213 (190-240); Ge 327 (310-350); Ti 433 (410-460); Ta 397 (370-430).

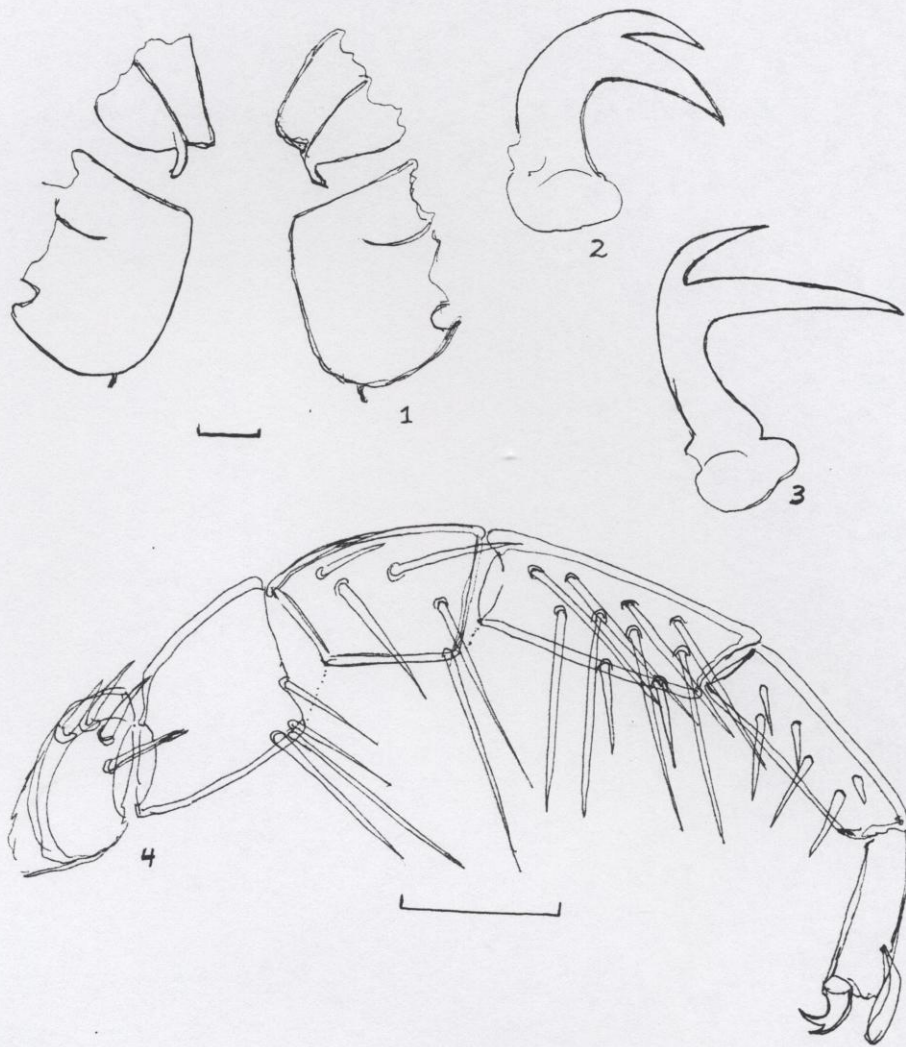
Female (3 specimens)-- Length including capitulum 1350 (1250-1500); length of posterior coxal group 366 (360-370); dorsal lengths of pedipalp segments: Ti 135 (130-140); Ta 67 (60-70); dorsal lengths of leg segments: leg I: TFe 150 (140-160); Ge 203 (200-210); Ti 180; Ta 137 (130-140); leg IV: TFe 217 (210-220); Ge 320 (310-330); Ti 400 (380-430); Ta 363 (360-370).

Notes-- Six specimens were found in four mussels. *Unionicola burchi* is almost identical to *U. conroyi*, but the chaetotaxy of the first walking leg differs. The latter is larger and has more setae on the first walking leg Ti than the former. These two mites inhabit the same host genus, and they are the only known members of the subgenus from the Pacific drainages. The two species may represent an ancient colonization events by host switching or they may have cospeciated after a single host switch, since they are found in a very unusual host group for this subgenus. The absence of gill mites belonging to the subgenus *Parasitatax* in the host mussels is perplexing. The similarity of tarsal claws of *Parasitatax* and these two species is likewise perplexing. The mussel-mite associations in the Pacific drainages are poorly known and need further study.

Host:

*Anodonta* sp.: Rio Turbio, Mexico. (specimens in the Museum of Zoology, University of Michigan, Ann Arbor). Art Bogan suspects it one of the two following species known from northeastern Mexico or from the Mexican Basin: *Anodonta dejecta* Lewis 1875 and *Anodonta impura* Say 1829





Figures 1-4. *Unionicola burchi* Vidrine 1986. 1. Female coxal plates. 2. Tarsal claw of first walking leg. 3. Tarsal claw of fourth walking leg. 4. Female first walking leg. Scales equal 100 micrometers.



Map 23. Known distribution of *Unionicola burchi* Vidrine 1986 in North America.



*Unionicola (Unionicolides) calnani* Vidrine 1986d  
Plates 53-55 in Vidrine (1996a)

Synonymy--

*Unionicola* sp. nov. type 6 in Vidrine (1980a).

*Unionicola (Unionicolides) calnani* Vidrine 1986d, Vidrine 1986e

Museum type number(s) and location-- CNC 19108, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Cyrtonaias tampicoensis* (Lea) from Nueces River at Rte. TX 16, ca. 17 km south of Tilden, McMullen County, Texas, collected 28 May 1973 by S. L. H. Fuller.

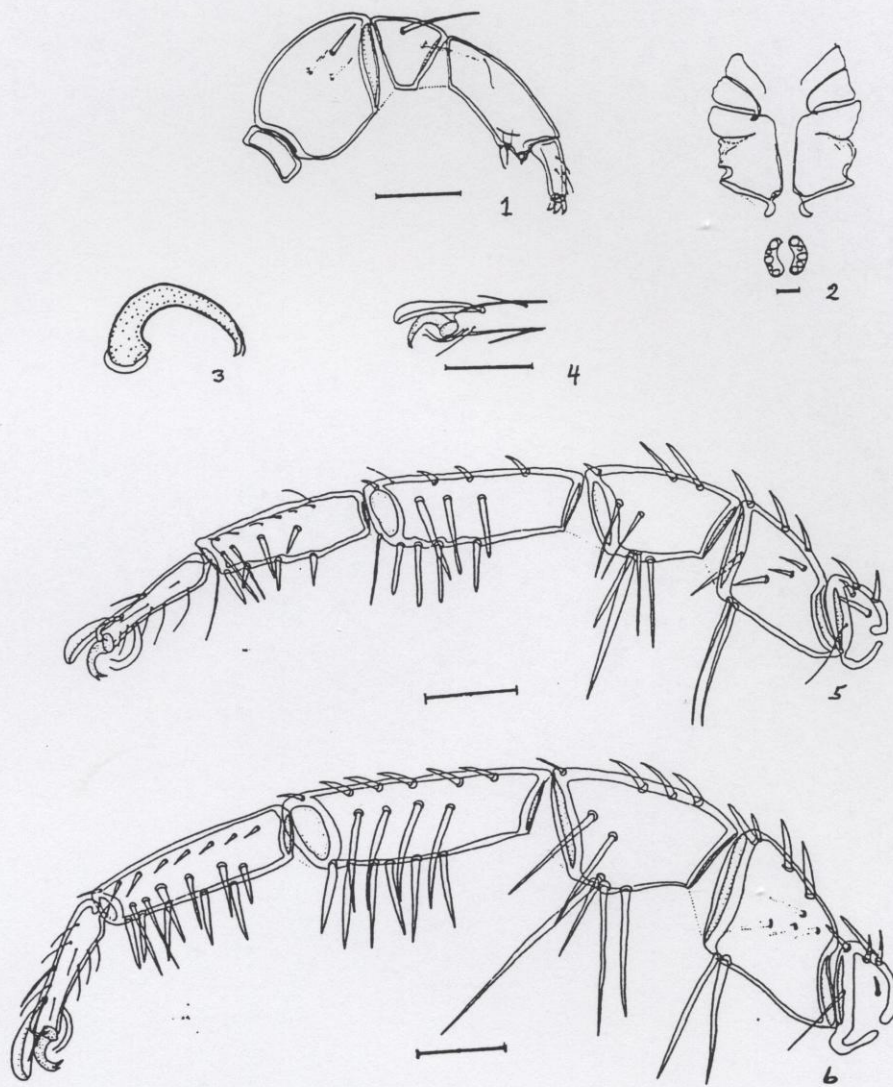
Etymology-- Named to honor Thomas R. Calnan.

Diagnosis-- Character states of the subgenus; dorsum with 2 pairs of small, nearly circular apodemes; posterior coxal group with an incomplete suture; genital field well sclerotized; pedipalps well sclerotized; all legs setose; first walking leg Ge 3 rows of large setae, and Ti with 3 rows of short setae; tarsal claws of first walking legs very moderately bifid; tarsal claws of posterior three pairs of walking legs bifid at tip, with the dorsal and ventral prongs curved and the dorsal prong smaller than but nearly equal in length to the ventral prong; female first walking leg with more setae than that of the male.

Male (10 specimens)-- Length including capitulum 1150 (1050-1250); length of posterior coxal group 454 (400-500); dorsal lengths of pedipalp segments: Ti 177 (160-200); Ta 79 (70-84); dorsal lengths of leg segments: leg I: TFe 200 (180-220); Ge 277 (260-300); Ti 218 (200-240); Ta 157 (150-170); leg IV: TFe 226 (200-250); Ge 366 (350-400); Ti 466 (430-500); Ta 435 (400-470).

Female (6 specimens)-- Length including capitulum 1458 (1350-1700); length of posterior coxal group 553 (530-570); dorsal lengths of pedipalp segments: Ti 218 (200-225); Ta 98 (85-100); dorsal lengths of leg segments: leg I: TFe 252 (230-270); Ge 340 (310-350); Ti 275 (250-290); Ta 180 (170-190); leg IV: TFe 288 (260-310); Ge 453 (420-480); Ti 552 (510-590); Ta 505 (460-530).

Notes-- Additional specimens were measured from: *C. tampicoensis* and *Disconaias discus* (Lea) from Rio Guayalejo at Rte. MX 80 near Maxcoltzin, Tamaulipas, Mexico, collected on 28 January 1982 by D. J. Bereza, S. V. Hensley, and M. F. Vidrine; *C. tampicoensis* from: 1. Rio Tempoal at Rte. MX 105 between Tempoal and Planton Sanchez, Veracruz, Mexico, collected on 8 February 1982 by D. J. Bereza, S. V. Hensley, R. T. Hensley, and M. F. Vidrine; 2. Rio San Juan at Rte. MX 25 ca. 30 km south of Santiago Tuxtla, Veracruz, Mexico, collected 15 February 1982 by D. J. Bereza, S. V. Hensley, R. T. Hensley, and M. F. Vidrine; 3. Rio Paploapan off Rte. MX 175 ca. 12 km south of Tlacotalpan, Veracruz, Mexico, collected on 17 February 1982 by D. J. Bereza, S. V. Hensley, R. T. Hensley, and M. F. Vidrine. *Unionicola calnani* usually occurs as a single male and



Figures 1-6. *Unionicola calnani* Vidrine 1986. 1. Male pedipalp. 2. Male venter. 3. Tarsal claw of fourth walking leg. 4. Tip of tarsus of fourth walking leg. 5. Male first walking leg. 6. Female first walking leg. Scale equals 100 micrometers. Reprinted with permission from the International Journal of Acarology: Vidrine 1986d.



Map 24. Known distribution of *Unionicola calnani* Vidrine 1986 in North America.

one or two females per infested host. It resembles *U. fossulata* and *U. sakantaka*, but it has distinctive tarsal claws which separate it from *U. fossulata* and distinctive leg chaetotaxy which separates it from *U. sakantaka*.

Hosts:

*Cyrtonaias tampicoensis* (Lea): Texas and Mexico (Vidrine 1986d).

*Disconaias discus* (Lea): Mexico (Vidrine 1986d).

*Unionicola (Unionicolides) conroyi* Vidrine 1986d  
Plates 56-59 in Vidrine (1996a)

Synonymy--

*Unionicola* sp. nov. type 4 in Vidrine 1980a.

*Unionicola (Unionicolides) conroyi* Vidrine 1986d, Vidrine 1986e

Museum type number(s) and location-- CNC 19104, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (female) found in *Anodonta nuttalliana* Lea from Vereux Lake ca. 12 km north of Oliver at public beach, British Columbia, Canada, collected 6 August 1972 by A. H. Clarke.

Etymology-- Named to honor John Conroy.

Diagnosis-- Character states of the subgenus; dorsum with 2 pairs of short, linear apodemes; posterior coxal group with an incomplete suture; genital field well sclerotized; pedipalps well sclerotized; all legs setose; first walking leg Ge with 10-12, large setae, and Ti with 10, thick setae; all tarsal claws of walking legs very deeply bifid; male and female walking legs similar.

Male (4 specimens)-- Length including capitulum 1250 (1100-1300); length of posterior coxal group 510 (500-540); dorsal lengths of pedipalp segments: Ti 188 (175-200); Ta 79 (75-85); dorsal lengths of leg segments: leg I: TFe 217 (200-230); Ge 277 (260-290); Ti 253 (230-270); Ta 167 (160-180); leg IV: TFe 303 (290-320); Ge 430 (410-450); Ti 565 (540-590); Ta 510 (470-540).

Female (5 specimens)-- Length including capitulum 1540 (1500-1600); length of posterior coxal group 502 (470-530); dorsal lengths of pedipalp segments: Ti 180; Ta 80 (75-85); dorsal lengths of leg segments: leg I: TFe 205 (190-230); Ge 272 (260-290); Ti 238 (220-250); Ta 166 (160-170); leg IV: TFe 284 (280-290); Ge 426 (410-450); Ti 558 (550-570); Ta 486 (480-490).

Notes-- Additional specimens were measured from: *A. nuttalliana* from Okanagan Lake, west side, ca. 12 km due west of Vernon, British Columbia, Canada, collected 12 August 1972 by A. H. Clarke and B. T. Kidd; *A. kennerlyi* from First Nanaimo Lake, east end of boat landing, ca. 21 km west of Nanaimo, British Columbia, Canada, collected on 6 August 1972 by A. H. Clarke; *A. oregonensis* Lea from Columbia River ca. 45 km above junction with Yakima Run, Washington; and *A. wahlamatensis* Lea (= *A. nuttalliana*) from Pit River, California collected by S. L. H. Fuller and D. Martin. *Unionicola conroyi* has distinctive chaetotaxy and tarsal claw structure. *U. conroyi* usually occurs as a single male and one or two females per host. It is known only in the northwest Pacific drainages and in mussels belonging to the genus *Anodonta*. It is closely related to *U. burchi*.

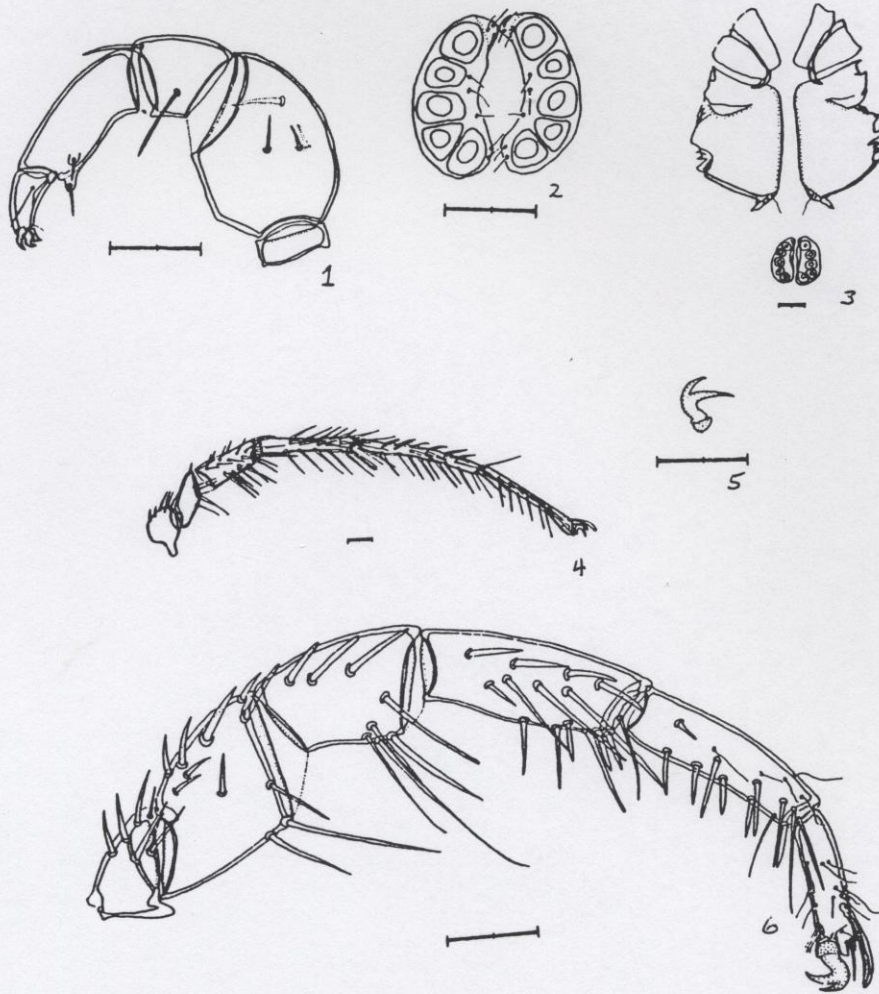
Hosts:

*Anodonta kennerlyi* Lea: Canada (Vidrine 1986d).

*Anodonta nuttalliana* Lea: *Anodonta wahlamatensis* Lea, California (Vidrine 1980a); Canada (Vidrine 1986d).

*Anodonta oregonensis* Lea: Washington (Vidrine 1986d)





Figures 1-6. *Unionicola conroyi* Vidrine 1986. 1. Male pedipalp. 2. Male genital field. 3. Male venter. 4. Male fourth walking leg. 5. Tarsal claw of fourth walking leg. 6. Male first walking leg. Scale equals 100 micrometers.



Map 25. Known distribution of *Unionicola conroyi* Vidrine 1986 in North America.

*Unionicola (Unionicolides) fossulata* (Koenike 1895a)  
Plates 60-62 in Vidrine (1996a)

Synonymy--

*Atax fossulatus* Koenike 1895a, Wolcott 1898 and 1899, Piersig 1901

*Unionicola fossulata* (Koenike 1895), Marshall 1927 and 1933b, Hoff 1944, Mitchell 1954, 1955, 1965, and 1967, Calnan 1976, Crowell 1961, and Habeeb 1967

*Unionicola (Pentatax) fossulata* (Koenike 1895), Viets and Plate 1954, Viets 1956, and Vidrine 1979b

*Unionicola (Unionicolella) fossulata* (Koenike 1895), Vidrine 1980a (in part)

*Unionicola (Unionicolides) fossulata* (Koenike 1895), Vidrine 1986d, 1986e

Museum type number(s) and location-- Koenike collection.

Type locality and host-- *Lampsilis siliquoidea*, Ridean River, Canada (see discussion under Hosts for species uncertain below).

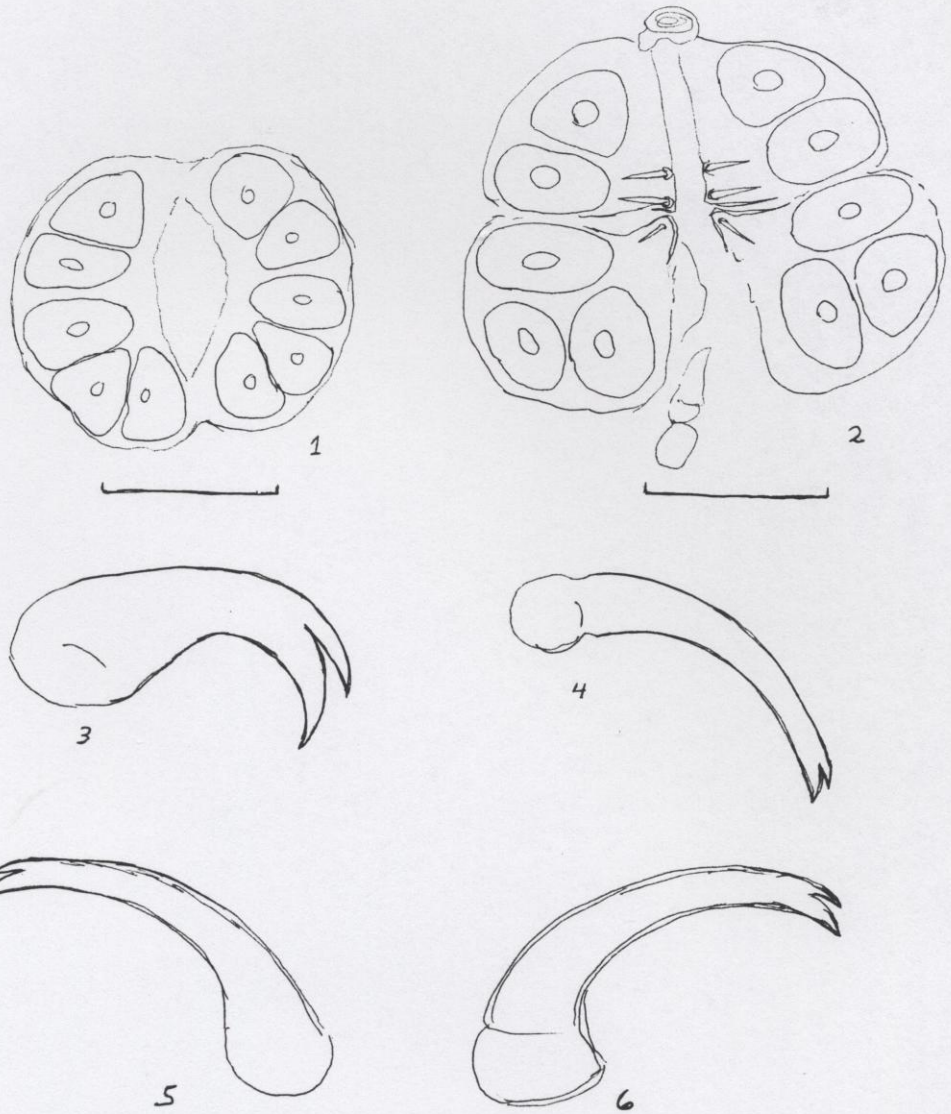
Etymology-- *Fossul* means to burrow, and this may refer to its occurrence inside mussels.

Diagnosis-- Character states of the subgenus; dorsum with 2 pairs of short, linear apodemes; posterior coxal group with an incomplete suture; genital field somewhat expanded posteriorly with each plate bearing 5 acetabula, with the 2, posteriad acetabula usually lying side-by-side; pedipalps heavy; all legs setose; first walking leg Ge with three rows of moderately long, heavy, blunt setae, and Ti with 2 rows of short, stout setae; all tarsal claws bifid, especially the first walking leg's claws; tarsal claws of the posterior walking legs nearly straight, tapered evenly, and bifid near the tip with the dorsal prong smaller (and shorter on the fourth pair of legs) than the ventral prong; female walking legs more setigerous than male walking legs, especially noticeable in the first walking legs.

Male (6 specimens)-- Length including capitulum 1383 (1100-1500); length of posterior coxal group 483 (390-560); dorsal lengths of pedipalp segments: Ti 182 (150-200); Ta 78 (70-90); dorsal lengths of leg segments: leg I: TFe 197 (170-220); Ge 250 (210-300); Ti 232 (190-260); Ta 182 (170-200); leg IV: TFe 215 (190-240); Ge 337 (290-370); Ti 462 (400-510); Ta 458 (400-500).

Female (5 specimens)-- Length including capitulum 1540 (1300-1700); length of posterior coxal group 512 (470-550); dorsal lengths of pedipalp segments: Ti 197 (190-200); Ta 83 (80-90); dorsal lengths of leg segments: leg I: TFe 216 (190-240); Ge 288 (250-330); Ti 252 (220-290); Ta 190 (180-200); leg IV: TFe 248 (220-270); Ge 386 (360-420); Ti 496 (460-540); Ta 482 (430-530).





Figures 1-6. *Unionicola fossulata* (Koenike 1895). 1. Male genital field. 2. Female genital field. 3. Tarsal claw of first walking leg. 4. Tarsal claw of second walking leg. 5. Tarsal claw of third walking leg. 6. Tarsal claw of fourth walking leg. Scales equal 100 micrometers.



Map 26. Known distribution of *Unionicola fossulata* (Koenike 1895) in North America.



Notes-- *Unionicola fossulata* is discussed and figured in Koenike (1895a), Wolcott (1899), Marshall (1933), Mitchell (1955 and 1965), Baker (1982), and Vidrine (1986d). Specimens examined are from *Lampsilis siliquoidea* (Barnes) from Arkansas, Ohio, Wisconsin, Minnesota, and Canada (Vidrine 1986b). This species appears to be found in only two species of mussels, *L. siliquoidea* from throughout the Mississippi Interior Basin and from *Actinonaias carinata* (= *Actinonaias ligamentina*) from Ontario, Canada (these latter records may be incidental). The structure of the tarsal claws of the posterior three pairs of legs, especially the third pair of legs, is the most useful character to make a quick identification, as these claws are unique in shape. Koenike (1895a) figured this tarsal claw. The tarsal claws most closely resemble those of *U. bakeri*; however, the tarsal claws of *U. fossulata* are more prominently bifid at their tips, and notably so on the third walking leg. While *U. hoesei* is also a member of this group, it has tarsal claws that are rather deeply bifid compared to either of the above species. I have not been able to distinguish any differences in the chaetotaxy of the walking legs, except in the Mexican *U. hoesei*, which are discussed under that taxon. It is noteworthy that *U. fossulata* in Downes' (1986, 1988, and 1989) papers is a mixture of *U. lasallei* and *U. poundsi* (Dimock *et al.* 1995), and thus it is not discussed in this section.

#### Hosts:

Species uncertain: *Anodonta luteola* from Ridean River, Canada (type description) (Koenike 1895a); *Glabaris patagonicus bambousearum* Morelet in Viets and Plate 1954 (this is a species in the Mutelacean genus *Anodontites*--not a Canadian element); my guess is that Koenike had mites from *Unio luteola*-- a probable synonym for the host of this mite, *Lampsilis siliquoidea* (Barnes).

*Actinonaias ligamentina* (Lamarck): *Actinonaias carinata* (Barnes), Ontario, Canada.

*Lampsilis siliquoidea* (Barnes): Michigan (Mitchell 1955 and 1965); New York (Baker 1982); Arkansas, Ohio, Wisconsin, Minnesota, and Canada (Vidrine 1986b); Ontario, Canada.

"Old" host records from Vidrine 1980a--Most of these are apparently a result of difficulties in the identification of the mites, and thus they are highly suspect although of historical importance for the completeness of record compilation. I will suggest an identification for each, where possible, based upon my experience.

*Actinonaias ligamentina* (Lamarck): *Unio ligamentinus* Lamarck, Michigan (Wolcott 1899); *Ortmanniana carinata* (Barnes) in Viets and Plate 1954; these may be valid records and/or they may include records for *U. hoesei* and/or *U. bakeri*.

*Amblema plicata plicata* Say: *Unio plicatus* Lea and *Unio undulatus* Barnes, Michigan and Illinois (Wolcott 1899 and in Viets and Plate 1954); these specimens were probably *U. tupara* and/or *U. amandita*.

*Anodontoides ferussacianus* (Lea): *Anodonta subcylindracea* Lea, Michigan (Wolcott 1899 and in Viets and Plate 1954); I cannot make a guess at this one.

*Cyrtonaias tampicoensis* (Lea): Texas (Calnan 1976); these specimens are *U. hoesei* and/or *U. calnani*.

*Fusconaia flava* (Rafinesque): *Unio rubiginosus* Lea and *Unio coccineus* Hild., Michigan (Wolcott 1899 and in Viets and Plate 1954); these specimens were either *U. parkeri* or *U. bogani*, probably the former.

*Lampsilis cardium* Rafinesque: *Unio ventricosus* Barnes and *Unio occidens* Lea, Michigan (Wolcott 1899) and *Unio occidens* in New York and Illinois (Wolcott 1899); *Lampsilis ovata cardium* Rafinesque in Viets and Plate 1954; *Lampsilis ventricosus* (Barnes) (Kelly 1899); these mites are probably *U. hoesei*.

*Lampsilis radiata radiata* (Gmelin): *Unio luteolus* Lamarck, Michigan, Wisconsin, and New York (Wolcott 1899); *Ligumia fasciata* Rafinesque in Viets and Plate 1954; this may be a valid record, but it is more likely *U. hoesei*.

*Lampsilis teres* (Rafinesque): *Lampsilis anodontoides* (Lea), Texas (Calnan 1976); these specimens are probably *U. hoesei*.

*Leptodea fragilis* (Rafinesque): *Unio gracilis* Barnes, Wisconsin and Illinois (Wolcott 1899 and in Viets and Plate 1954); Texas (Calnan 1976); these specimens are probably *U. hoesei*.

*Ligumia recta* (Lamarck): *Unio rectus* Lamarck, Michigan and Iowa (Wolcott 1899 and in Viets and Plate 1954); these may be records of *U. gordonii*.

*Megaloniaias nervosa* (Rafinesque): *Megaloniaias gigantea* (Barnes), Texas (Calnan 1976); this is probably an incidental occurrence of *U. hoesei*.

*Obliquaria reflexa* Rafinesque: *Unio cornutus* Barnes, Illinois (Wolcott 1899 and in Viets and Plate 1954); these specimens are probably *U. vikitra*.

*Potamilus alatus* (Say): *Unio alatus* Say, Michigan, Iowa, and Illinois (Wolcott 1899 and in Viets and Plate 1954); *Lampsilis alata* (Say), Iowa (Kelly 1899); these mites are probably *U. hoesei*.

*Potamilus ohioensis* (Rafinesque): *Unio laevissimus* Lea, Illinois (Wolcott 1899 and in Viets and Plate 1954); *Lampsilis laevissimus* (Lea) (Kelly 1899); these specimens are probably *U. hoesei*.

*Potamilus purpuratus* (Lamarck): *Proptera purpurata* (Lamarck), Texas (Calnan 1976); these specimens are probably *U. hoesei*.

*Pyganodon fragilis* (Lamarck): *Anodonta fragilis* Lamarck, Michigan (Wolcott 1899); *Anodonta marginata* Say in Viets and Plate 1954; I cannot make a guess at this one.

*Pyganodon grandis* (Say): *Anodonta footiana* Lea, Michigan (Wolcott 1899); *Pyganodon grandis footiana* Lea in Viets and Plate 1954; *Anodonta corpulenta* Cooper, Tennessee (Hoff 1944); I cannot make a guess at these.

*Quadrula nodulata* Rafinesque: *Unio pustulatus* Lea, Michigan (Wolcott 1899); *Pustulosa nodulata* Rafinesque in Viets and Plate 1954; these specimens were *U. vikitra* and/or *U. vikitrella*.

*Quadrula pustulosa pustulosa* (Lea): *Unio schoolcrafti* Lea, Michigan (Wolcott 1899); *Unio pustulosus* Lea, Illinois (Wolcott 1899); *Pustulosa nodulata* Rafinesque in Viets and Plate 1954; Tennessee (Hoff 1944); these specimens are probably *U. vikitra* and/or *U. vikitrella*.

*Quadrula quadrula* (Rafinesque): *Unio asperrimus* Lea and *Unio lachrymosus* Lea, Illinois (Wolcott 1899 and in Viets and Plate 1954); these specimens are probably *U. vikitra* and/or *U. vikitrella*.

*Strophitus undulatus* (Say): *Anodonta edentula* Say, Michigan (Wolcott 1899 and in Viets and Plate 1954); I cannot make a guess at this one.

*Tritogonia verrucosa* (Rafinesque): *Unio verrucosus* Barnes (?) and *Unio tuberculatus* Rafinesque, Illinois (Wolcott 1899 and Viets and Plate 1954); these specimens were probably *U. vamana*.

*Venustaconcha ellipsiformis* Conrad: *Unio spatulatus* Lea, Michigan (Wolcott 1899); Viets and Plate 1954; uncertain mite identification.

*Villosa iris* (Lea): *Unio Novi-eboraci* Lea, Michigan (Wolcott 1899); *Ligumia nervosa novi-eboraci* Lea in Viets and Plate 1954; these specimens were probably *U. hoesei*.

*Villosa lienosa* (Conrad): Texas (Calnan 1976); these specimens are probably *U. gailae*.

In many of the following records, Dobson (1966) refers to specimens of probably *U. hoesei* as *U. sakantaka*. This list is a compilation of these records; Vidrine (1980a) listed them as "old" records for *U. fossulata*. To avoid any further confusion, these records are placed here and referenced under discussions of each of the listed taxa.

*Lampsilis australis* Simpson: Apalachicola (Dobson 1966); these specimens are probably *U. hoesei*.

*Lampsilis claibornensis* (Lea): Apalachicola (Dobson 1966); these specimens are probably *U. hoesei*.

*Lampsilis hydiana* (Lea): Apalachicola (Dobson 1966); these specimens are probably *U. hoesei*.

*Lampsilis subangulata* (Lea): Apalachicola (Dobson 1966); these specimens are probably *U. hoesei*.

*Lampsilis teres* (Rafinesque): *Lampsilis anodontoides anodontoides* (Lea) and *Lampsilis anodontoides floridensis* (Lea), Apalachicola (Dobson 1966); these specimens are probably *U. hoesei*.

*Toxolasma paulus* (Lea): Apalachicola (Dobson 1966); these specimens are probably incidental *U. hoesei*.

*Villosa lienosa* (Conrad): Apalachicola (Dobson 1966); these specimens are probably *U. gailae*.

*Villosa vibex* (Conrad): Apalachicola (Dobson 1966); these specimens are probably *U. hoesei*.

*Villosa villosa* (Wright): Apalachicola (Dobson 1966); these specimens are probably *U. poundsi*.

*Unionicola (Unionicolides) fulleri* Vidrine 1986d  
Plates 63-65 in Vidrine (1996a)

Synonymy--

*Unionicola* type C in Vidrine 1974a

*Unionicola* sp. nov. type C in Vidrine 1980a.

*Unionicola (Unionicolides) fulleri* Vidrine 1986d, 1986e

Museum type number(s) and location-- CNC 19103, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Proptera purpurata* (Lamarck)(=*Potamilus purpuratus*) from Louisiana Irrigation Canal ca. 5.0 km north of Iowa at Rte. LA 383, Jefferson Davis Parish, Louisiana, collected on 2 May 1981 by Macky and M. F. Vidrine.

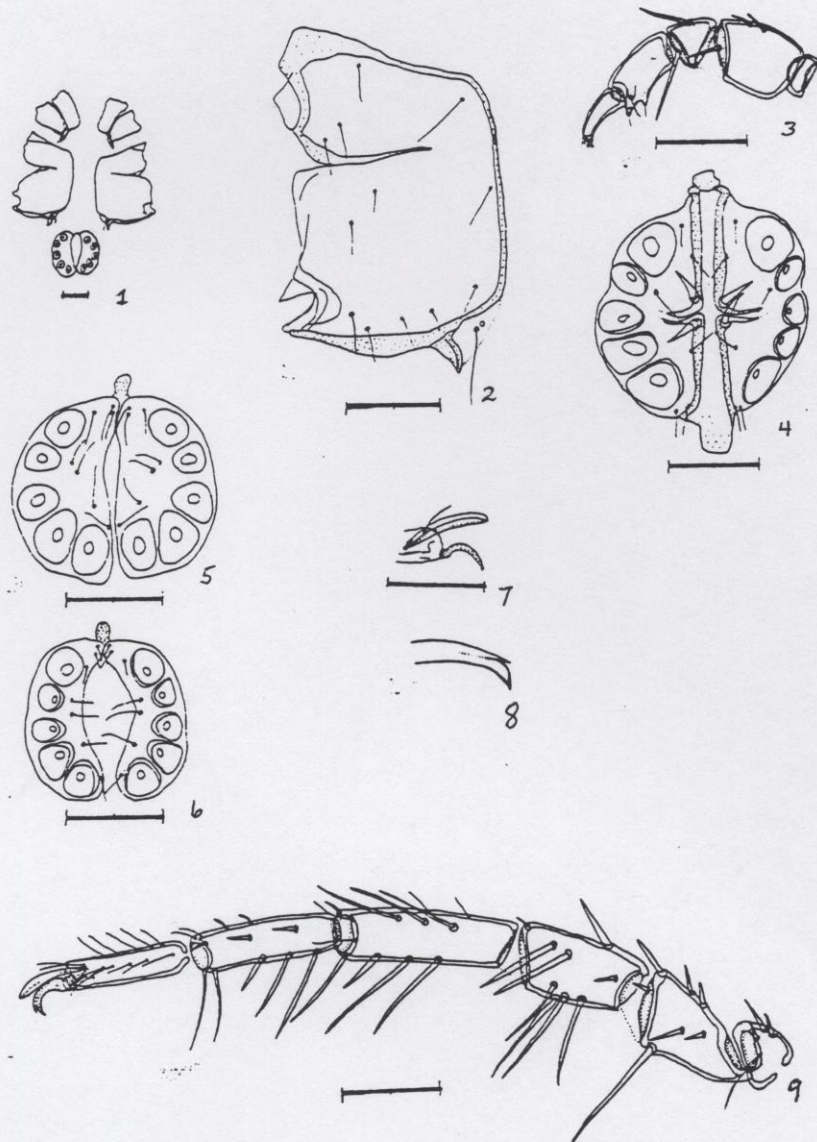
Etymology-- Named to honor Samuel L. H. Fuller.

Diagnosis-- Character states of the subgenus; dorsum with 2 pairs of small, rounded apodemes; posterior coxal group with an incomplete suture; genital field well sclerotized; pedipalps well sclerotized; all legs setose; first walking leg Ge with 5-6, long, hairlike setae; all tarsal claws of walking legs deeply bifid; tarsal claws of posterior three pairs of walking legs bifid at the very tip with the ventral prong thick and dorsal prong thin and straight; male and female walking legs similar.

Male (5 specimens)-- Length including capitulum 846 (780-900); length of posterior coxal group 290 (250-330); dorsal lengths of pedipalp segments: Ti 84 (80-90); Ta 64 (60-70); dorsal lengths of leg segments: leg I: TFe 148 (130-170); Ge 202 (180-230); Ti 158 (140-180); Ta 140 (130-150); leg IV: TFe 218 (190-250); Ge 298 (260-340); Ti 308 (270-350); Ta 310 (270-350).

Female (5 specimens)-- Length including capitulum 1030 (900-1100); length of posterior coxal group 308 (270-330); dorsal lengths of pedipalp segments: Ti 91 (83-100); Ta 68 (65-70); dorsal lengths of leg segments: leg I: TFe 154 (140-160); Ge 212 (190-230); Ti 160 (150-170); Ta 140 (130-150); leg IV: TFe 226 (200-240); Ge 312 (290-330); Ti 314 (280-330); Ta 322 (290-340).

Notes-- The type as well as additional specimens were measured from *P. alatus* (Say) from the Mississippi River at Rock Island, Rock Island County, Illinois, collected in 1977 by S. L. H. Fuller. The Illinois specimens were considerably larger than the type specimen and its southern cohorts. An infested mussel host may contain more than 100 individuals. This mite generally infests hosts belonging to the genus *Potamilus*. Apparently *U. fulleri* has been confused with *U. stricta* in earlier literature, *e. g.*, Marshall (1933b). However, it has distinctive tarsal claws on the posterior three pairs of walking legs and unusual chaetotaxy on the first walking leg.



Figures 1-9. *Unionicola fulleri* Vidrine 1986. 1. Male venter. 2. Posterior coxal plates. 3. Male pedipalp. 4. Female genital field. 5-6. Male genital fields. 7. Tip of distal end of tarsus of third walking leg. 8. Tip of tarsal claw of third walking leg. 9. Male first walking leg. Scale equals 100 micrometers.





Map 27. Known distribution of *Unionicola fulleri* Vidrine 1986 in North America.

Hosts:

*Ellipsaria lineolata* (Rafinesque): Illinois, Iowa, and Missouri (Vidrine 1980a).

*Lampsilis teres* (Rafinesque): Louisiana (Vidrine 1974a).

*Leptodea fragilis* (Rafinesque): Louisiana, Arkansas, and Illinois (Vidrine 1974a and 1980a), Ontario, Canada.

*Potamilus alatus* (Say): *Proptera alata* (Say), Illinois, Iowa, Missouri, Wisconsin, and Minnesota (Vidrine 1980a); Ontario, Canada.

*Potamilus ohiensis* (Rafinesque): *Proptera laevissima* (Lea), Arkansas (Vidrine 1980a).

*Potamilus purpuratus* (Lamarck): *Proptera purpurata* (Lamarck), Louisiana, Arkansas, and Texas (Vidrine 1974a and 1980a).

*Pyganodon grandis* (Say): *Anodonta grandis* Say, Louisiana, Wisconsin, Iowa, and Illinois (Vidrine 1974a and 1980a).

*Quadrula apiculata* (Say): Louisiana (Vidrine 1974a).

*Toxolasma parvus* (Barnes): *Carunculina parva* (Barnes), Mississippi (Vidrine 1980a).

*Tritogonia verrucosa* (Rafinesque): Louisiana (Vidrine 1974a).

*Unionicola (Unionicolides) gailae* Vidrine 1987b  
Plates 66-69 in Vidrine (1996a)

Synonymy--

*Unionicola vamana* group variable 4 in Vidrine (1980a).

*Unionicola (Unionicolides) vamana* Mitchell and Wilson 1965 in Vidrine 1986d and 1986e

*Unionicola (Unionicolides) gailae* Vidrine 1987b

Museum type number(s) and location-- CNC 19666, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Found in *Villosa lienosa* (Conrad 1834) from East Fork Amite River ca. 15 km west of Gilsburg and ca. 2 km north of Louisiana border, Amite County, Mississippi, collected on 25 July 1977 by D. J. Bereza and M. F. Vidrine.

Etymology-- Named to honor my wife, Gail J. Quillman-Vidrine.

Diagnosis-- Character states of the subgenus; chaetotaxy and leg segment ratios of the first walking leg distinctive; Ta of first walking leg shorter than Ti; ventral setae on Ti shorter than width of Ti; ventral setae on Ge not equal in length and only slightly shorter than width of Ge; dorsal setae on Ge usually two, somewhat elongate, blunted setae; usually two setae in central row on Ge; central and ventral setae on Ge somewhat pointed at tips; male and female legs nearly identical.

Male (holotype)-- Length including capitulum 1000; length of posterior coxal group 370; dorsal lengths of pedipalp segments: Ti 150; Ta 65; dorsal lengths of leg segments: leg I: Ge 230; Ti 170; Ta 150; leg IV: Ge 300; Ti 350; Ta 340.

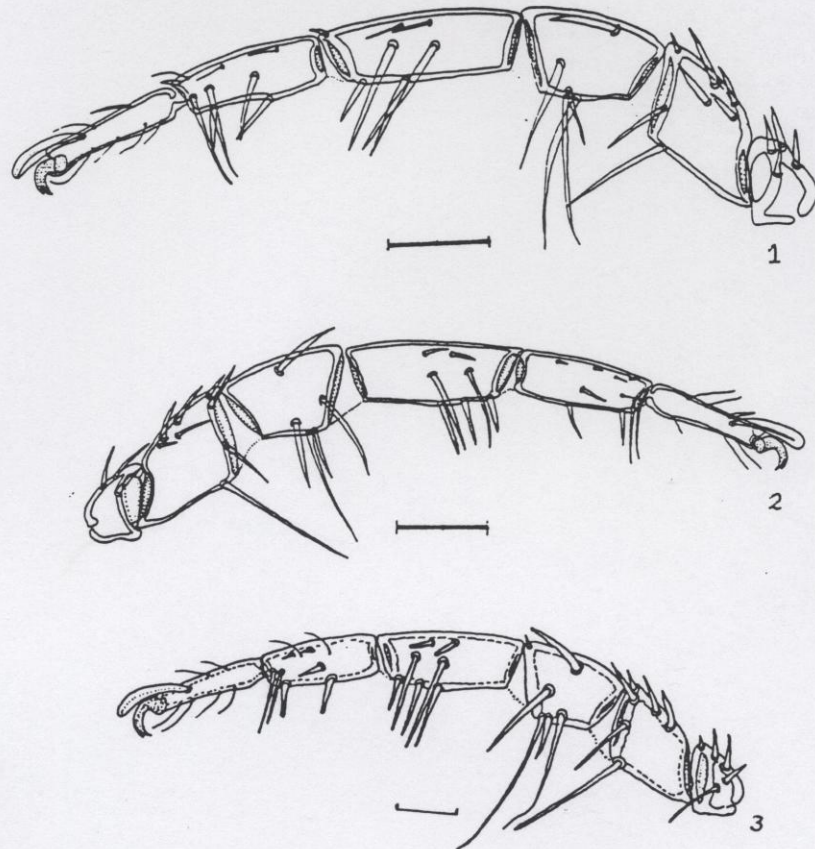
Female (allotype)-- Length including capitulum 1250; length of posterior coxal group 420; dorsal lengths of pedipalp segments: Ti 165; Ta 75; dorsal lengths of leg segments: leg I: Ge 255; Ti 195; Ta 165; leg IV: Ge 260; Ti 410; Ta 380.

Notes-- Although chaetotaxy remains constant, there is much variation in size among members of populations in this species. It is closely related to *U. guilloryi*, but they are distinguished by slight variations in their chaetotaxy in the first walking legs and host selection. *Unionicola gailae* is host specific for *V. lienosa*, and it appears to follow that host throughout its range. The numerous other species of *Villosa* are parasitized by either *U. hoesei* or *U. poundsi*. This suggests that a polyphyletic nature is plausible for the host genus. Another close relative of *U. gailae* is *U. kavanaghi*, which is smaller and a typical parasite of *Toxolasma* in southwestern Louisiana.

Hosts:

*Obovaria jacksoniana* (Frierson): Louisiana (Vidrine 1989a).

*Villosa lienosa* (Conrad): Alabama, Arkansas, Louisiana, Mississippi, Texas, Florida, and Oklahoma (Vidrine 1980a).



Figures 1-3. *Unionicola gillae* Vidrine 1987. 1. Female first walking leg. 2. Male first walking leg. 3. Male first walking leg (Reprinted with permission from the International Journal of Acarology: Vidrine 1987b). Scale equals 100 micrometers.





Map 28. Known distribution of *Unionicola gailae* Vidrine 1987 in North America.



*Unionicola (Unionicolides) gordonii* Vidrine 1987b

Synonymy--

*Unionicola vamana* group variable 5 in Vidrine (1980a).

*Unionicola (Unionicolides) vamana* Mitchell and Wilson 1965 in Vidrine 1986d and 1986e

*Unionicola (Unionicolides) gordonii* Vidrine 1987b

Museum type number(s) and location-- CNC 19667, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Found in *Ligumia recta* (Lamarck 1819) from South Fork Spring River at Rte. AR 9 ca. 3 km northeast of Salem, Fulton County, Arkansas, collected on 14 August 1979 by D. J. Bereza and C. F. and M. F. Vidrine.

Etymology-- Named to honor Mark E. Gordon.

Diagnosis-- Character states of the subgenus; chaetotaxy and leg segment ratios of the first walking leg distinctive; Ta of first walking leg shorter than Ti; ventral setae on Ti shorter than width of Ti; ventral setae on Ge not equal in length and only slightly shorter than width of Ge; dorsal setae on Ge usually a single short seta; usually two setae in central row on Ge; thicker setae on the first walking leg obviously serrated; male and female legs nearly identical.

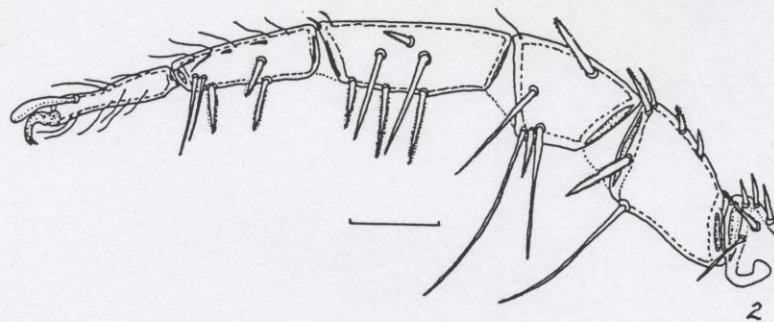
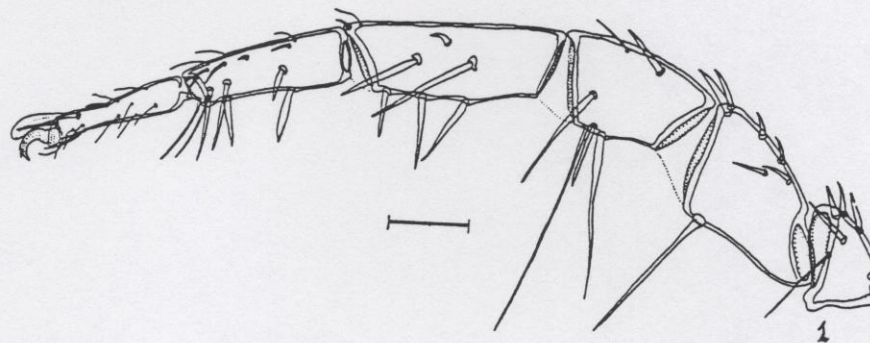
Male (holotype)-- Length including capitulum 1200; length of posterior coxal group 440; dorsal lengths of pedipalp segments: Ti 130; Ta 70; dorsal lengths of leg segments: leg I: Ge 220; Ti 185; Ta 175; leg IV: Ge 300; Ti 410; Ta 420.

Female (allotype)-- Length including capitulum 1600; length of posterior coxal group 550; dorsal lengths of pedipalp segments: Ti 160; Ta 75; dorsal lengths of leg segments: leg I: Ge 280; Ti 230; Ta 200; leg IV: Ge 370; Ti 480; Ta 485.

Notes-- This species is known only from a single host species in Arkansas; in fact, the only verified records are those of the types. Its large size and obviously serrated setae are useful in readily identifying this species (Vidrine 1987b). During the summer of 1994, Dr. Veryl Board attempted to rediscover this mite in its type locality, but he was unsuccessful. Several specimens of a mite which closely resembles this species (see Plates 70-71 in Vidrine 1996a) were found in *Actinonaias ligamentina* from the Black River in Michigan (station 293) by Randy Hoeh. These latter specimens represent an undescribed species, which is tentatively designated *Unionicola* sp. near *gordonii*.

Host:

*Ligumia recta* (Lamarck): Arkansas (Vidrine 1987b).



Figures 1-2. *Unionicola gordonii* Vidrine 1987. 1. Female first walking leg. 2. Male first walking leg (Reprinted with permission from the International Journal of Acarology: Vidrine 1987b). Scale equals 100 micrometers.



Map 29. Known distribution of *Unionicola gordonii* Vidrine 1987 in North America.

*Unionicola (Unionicolides) gowani* Vidrine 1987b  
Plates 72-74 in Vidrine (1996a)

Synonymy--

*Unionicola vamana* group variable 2 in Vidrine (1980a).

*Unionicola (Unionicolides) vamana* Mitchell and Wilson 1965 in Vidrine 1986d and 1986e

*Unionicola (Unionicolides) gowani* Vidrine 1987b

Museum type number(s) and location: CNC 19663, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Found in *Pleurobema riddelli* (Lea 1861) from Village Creek at Rte. U. S. 96, Silsbee, Hardin County, Texas, collected on 15 August 1980 by D. R. Clark, M. W. LaSalle, Macky and M. F. Vidrine.

Etymology-- Named to honor Don Gowan.

Diagnosis-- Character states of the subgenus; chaetotaxy and leg segment ratios of the first walking leg distinctive; Ta of first walking leg shorter than Ti; ventral spines of Ti shorter than width of Ti; ventral setae on Ge equal in length and shorter than width of Ge; dorsal setae on Ge usually a single blunt short seta; usually only two setae in central row on Ge; central and ventral setae on Ge nearly pointed at tips; male and female legs nearly identical.

Male (holotype)-- Length including capitulum 950; length of posterior coxal group 310; dorsal lengths of pedipalp segments: Ti 120; Ta 60; dorsal lengths of leg segments: leg I: Ge 190; Ti 155; Ta 135; leg IV: Ge 220; Ti 290; Ta 270.

Female (allotype)-- Length including capitulum 1050; length of posterior coxal group 360; dorsal lengths of pedipalp segments: Ti 140; Ta 65; dorsal lengths of leg segments: leg I: Ge 210; Ti 180; Ta 150; leg IV: Ge 270; Ti 340; Ta 320.

Notes-- This species is also known from *P. pyriforme* (Lea 1857), *P. strodeanum* (Wright 1898), *P. beadleanum* (Lea 1861), and *Quincuncina burkei* (Walker 1922). Its range includes Alabama, Florida, Georgia, Louisiana, Mississippi, and Texas. Measurements of specimens are relatively consistent throughout its range (Vidrine 1987b). This mite clearly demonstrates an eastern to western Gulf distribution, where it occurs in different hosts in different drainages--a possible result of cospeciation and certainly a candidate for Thompson's (1994) Geographical Mosaic Theory of Coevolution, where different populations of the same parasite evolve in uniquely different ways forming a variety (mosaic) of evolutionary results.

Hosts:

*Pleurobema beadleanum* (Lea): *Elliptio "Unio" beadliana* (Lea), Louisiana and Mississippi (Vidrine 1980a).

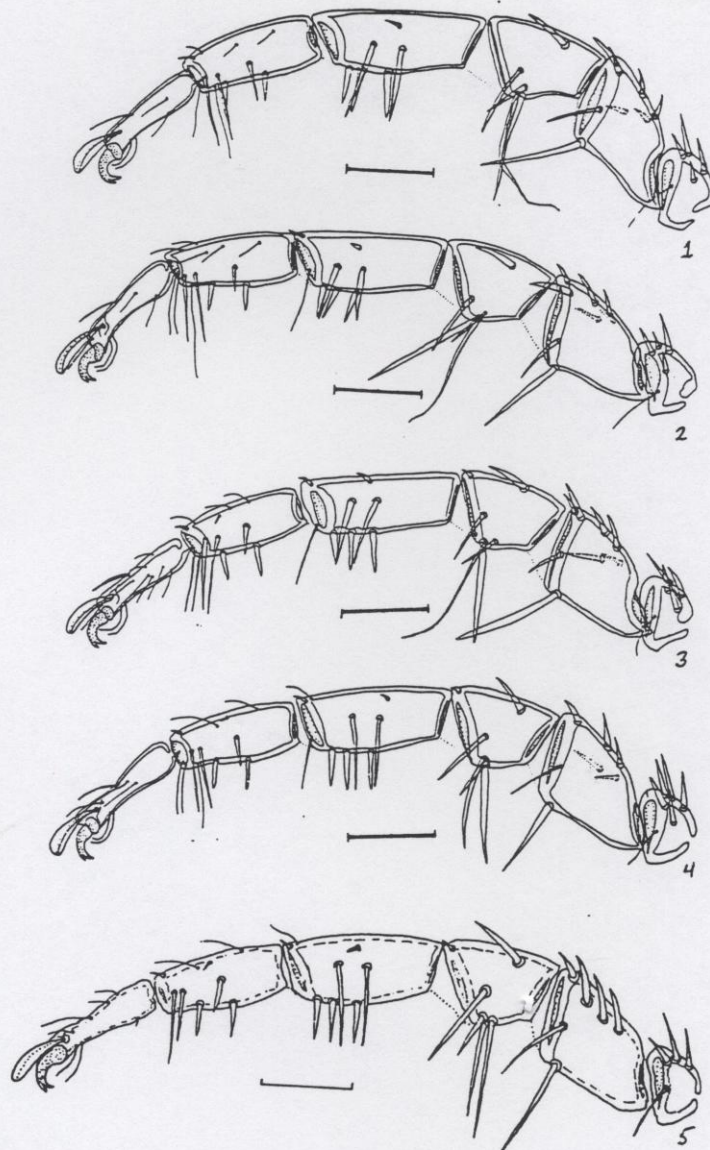
*Pleurobema pyriforme* (Lea): Georgia (Vidrine 1980a).

*Pleurobema riddelli* (Lea): Louisiana and Texas (Vidrine 1980a).

*Pleurobema strodeanum* (Wright): Alabama (Vidrine 1980a).

*Quincuncina burkei* (Walker): Florida and Alabama (Vidrine 1980a).





Figures 1-5. *Unionicola gowani* Vidrine 1987. 1. Male first walking leg (from *Quincuncina burkei* from Florida). 2. Male first walking leg (from *Pleurobema beadleanum* from Louisiana). 3. Male first walking leg (from *Pleurobema strodeanum* from Alabama). 4. Male first walking leg (from *Pleurobema riddelli* from Texas). 5. Male first walking leg (from *Pleurobema riddelli* from Texas) (Reprinted with permission from the International Journal of Acarology: Vidrine 1987b). Scale equals 100 micrometers.





Map 30. Known distribution of *Unionicola gowani* Vidrine 1987 in North America.

*Unionicola (Unionicolides) guilloryi* Vidrine 1987b  
Plates 75-77 in Vidrine (1996a)

Synonymy--

*Unionicola vamana* group variable 6 in Vidrine (1980a).

*Unionicola (Unionicolides) vamana* Mitchell and Wilson 1965 in Vidrine 1986d and 1986e

*Unionicola (Unionicolides) guilloryi* Vidrine 1987b

Museum type number(s) and location-- CNC 19668, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Found in *Obovaria unicolor* (Lea 1845) from West Fork Amite River ca. 20 km west of Gilsburg and ca. 4 km north of the Louisiana border, Amite County, Mississippi on 2 July 1978 by Beth and Darryl Clark, Bill Bell, and M. F. Vidrine.

Etymology-- Named to honor Harland D. Guillory.

Diagnosis-- Character states of the subgenus; chaetotaxy and leg segment ratios of the first walking leg distinctive; Ta of first walking leg shorter than Ti; ventral setae on Ti shorter than width of Ti; ventral setae on Ge not equal in length and only slightly shorter than width of Ge; dorsal setae on Ge usually two somewhat elongate blunted setae; usually two setae in central row on Ge; central and ventral setae on Ge somewhat pointed at tips; male and female legs nearly identical.

Male (holotype)-- Length including capitulum 900; length of posterior coxal group 300; dorsal lengths of pedipalp segments: Ti 125; Ta 55; dorsal lengths of leg segments: leg I: Ge 180; Ti 150; Ta 135; leg IV: Ge 210; Ti 290; Ta 280.

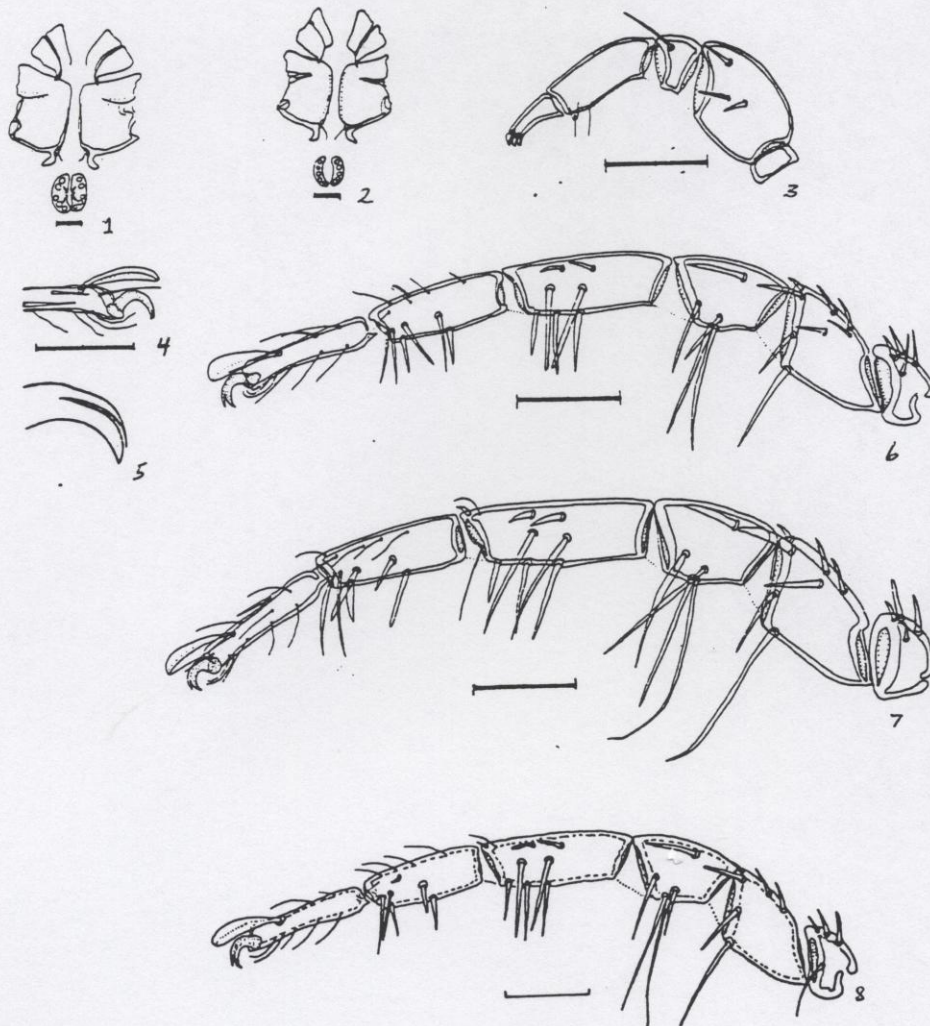
Female (allotype)-- Length including capitulum 1100; length of posterior coxal group 350; dorsal lengths of pedipalp segments: Ti 135; Ta 65; dorsal lengths of leg segments: leg I: Ge 210; Ti 160; Ta 145; leg IV: Ge 250; Ti 330; Ta 320.

Notes-- Specimens of this species are apparently smaller than specimens of *U. gailae* taken in *V. lienosa* in the same locality. The two species of mites are very closely related. Larger lots of *U. guilloryi* are needed for a more thorough evaluation of these two species.

Hosts:

*Obovaria jacksoniana* (Frierson): Mississippi (a single specimen).

*Obovaria unicolor* (Lea): Mississippi (Vidrine 1987b).



Figures 1-8. *Unionicola guilloryi* Vidrine 1987. 1. Female venter. 2. Male venter. 3. Male pedipalp. 4. Tip of tarsus of fourth walking leg. 5. Tip of tarsal claw of fourth walking leg. 6. Male first walking leg. 7. Female first walking leg. 8. Male first walking leg (Reprinted with permission from the International Journal of Acarology: Vidrine 1987b). Scale equals 100 micrometers.





Map 31. Known distribution of *Unionicola guilloryi* Vidrine 1987 in North America.

*Unionicola (Unionicolides) hendrixii* Vidrine 1987b  
Plates 78-80 in Vidrine (1996a)

Synonymy--

*Unionicola vamana* group variable 7 in Vidrine 1980a.

*Unionicola (Unionicolides) vamana* Mitchell and Wilson 1965 in Vidrine 1986d and 1986e

*Unionicola (Unionicolides) hendrixii* Vidrine 1987b, Vidrine and Wilson 1991

Museum type number(s) and location-- CNC 19669, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Found in *Medionidus conradicus* (Lea 1834) from Possum Creek near Gate City near Rte. VA 649 (North Fork Holston River drainage), Scott County, Virginia on 22 September 1975 by D. J. Bereza and M. F. Vidrine.

Etymology-- Named to honor Sherman Hendrix.

Diagnosis-- Character states of the subgenus; chaetotaxy and leg segment ratios of the first walking leg distinctive; Ta of first walking leg shorter than Ti; ventral setae on Ti shorter than width of Ti; ventral setae on Ge not equal in length and shorter than width of Ge; usually two setae in central row on Ge; all setae pointed at tips; some specimens with additional setae on Ti; male and female legs nearly identical.

Male (holotype)-- Length including capitulum 800; length of posterior coxal group 200; dorsal lengths of pedipalp segments: Ti 85; Ta 55; dorsal lengths of leg segments: leg I: Ge 135; Ti 110; Ta 111; leg IV: Ge 200; Ti 230; Ta 210.

Female (allotype)-- Length including capitulum 850; length of posterior coxal group 210; dorsal lengths of pedipalp segments: Ti 90; Ta 55; dorsal lengths of leg segments: leg I: Ge 150; Ti 120; Ta 100; leg IV: Ge 240; Ti 250; Ta 240.

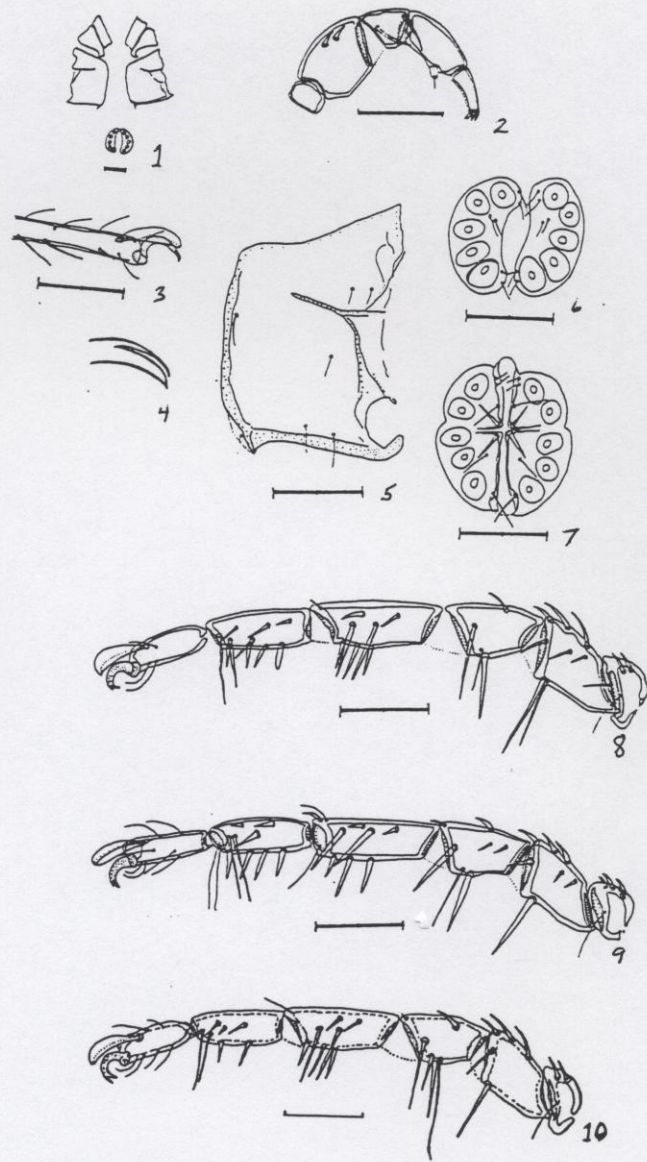
Notes-- This species is only known from a single host species in Tennessee and Virginia (Vidrine 1987b and Vidrine and Wilson 1991). This small mite is also unique morphologically. Unfortunately, its only known host is extremely rare.

This is another species which is restricted in its habitat (both host and geography) in such a way as to beg for us to search for the story it has to tell.

Host:

*Medionidus conradicus* (Lea): Tennessee and Virginia (Vidrine 1987b and Vidrine and Wilson 1991).





Figures 1-10. *Unionicola hendrxi* Vidrine 1987. 1. Male venter. 2. Male pedipalp. 3. Tip of tarsus of fourth walking leg. 4. Tip of tarsal claw of fourth walking leg. 5. Posterior coxal plates. 6. Male genital field. 7. Female genital field. 8. Male first walking leg. 9. Female first walking leg. 10. Male first walking leg (Reprinted with permission from the International Journal of Acarology: Vidrine 1987b). Scale equals 100 micrometers.



Map 32. Known distribution of *Unionicola hendrxi* Vidrine 1987 in North America.

*Unionicola (Unionicolides) hoesei* Vidrine 1986d  
Plates 81-89 in Vidrine (1996a)

Synonymy--

*Unionicola* type D in Vidrine 1974a

*Unionicola fossulata* group variable 1 in Vidrine 1980a

*Unionicola (Unionicolides) hoesei* Vidrine 1986d in Vidrine 1986e

Museum type number(s) and location-- CNC 19101, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (female) found in *Lampsilis teres* (Rafinesque) from Bayou des Cannes at Rte. LA 13, ca. 4.0 km north of Eunice, border of Evangeline and St. Landry parishes, Louisiana, collected on 1 April 1972 by Blake and M. F. Vidrine.

Etymology-- Named to honor H. Dickson Hoese, my major professor for my doctorate.

Diagnosis-- Character states of the subgenus; dorsum with 2 pairs of short, linear apodemes; posterior coxal group with an incomplete suture; genital field somewhat expanded posteriorly with each plate bearing 5 acetabula, with or without the 2, posteriad acetabula lying side-by-side; pedipalps thick; all legs setose; first walking leg Ge with three rows of moderately long, heavy, blunt setae, and Ti with 2 rows of short, stout setae; all tarsal claws of walking legs bifid; tarsal claws of the posterior three pairs of walking legs obviously bifid with the dorsal prong ca. one-half the length of the ventral prong; female walking legs more setigerous than male walking legs, especially noticeable in the first walking legs.

Male (14 specimens)-- Length including capitulum 1276 (1100-1600); length of posterior coxal group 465 (380-600); dorsal lengths of pedipalp segments: Ti 167 (130-200); Ta 71 (55-90); dorsal lengths of leg segments: leg I: TFe 217 (170-280); Ge 259 (220-340); Ti 224 (180-290); Ta 150 (130-180); leg IV: TFe 217 (170-280); Ge 338 (270-440); Ti 435 (330-600); Ta 454 (350-580).

Female (17 specimens)-- Length including capitulum 1679 (1350-2250); length of posterior coxal group 520 (440-600); dorsal lengths of pedipalp segments: Ti 189 (160-230); Ta 79 (70-95); dorsal lengths of leg segments: leg I: TFe 223 (190-270); Ge 299 (240-380); Ti 264 (220-330); Ta 169 (140-200); leg IV: TFe 265 (220-330); Ge 409 (340-510); Ti 508 (430-630); Ta 508 (420-620).

Notes-- Usually a single male and one or two females occur in each host. *Unionicola hoesei* closely resembles *U. bakeri* and *U. fossulata*, but the structures of the claws of the posterior walking legs are different. *Unionicola hoesei* occurs in many host species belonging to at least 15 genera in the Tribe Lampsilini. As a parasite of a number of closely related host taxa over its broad geographic range, it is certainly a candidate for Thompson's (1994) Geographical Mosaic Theory of Coevolution, where different populations of the same parasite evolve in uniquely different ways forming a variety (mosaic) of evolutionary results. Although it is quite variable, the tarsal claw is

relatively uniform in shape across its ranges, both host and geographic ranges. It may actually be an *Artenkreis* of sibling species or a *Rassenkreis* of subspecies. For example, re-examination of the specimens from Mexico demonstrate that these specimens are uniquely different with less setose first walking legs. These differences support the separation of Mexican *U. hoesei* from other North American populations. Also, the specimens from *Glebula rotundata* also possess fewer setae on their first walking legs than typical *U. hoesei* and also may warrant separation.

Hosts:

*Actinonaias ligamentina* (Lamarck): *Actinonaias carinata* (Barnes), Tennessee (Vidrine and Wilson 1991).

*Actinonaias pectorosa* (Conrad): Tennessee (Vidrine 1980a).

*Actinonaias sapatolensis* (Lea): *Actinonaias* sp., Veracruz, Mexico (Vidrine 1980a). (These specimens may be *Lampsilis rovirosai*).

*Anodonta suborbiculata* Say: Louisiana (Vidrine 1974a).

*Cyprogenia aberti* (Conrad): Arkansas (Vidrine 1980a).

*Cyrtonaias tampicoensis* (Lea): Brazos River system, Texas (Vidrine 1980a).

*Disconaias discus* (Lea): Mexico.

*Disconaias fimbriata* (Frierson): Panuco River system, Mexico (Vidrine 1980a).

*Elliptio icterina* (Conrad): Alabama.

*Elliptoideus sloatianus* (Lea): Georgia (Vidrine 1980a).

*Friersonia iridella* (Pilsbry and Frierson): Panuco River system, Mexico (Vidrine 1980a).

*Friersonia moctezumensis* (Pilsbry): Mexico.

*Friersonia semirasa* (Pilsbry): Mexico.

*Friersonia* sp.: Mexico.

*Fusconaia askewi* (Marsh): *Fusconaia flava* (Rafinesque), Texas (Vidrine 1980a).

*Glebula rotundata* (Lamarck): Louisiana, Mississippi, and Texas (Vidrine 1974a and 1980a).

*Lampsilis abrupta* (Say): *Lampsilis orbiculata* (Hildreth), Tennessee (Vidrine and Wilson 1991).

*Lampsilis australis* Simpson: Alabama (Vidrine 1980a).

*Lampsilis dolabraeformis* (Lea): Tennessee.

*Lampsilis cardium* Rafinesque: *Lampsilis ovata* (Say) in part, Arkansas, Wisconsin, Mississippi, and Minnesota (Vidrine 1980a); and Ontario, Canada.

*Lampsilis fasciola* Rafinesque: Tennessee (Vidrine and Wilson 1991).

*Lampsilis hydiana* (Lea): Louisiana, Texas, Arkansas, and Oklahoma (Vidrine 1974a and Vidrine 1980a).

*Lampsilis ornata* (Conrad): *Lampsilis excavata* (Lea), Louisiana and Mississippi (Vidrine 1980a).

*Lampsilis ovata* (Say): Tennessee (Vidrine 1980a).

*Lampsilis ovata/cardium* complex: Stones and Duck Rivers, Tennessee (Vidrine and Wilson 1991).

*Lampsilis radiata radiata* (Gmelin): New Jersey, Virginia, Rhode Island, North Carolina, and Massachusetts (Vidrine 1980a), and Quebec, Canada.

*Lampsilis reeviana reeviana* (Lea): *Villosa brevicula* (Call), Arkansas (Vidrine 1980a).

*Lampsilis rovirosai* (Pilsbry): Mexico.

*Lampsilis satur* (Lea): *Lampsilis ovata satura* (Lea), Louisiana and Texas (Vidrine 1974a and

1980a).

*Lampsilis splendida* (Lea): Virginia.

*Lampsilis straminea claibornensis* (Lea): Alabama, Florida, Louisiana, and Mississippi (Vidrine 1980a).

*Lampsilis streckeri* Frierson: Arkansas (Vidrine 1980a).

*Lampsilis subangulata* (Lea): Florida.

*Lampsilis teres* (Rafinesque): Louisiana, Texas, Georgia, Florida, Alabama, Arkansas, Mississippi, and Oklahoma (Vidrine 1974a and 1980a).

*Lampsilis* sp.: Alabama (Vidrine 1980a).

*Lasmigona costata* (Rafinesque): Virginia (Vidrine 1980a).

*Leptodea fragilis* (Rafinesque): Louisiana, Virginia, Tennessee, Texas, Arkansas, Mississippi, and Oklahoma (Vidrine 1974a and 1980a).

*Leptodea leptodon* (Rafinesque): Arkansas (Vidrine 1980a).

*Leptodea ochracea* (Say): *Lampsilis ochracea* (Say), North Carolina (Vidrine 1980a).

*Ligumia subrostrata* (Say): Texas and Arkansas (Vidrine 1980a).

*Megaloniaias nervosa* (Rafinesque): *Megaloniaias gigantea* (Barnes), Texas (Calnan 1976).

*Obliquaria reflexa* Rafinesque: Texas (Vidrine 1980a).

*Obovaria jacksoniana* (Frierson): *Obovaria castenea* (Lea), Louisiana (Vidrine 1980a).

*Potamilus alatus* (Say): *Proptera alata* (Say), Tennessee, Minnesota, and Wisconsin (Vidrine 1980a).

*Potamilus amphichaenus* (Frierson): *Proptera amphichaena* (Frierson), Texas (Vidrine 1980a).

*Potamilus ohiensis* (Rafinesque): *Proptera laevisissima* (Lea), Arkansas (Vidrine 1980a).

*Potamilus purpuratus* (Lamarck): *Proptera purpurata* (Lamarck), Louisiana, Mississippi, Arkansas, Texas, and Oklahoma (Vidrine 1974a and 1980a).

*Ptychobranthus fasciolaris* (Rafinesque): Ohio (Vidrine 1980a).

*Ptychobranthus jonesi* (van der Schalie): Alabama (Vidrine 1980a).

*Ptychobranthus occidentalis* (Conrad): *Ptychobranthus fasciolaris* (Rafinesque), Arkansas (Vidrine 1980a).

*Ptychobranthus subtentum* (Say): Virginia (Vidrine 1980a).

*Pyganodon cataracta* (Say): *Anodonta cataracta* Say, Rhode Island and New Jersey (Vidrine 1980a).

*Pyganodon grandis* (Say): *Anodonta grandis* Say, Louisiana (Vidrine 1974a).

*Quincuncina infucata* (Conrad): Florida.

*Toxolasma parvus* (Barnes): *Carunculina parva* (Barnes), Louisiana (Vidrine 1980a).

*Truncilla donaciformis* (Lea): Texas (Vidrine 1980a).

*Truncilla truncata* Rafinesque: Louisiana (Vidrine 1980a).

*Villosa delumbis* (Conrad): South Carolina and North Carolina (Vidrine 1980a).

*Villosa fabalis* (Lea): Tennessee (Vidrine and Wilson 1991).

*Villosa iris* (Lea): Virginia and Arkansas (Vidrine 1980a), and Ontario, Canada.

*Villosa lienosa* (Conrad): Mississippi and Alabama (Vidrine 1980a).

*Villosa taeniata* (Conrad): Tennessee (Vidrine and Wilson 1991).

*Villosa vibex* (Conrad): Louisiana, Alabama, Georgia, and Mississippi (Vidrine 1980a).

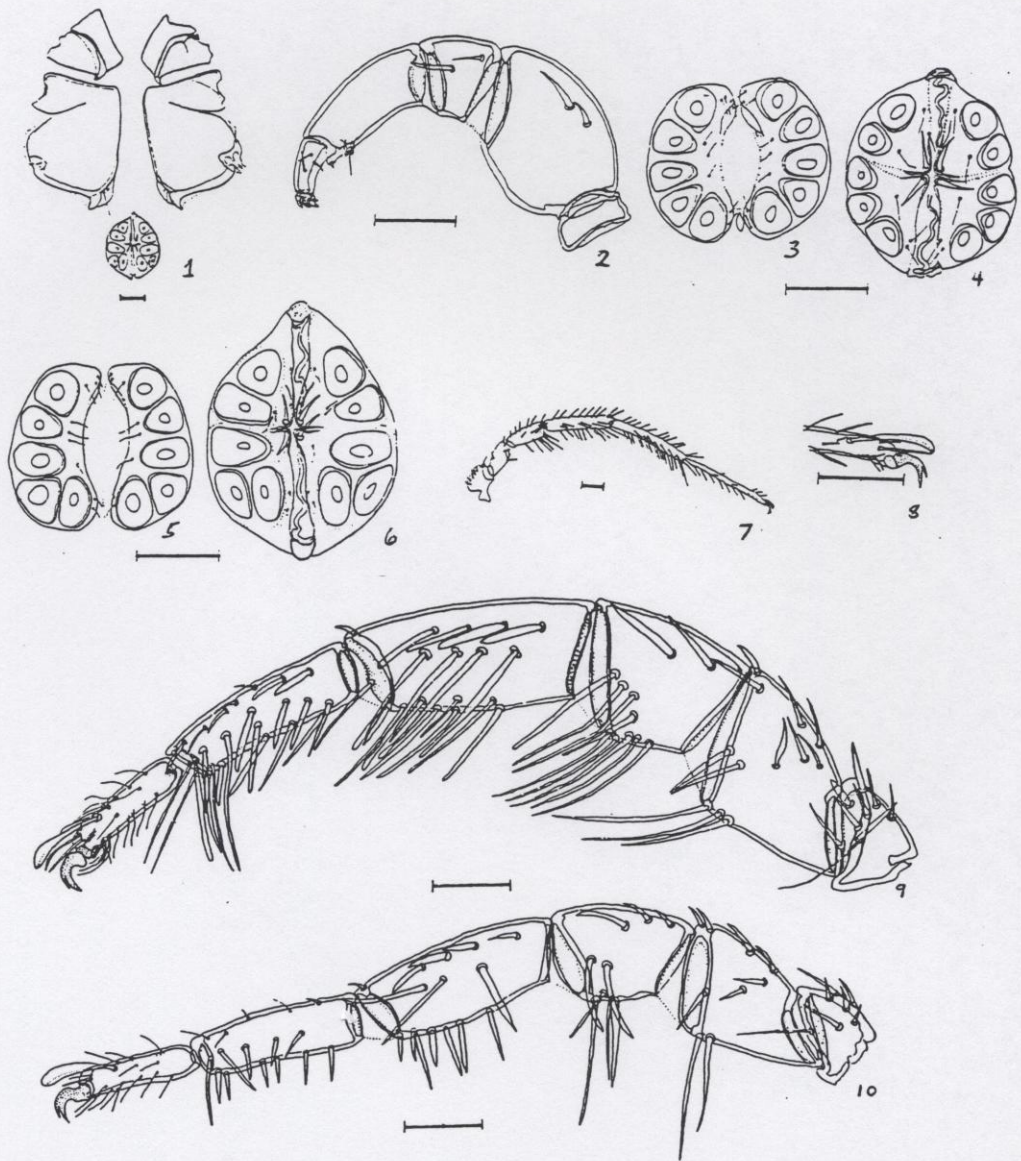
*Villosa villosa* (Wright): Florida.



*Villosa* sp.: Dugdemona River, Louisiana.

*Utterbackia imbecillis* (Say): Mexico.

*Utterbackia peggyae* (Johnson): Florida.



Figures 1-10. *Unionicola hoesei* Vidrine 1986. 1. Female venter. 2. Male pedipalp. 3. Male genital field. 4. Female genital field. 5. Male genital field. 6. Female genital field. 7. Fourth walking leg. 8. Tip of tarsus of fourth walking leg. 9. Female first walking leg. 10. Male first walking leg. Scale equals 100 micrometers.



Map 33. Known distribution of *Unionicola hoesei* Vidrine 1986 in North America.

*Unionicola (Unionicolides) kavanaghi* Vidrine 1987b  
Plates 90-92 in Vidrine (1996a)

Synonymy--

*Unionicola vamana* group variable 8 in Vidrine 1980a.

*Unionicola (Unionicolides) vamana* Mitchell and Wilson 1965 in Vidrine 1986d and 1986e

*Unionicola (Unionicolides) kavanaghi* Vidrine 1987b

Museum type number(s) and location-- CNC 19670, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Found in *Toxolasma parvus* (Barnes 1823) from Kisatchie Bayou at Rte. LA 117, Kisatchie, Natchitoches Parish, Louisiana on 22 April 1984 by Gail and M. F. Vidrine.

Etymology-- Named to honor Dirk Kavanagh.

Diagnosis-- Character states of the subgenus; chaetotaxy and leg segment ratios of the first walking leg distinctive; Ta of first walking leg shorter than Ti; ventral setae on Ti shorter than width of Ti; ventral setae on Ge not equal in length and only moderately shorter than width of Ge; dorsal setae on Ge usually a single somewhat elongate blunted seta; usually two setae in the central row on Ge; central and ventral setae on Ge somewhat pointed at tips; male and female legs nearly identical.

Male (holotype)-- Length including capitulum 650; length of posterior coxal group 240; dorsal lengths of pedipalp segments: Ti 100; Ta 50; dorsal lengths of leg segments: leg I: Ge 150; Ti 120; Ta 105; leg IV: Ge 185; Ti 235; Ta 235.

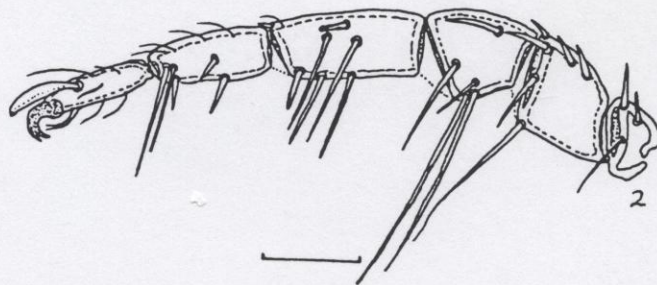
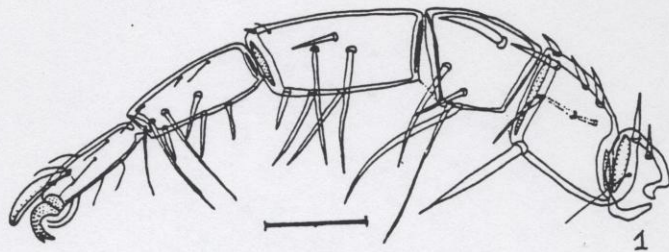
Female (allotype)-- Length including capitulum 925; length of posterior coxal group 290; dorsal lengths of pedipalp segments: Ti 115; Ta 55; dorsal lengths of leg segments: leg I: Ge 180; Ti 140; Ta 120; leg IV: Ge 230; Ti 290; Ta 280.

Notes-- *Unionicola kavanaghi* is only known from a single host species in western Louisiana and eastern Texas (Vidrine 1987b). It is a sibling species with *U. gailae* and *U. guilloryi*, but it is smaller and has longer setae on the genu of the first walking leg. Randy Hoeh (personal communication, 1994) examined the host of this mite, and he contends that it is not the hermaphroditic species with female-only phenotypes known as *T. parvus* but rather a possible new species with sexually dimorphic shells. The unique nature of the host may explain not only the occurrence of this unique mite but also the absence of this mite from the many other species of *Toxolasma*.

Hosts:

*Toxolasma parvus* (Barnes): *Carunculina parva* (Barnes), Texas and Louisiana (Vidrine 1980a).





Figures 1-2. *Unionicola kavanaghi* Vidrine 1987. 1. Male first walking leg. 2. Male first walking leg (Reprinted with permission from the International Journal of Acarology: Vidrine 1987b). Scale equals 100 micrometers.





Map 34. Known distribution of *Unionicola kavanaghi* Vidrine 1987 in North America.

*Unionicola (Unionicolides) lasallei* Vidrine 1986d  
Plates 93-96 in Vidrine (1996a)

Synonymy--

*Unionicola* sp. nov. type 5 in Vidrine 1980a.

*Unionicola (Unionicolides) lasallei* Vidrine 1986d, Vidrine 1986e, Dimock *et al.* 1995

*Unionicola lasellai* (sic) Vidrine 1986 in Downes 1989 and 1990

*Unionicola fossulata* (Koenike) in Downes 1988 and 1989

Museum type number(s) and location-- CNC 19107, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Uniomerus tetralasmus* (Say)(= *Uniomerus obesus* (Lea)) from pond at headwater of Mosquito Creek off Rte. U. S. 90, Gadsden County, Florida, collected on 19 July 1977 by D. J. Bereza and M. F. Vidrine.

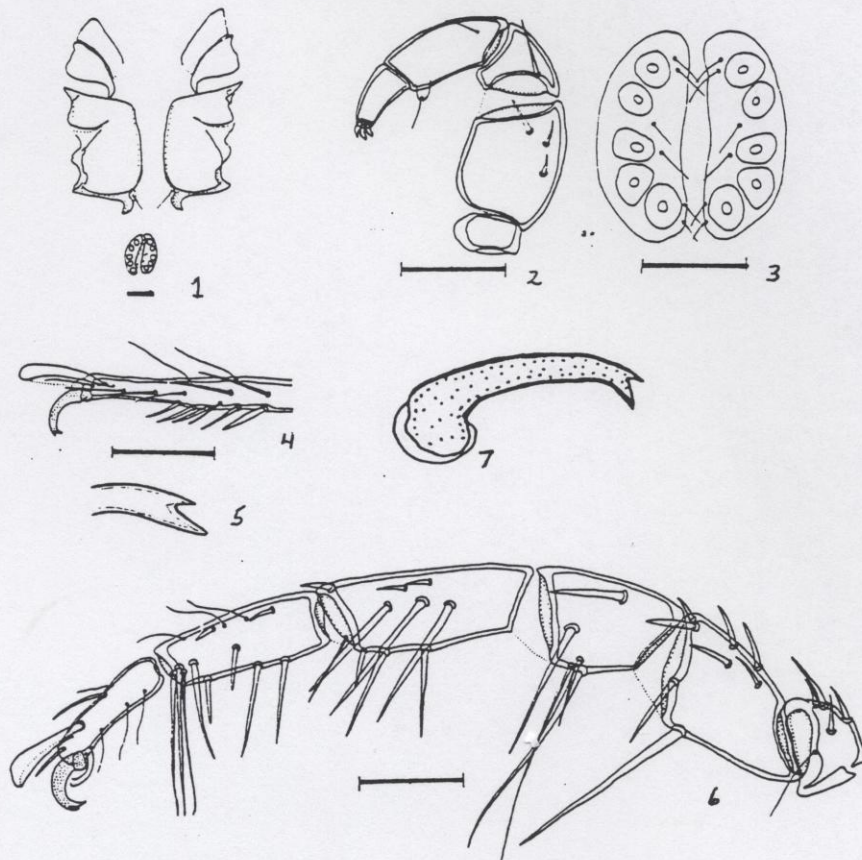
Etymology-- Named to honor Mark W. LaSalle.

Diagnosis-- Character states of the subgenus; dorsum with 2 pairs of small, nearly circular apodemes; posterior coxal group with an incomplete suture; genital field well sclerotized; pedipalps well sclerotized; all legs setose, but first walking leg Ge with somewhat reduced chaetotaxy; tarsal claws of first walking legs moderately bifid; tarsal claws of posterior three pairs of walking legs obviously bifid with divergent prongs; male and female walking legs similar.

Male (7 specimens)-- Length including capitulum 1110 (1000-1200); length of posterior coxal group 358 (300-430); dorsal lengths of pedipalp segments: Ti 142 (125-160); Ta 69 (60-75); dorsal lengths of leg segments: leg I: TFe 169 (150-190); Ge 236 (210-260); Ti 191 (170-220); Ta 150 (140-170); leg IV: TFe 199 (170-230); Ge 314 (270-370); Ti 380 (330-440); Ta 336 (290-370).

Female (3 specimens)-- Length including capitulum 1300; length of posterior coxal group 430; dorsal lengths of pedipalp segments: Ti 163 (160-170); Ta 77 (75-80); dorsal lengths of leg segments: leg I: TFe 200 (190-210); Ge 270 (260-280); Ti 206 (200-220); Ta 163 (160-170); leg IV: TFe 223 (220-230); Ge 363 (360-370); Ti 426 (420-440); Ta 363 (350-380).

Notes-- Usually a single male and one or two females occur in each host. Downes (1990) had synonymized *U. lasallei* with *U. poundsi*, but it was resurrected (Dimock *et al.* 1995) because of the genetic differences between the two mite species. *Unionicola lasallei* was consistently reported from *Uniomerus declivus* by Downes (1986, 1988, 1989, 1990, 1991, and 1995), but this mussel in the St. John's River is more probably *U. obesus*. *Unionicola lasallei* has very distinctive tarsal claw structure on the walking legs, whereas *U. poundsi* more closely resembles *U. hoesei*, especially in tarsal claw structure of the walking legs. *Unionicola lasallei* and *U. poundsi* can be readily separated based upon the tarsal claw structure of their posterior three pairs of walking legs.



Figures 1-7. *Unionicola lasallei* Vidrine 1986. 1. Male venter. 2. Male pedipalp. 3. Male genital field. 4. Distal end of tarsus of fourth walking leg. 5. Tip of tarsal claw of fourth walking leg. 6. Male first walking leg. 7. Tarsal claw of fourth walking leg (Reprinted with permission from the International Journal of Acarology: Vidrine 1986d). Scale equals 100 micrometers.





Map 35. Known distribution of *Unionicola lasallei* Vidrine 1986 in North America.

Hosts:

*Uniomerus obesus* (Lea): *Uniomerus tetralasmus* (Say), Florida, North Carolina, and South Carolina (Vidrine 1980a and 1986d); *Uniomerus declivus* (Say), St. John's River, Florida (Downes 1986, 1988, 1989, 1990, 1991, and 1995). Some of these mussel specimens, especially those from the Carolinas, may have been *Uniomerus caroliniana* (Bosc).



*Unionicola (Unionicolides) parkeri* Vidrine 1987b  
Plates 97-100 in Vidrine (1996a)

Synonymy--

*Unionicola* type F (in part) in Vidrine 1974a

*Unionicola vamana* group variable 1 in Vidrine (1980a).

*Unionicola (Unionicolides) vamana* Mitchell and Wilson 1965 in Vidrine 1986d and 1986e

*Unionicola (Unionicolides) parkeri* Vidrine 1987b

Museum type number(s) and location-- CNC 19662, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Found in *Fusconaia flava* (Rafinesque 1820) from Kisatchie Bayou at Rte. LA 117, Kisatchie, Natchitoches Parish, Louisiana, collected on 22 April 1984 by M. F. and Gail Vidrine.

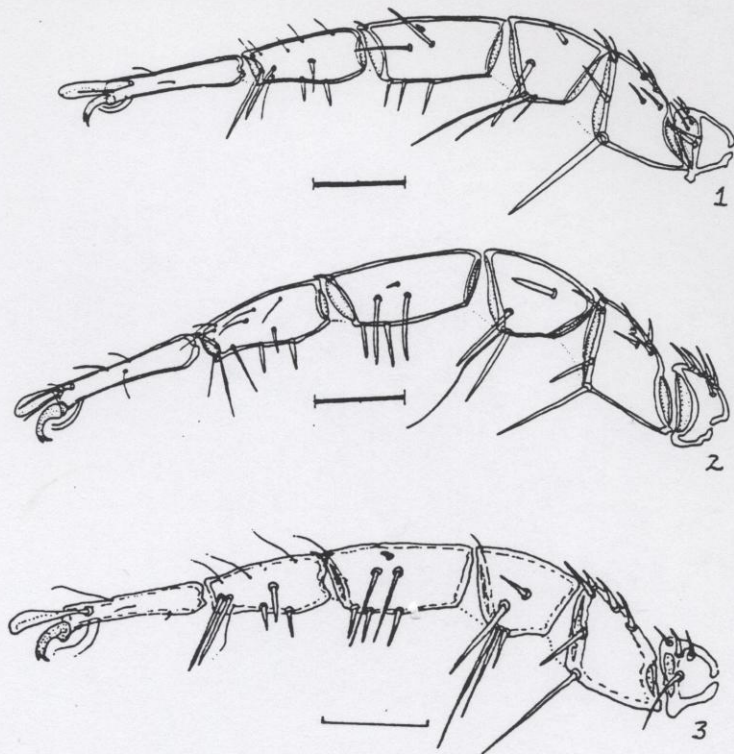
Etymology--Name to honor Robert S. Parker.

Diagnosis-- Character states of the subgenus; chaetotaxy and leg segment ratios of the first walking leg distinctive; Ta of the first walking leg equal or longer than Ti; ventral setae on Ti shorter than width of Ti; ventral setae on Ge equal in length and shorter than width of Ge; dorsal setae on Ge usually only a single blunt seta, very short and usually distal to the middle of the segment; usually only two setae in the central row on Ge; central and ventral setae on Ge nearly pointed at tips; male and female legs essentially identical.

Male (holotype)-- Length including capitulum 650; length of posterior coxal group 280; dorsal lengths of pedipalp segments: Ti 100; Ta 55; dorsal lengths of leg segments: leg I: Ge 160; Ti 140; Ta 150; leg IV: Ge 180; Ti 250; Ta 250.

Female (allotype)-- Length including capitulum 1250; length of posterior coxal group 350; dorsal lengths of pedipalp segments: Ti 130; Ta 60; dorsal lengths of leg segments: leg I: Ge 210; Ti 165; Ta 170; leg IV: Ge 240; Ti 330; Ta 325.

Notes-- This species is known from *Fusconaia* spp. from Arkansas, Florida, Louisiana, Minnesota, Mississippi, Oklahoma, Texas, Tennessee, Wisconsin, and Canada. Specimens from the upper Mississippi River are 50% larger than the types but otherwise identical. Several *Elliptio dilatata* Rafinesque 1820 were occasionally associated with this mite in Arkansas. This presence of this mite in this collection of species of *Fusconaia* suggests a close relationship between the varied host species of the host genus. It is however important to note that the species of *Fusconaia* in the upper Tennessee River system are parasitized by a different mite, *U. bogani*. Both of the *Fusconaia* mites are part of a much larger and more diverse group of mites which were once treated collectively under the name *U. vamana*, and then later these were divided into 8 species (Vidrine 1986d and 1987b). However, it is noteworthy that other *Fusconaia* have different mites. *Fusconaia succissa*



Figures 1-3. *Unionicola parkeri* Vidrine 1987. 1. Male first walking leg. 2. Female first walking leg. 3. Male first walking leg (Reprinted with permission from the International Journal of Acarology: Vidrine 1987b). Scale equals 100 micrometers.



Map 36. Known distribution of *Unionicola parkeri* Vidrine 1987 in North America.

has a distinctively different mite--*Unionicola sakantaka*, which is the typical parasite of the mussel genus *Cyclonaias*. *Fusconaia ebena* was found parasitized by *U. scutella* along the Gulf Coast. The mites suggest that the host mussel genus may be polyphyletic.

Hosts:

*Elliptio dilatata* Rafinesque: Arkansas (Vidrine and Clark 1993).

*Fusconaia askewi* (Marsh): *Fusconaia lananensis* (Frierson), Louisiana and Texas (Vidrine 1980a).

*Fusconaia cerina* (Conrad): *Fusconaia flava* (Rafinesque), Florida, Mississippi, and Louisiana (Vidrine 1980a).

*Fusconaia flava* (Rafinesque): *Fusconaia undata* (Barnes), Louisiana (Vidrine 1974a); Arkansas, Louisiana, Oklahoma, Minnesota, and Wisconsin (Vidrine 1980a); Tennessee (Vidrine and Wilson 1991); and Ontario, Canada.

*Unionicola (Unionicolides) poundsi* Vidrine 1986d  
Plates 101-103 in Vidrine (1996a)

Synonymy--

*Unionicola fossulata* group variable 2 in Vidrine 1980a.

*Unionicola (Unionicolides) poundsi* Vidrine 1986d, Vidrine 1986e, Dimock *et al.* 1995

*Unionicola fossulata* (Koenike) in Downes 1988 and 1989

*Unionicola poundsi* Vidrine 1986 in Downes 1990 and 1991

Museum type number(s) and location-- CNC 19102, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Villosa amygdala* (Lea) from Kissimmee River at Rte. U. S. 98, border of Okeechobee and Highlands Counties, Florida, collected on 9 July 1977 by M. F. Vidrine.

Etymology-- Named to honor Alan Pounds.

Diagnosis-- Character states of the subgenus; dorsum with 2 pairs of small, rounded apodemes; posterior coxal group with an incomplete suture; genital field well-sclerotized; pedipalps well-sclerotized; all legs setose, but first walking leg Ge with 6-7, large, blunt setae; all tarsal claws of walking legs deeply bifid; male and female walking legs similar.

Male (8 specimens)-- Length including capitulum 925 (850-1000); length of posterior coxal group 367 (350-380); dorsal lengths of pedipalp segments: Ti 143 (130-155); Ta 63 (57-70); dorsal lengths of leg segments: leg I: TFe 156 (140-170); Ge 221 (200-240); Ti 180 (170-190); Ta 134 (130-140); leg IV: TFe 184 (170-200); Ge 281 (270-290); Ti 368 (340-390); Ta 349 (330-370).

Female (6 specimens)-- Length including capitulum 950 (800-1000); length of posterior coxal group 350 (310-370); dorsal lengths of pedipalp segments: Ti 143 (130-150); Ta 61 (55-65); dorsal lengths of leg segments: leg I: TFe 158 (150-170); Ge 222 (200-240); Ti 178 (170-190); Ta 130 (120-140); leg IV: TFe 192 (170-200); Ge 295 (270-320); Ti 372 (330-400); Ta 347 (330-360).

Notes-- Usually a single male and one or two females occur in each host. *Unionicola poundsi* resembles *U. hoesei*, especially in tarsal claw structure of the walking legs. *Unionicola poundsi* is a distinctive species morphologically and genetically (Dimock *et al.* 1995). Downes (1989, 1990, 1991, and 1995) studied this species and consistently confused this species with *U. lasallei*.

Hosts:

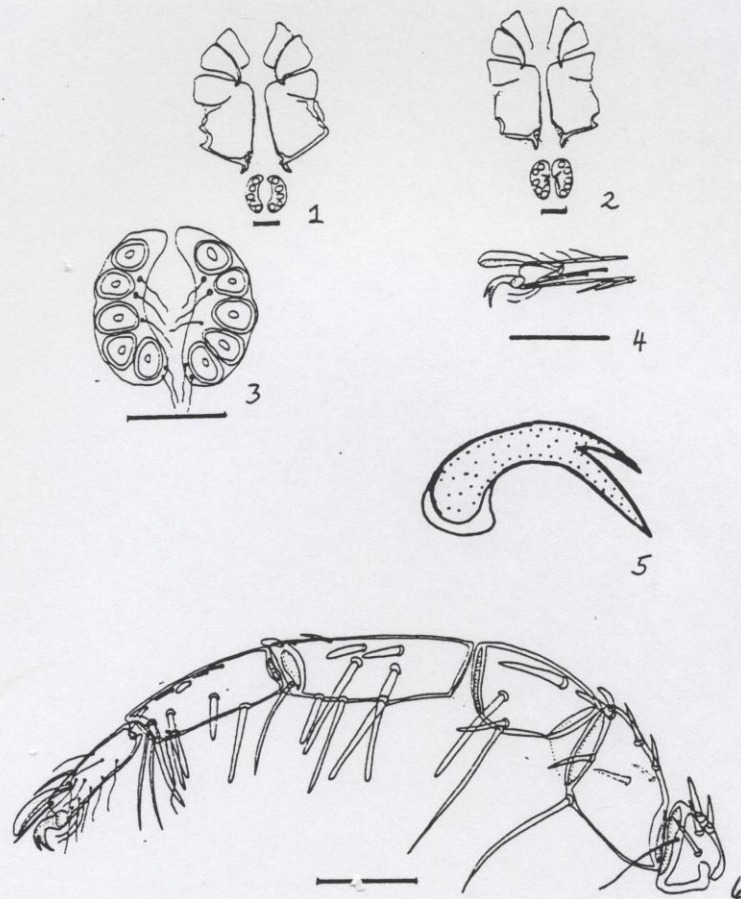
*Utterbackia peggyae* (Johnson): *Anodonta peggyae* Johnson, Florida (Vidrine 1980a).

*Villosa amygdala* (Lea): Florida (Vidrine 1980a).

*Villosa vibex* (Conrad): Jetport, Florida (possible misidentification of mussel host) (Vidrine 1980a).

*Villosa villosa* (Wright): Florida (Vidrine 1980a).





Figures 1-6. *Unionicola poundsi* Vidrine 1986. 1. Male venter. 2. Female venter. 3. Male genital field. 4. Tip of tarsus of fourth walking leg. 5. Tarsal claw of fourth walking leg (Reprinted with permission from the International Journal of Acarology: Vidrine 1987b). 6. Male first walking leg. Scale equals 100 micrometers.



Map 37. Known distribution of *Unionicola poundsi* Vidrine 1986 in North America.

*Unionicola (Unionicolides) sakantaka* Mitchell and Wilson 1965  
Plates 104-109 in Vidrine (1996a)

Synonymy--

*Unionicola (Pentatax) sakantaka* Mitchell and Wilson 1965, Dobson (1966)?, Habeeb 1967

*Unionicola (Unionicolella) sakantaka* Mitchell and Wilson 1965 in Vidrine 1980a

*Unionicola vikitra sensu* Dobson 1966

*Unionicola (Unionicolides) sakantaka* Mitchell and Wilson 1965, Vidrine 1986d and 1986e

Museum type number(s) and location-- Field Museum of Natural History, Chicago, Illinois.

Type locality and host-- Found in *Cyclonaias tuberculata* (Rafinesque) from 35.35N/86.47W, Duck River, Marshall County, Tennessee, collected on 25 August 1956 by J. L. Wilson.

Etymology-- from Sanskrit "sakantaka" meaning "with hair erect" for the large number of large, straight setae on the legs (Mitchell and Wilson 1965)

Diagnosis-- Character states of the subgenus; dorsum with 2 pairs of short, linear apodemes; posterior coxal group usually divided by an incomplete suture; pedipalps well sclerotized; genital field well sclerotized; legs setose; first walking leg Ge with three rows of large setae (males have fewer setae); tarsal claws of first walking legs distinctly bifid at tip; tarsal claws of posterior three pairs of walking legs bifid at tip, with the dorsal and ventral prongs curved and nearly equal in length, but the ventral prong is nearly three times as thick as the dorsal prong; male and female first walking legs obviously different in chaetotaxy.

Male (18 specimens)-- Length including capitulum 1053 (800-1200); length of posterior coxal group 330 (280-400); dorsal lengths of pedipalp segments: Ti 125 (110-140); Ta 61 (50-70); dorsal lengths of leg segments: leg I: TFe 148 (120-180); Ge 188 (170-210); Ti 158 (130-180); Ta 114 (100-130); leg IV: TFe 205 (170-240); Ge 291 (250-340); Ti 359 (300-400); Ta 320 (280-350).

Female (8 specimens)-- Length including capitulum 1183 (1050-1350); length of posterior coxal group 345 (320-370); dorsal lengths of pedipalp segments: Ti 141 (130-160); Ta 69 (65-70); dorsal lengths of leg segments: leg I: TFe 168 (150-200); Ge 220 (200-250); Ti 184 (170-200); Ta 128 (120-150); leg IV: TFe 234 (220-270); Ge 330 (300-390); Ti 401 (350-490); Ta 360 (330-420).

Notes-- This species resembles members of the *U. fossulata/bakeri/hoesei* group and *U. calnani*. An infested host usually has a single male and one or two females. There are five major hosts for this species: *C. tuberculata*, *Q. infucata*, *F. succissa*, *Q. metanevra*, and *Q. cylindrica*. The specimens from the Apalachicola, *i. e.*, those from *Q. infucata* and *F. succissa*, are less setose in the chaetotaxy of the first walking leg. This is especially apparent in the first walking leg of the males, and these specimens most likely represent not only a distinctive morphotype but also a separate and distinctive, new species.

Hosts:

*Cyclonaias tuberculata* (Rafinesque): Tennessee (Mitchell and Wilson 1965, Vidrine and Wilson 1991, Vidrine 1980a), Arkansas, and Ontario, Canada.

*Elliptio mcMichaeli* Clench and Turner: Apalachicola (Dobson 1966); identification of mite uncertain.

*Elliptio strigosus* (Lea): Apalachicola (Dobson 1966); identification of mite uncertain.

*Elliptio toumeyii* (Lea): Apalachicola (Dobson 1966); identification of mite uncertain.

*Fusconaia escambia* (Clench and Turner): Alabama.

*Fusconaia succissa* (Lea): Apalachicola (Dobson 1966); Alabama (Vidrine 1980a).

*Hemistena lata* (Rafinesque): Tennessee (Vidrine 1980a).

*Lampsilis teres* (Rafinesque): *Lampsilis anodontoides floridensis* (Lea), Apalachicola (Dobson 1966); identification of mite uncertain.

*Pyganodon gibbosa* (Say): Florida.

*Quadrula cylindrica cylindrica* (Say): *Orthonymus cylindrica* (Say), Tennessee (Vidrine 1980a) and Arkansas.

*Quadrula metanevra* (Rafinesque): *Orthonymus metanevra* (Rafinesque), Arkansas (Vidrine 1980a).

*Quincuncina burkei* (Walker): Apalachicola (Dobson 1966); identification of mite uncertain.

*Quincuncina infucata* (Conrad): Apalachicola (Dobson 1966); Georgia and Florida (Vidrine 1980a).

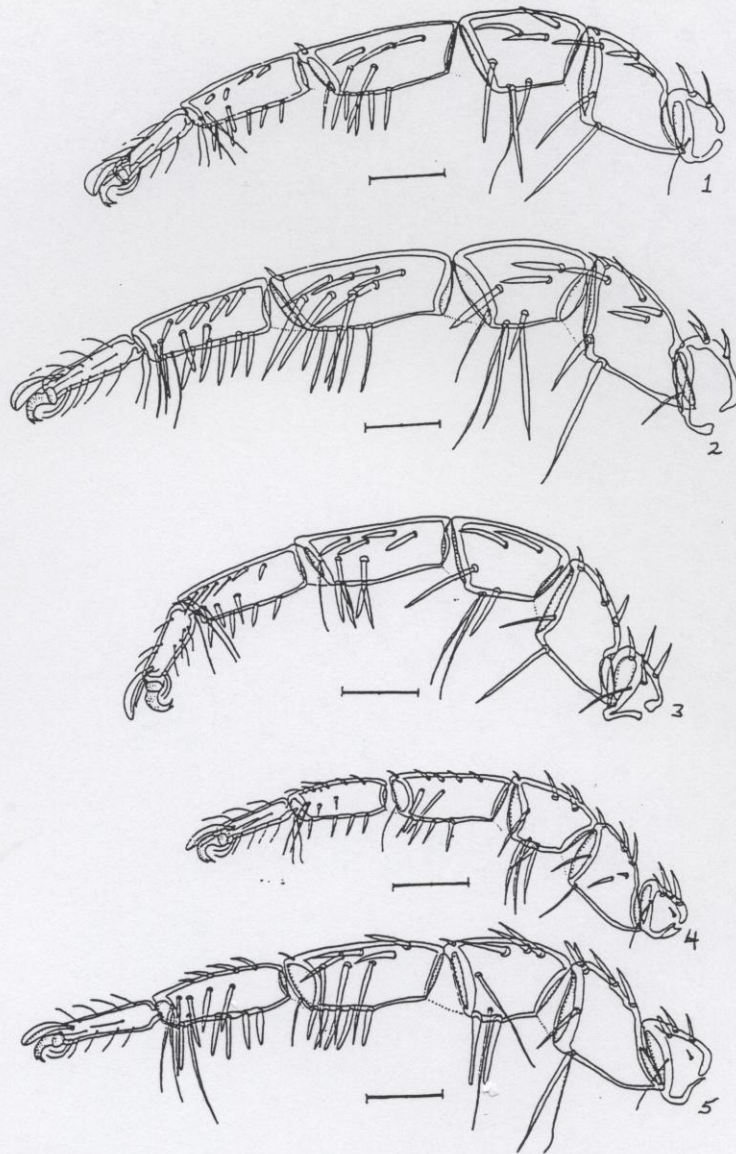
*Toxolasma paulus* (Lea): Apalachicola (Dobson 1966); identification of mite uncertain.

*Tritogonia verrucosa* (Rafinesque): Tennessee (Vidrine and Wilson 1991).

*Villosa lienosa* (Conrad): Florida.

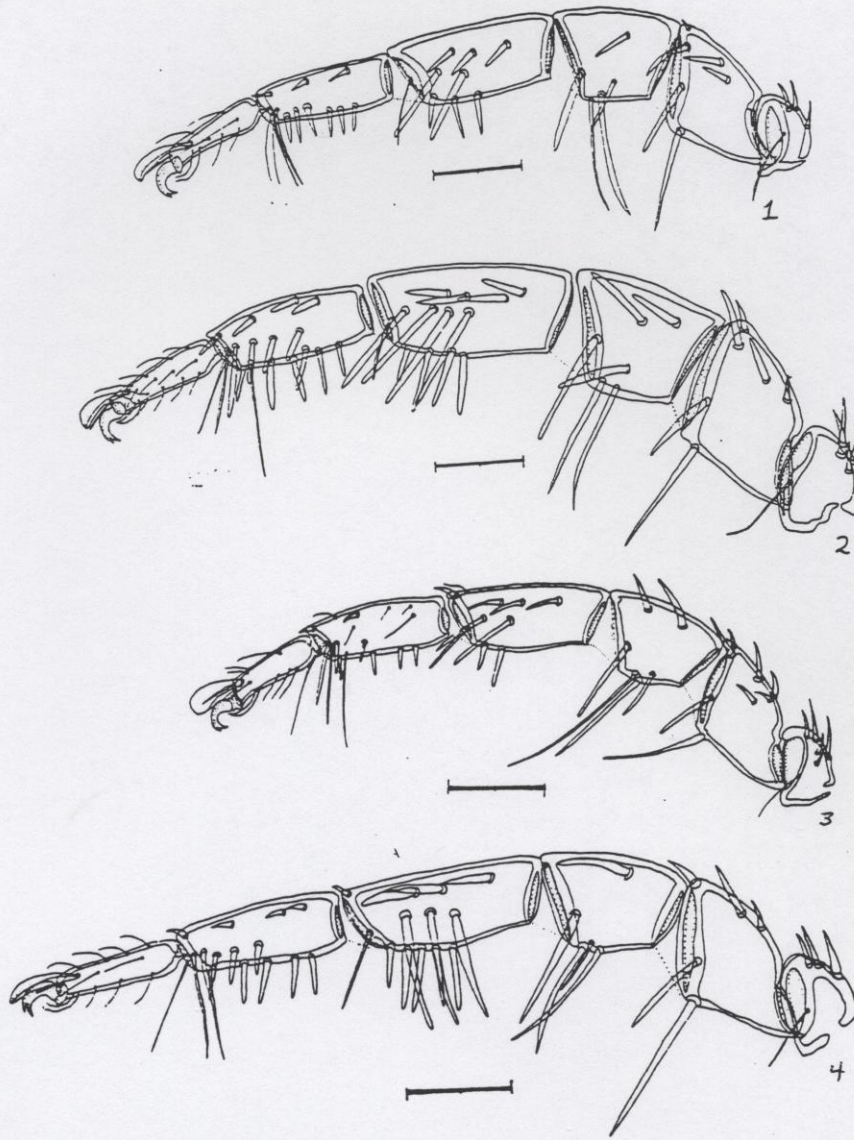
*Villosa villosa* (Wright): Apalachicola (Dobson 1966); identification of mite uncertain.





Figures 1-5. *Unionicola sakantaka* Mitchell and Wilson 1965. 1. Male first walking leg (from *Cyclonaias tuberculata* from Tennessee). 2. Female first walking leg (from *Cyclonaias tuberculata* from Tennessee). 3. Male first walking leg (from *Quadrula cylindrica* from Tennessee). 4. Male first walking leg (from *Quadrula metanevra* from Arkansas). 5. Female first walking leg from *Quadrula metanevra* from Arkansas). (Reprinted with permission from the International Journal of Acarology: Vidrine 1986d). Scale equals 100 micrometers.





Figures 1-4. *Unionicola sakantaka* Mitchell and Wilson 1965. 1. Male first walking leg (from *Fusconaia succissa* from Florida). 2. Female first walking leg (from *Fusconaia succissa* from Florida). 3. Male first walking leg (from *Quincuncina infucata* from Florida). 4. Female first walking leg (from *Quincuncina infucata* from Florida). (Reprinted with permission from the International Journal of Acarology: Vidrine 1986d). Scale equals 100 micrometers.



Map 38. Known distribution of *Unionicola sakantaka* Mitchell and Wilson 1965 in North America.

*Unionicola (Unionicolides) scutella* Vidrine 1986d

Synonymy--

*Unionicola* sp. nov. type 7 in Vidrine 1980a.

*Unionicola (Unionicolides) scutella* Vidrine 1986d in Vidrine 1986e

Museum type number(s) and location-- CNC 19106, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (female) found in *Fusconaia ebena* Lea from Leaf River at Rte U. S. 98, Greene County, Mississippi, collected on 23 July 1977 by D. J. Bereza and M. F. Vidrine.

Etymology-- Named for the obvious scute (plate) on its dorsum.

Diagnosis-- Character states of the subgenus; dorsum with obvious, large, oval plate (scute); posterior coxal group with a complete suture; genital field well sclerotized; pedipalps well sclerotized; all legs setose; first walking leg Ge with one short and 6 long, hairlike setae; tarsal claws of first walking leg moderately bifid at tip; tarsal claws of posterior three pairs of walking legs bifid at tip with 2, equal, lateral prongs.

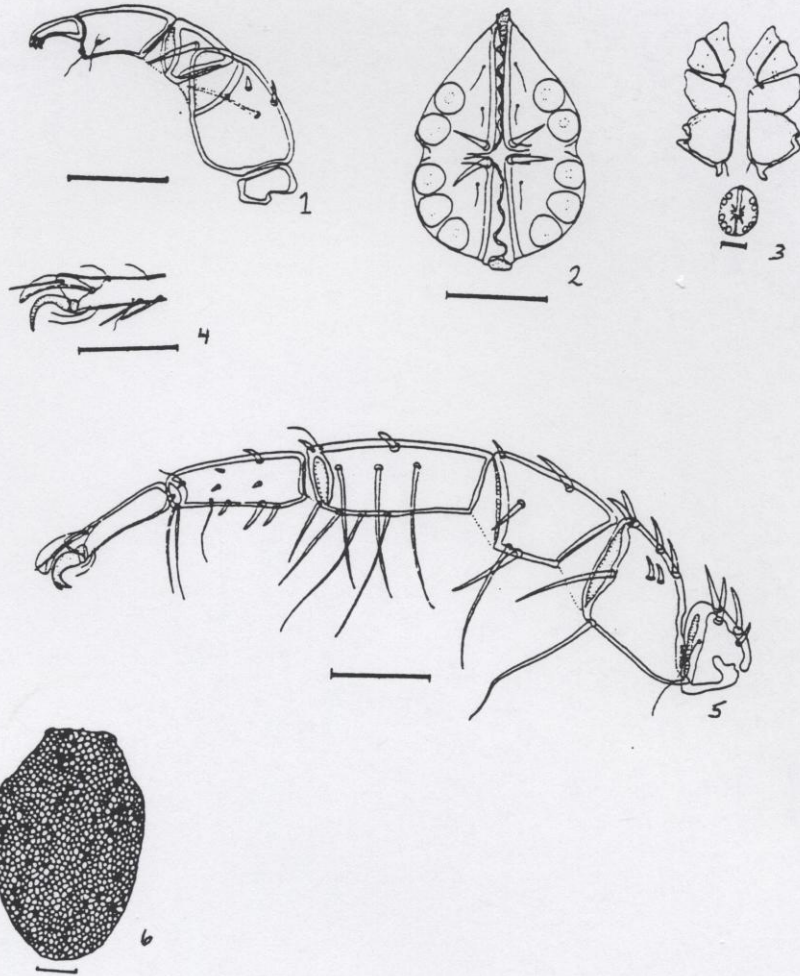
Female (3 specimens)-- Length including capitulum 1000 (950-1050); length of posterior coxal group 380 (360-400); dorsal plate 647 (580-700) long, 420 (400-440) wide; dorsal lengths of pedipalp segments: Ti 105 (100-110); Ta 54 (52-55); dorsal lengths of leg segments: leg I: TFe 130 (120-140); Ge 180 (170-190); Ti 133 (130-140); Ta 117 (110-120); leg IV: TFe 143 (130-150); Ge 266 (250-280); Ti 343 (320-360); Ta 293 (270-310).

Notes-- Three females were found in two mussels, and the males are unknown. *Unionicola scutella* has distinctive dorsal and ventral morphology. The dorsal plate resembles that of *U. sica* Lundblad 1937. The first walking leg resembles that of *U. fulleri*. This mite is so distinctive that it is difficult to not only predict the male's appearance but also to determine its closest North American relative. Surprisingly, the host of this mite has a tremendous range in the eastern United States, but this is the only known parasite and the only locality where it has been found parasitized.

Host:

*Fusconaia ebena* Lea: Mississippi.





Figures 1-6. *Unionicola scutella* Vidrine 1986. 1. Female pedipalp. 2. Female genital field. 3. Female venter. 4. Tip of tarsus of fourth walking leg. 5. Female first walking leg. 6. Female dorsal plate. (Reprinted with permission from the International Journal of Acarology; Vidrine 1986d). Scale equals 100 micrometers.



Map 39. Known distribution of *Unionicola scutella* Vidrine 1986 in North America.



*Unionicola (Unionicolides) stricta* (Wolcott 1898)  
Plates 110-112 in Vidrine (1996a)

Synonymy--

*Atax stricta* Wolcott 1898, 1899

*Atax strictus* Wolcott 1898, Piersig 1901

*Unionicola stricta* (Wolcott 1898), non-Marshall (1933b, misidentified this species in her figure), Habeeb (1967), and Goldenstein and Boles 1970

*Unionicola (Pentatax) stricta* (Wolcott 1898), Viets and Plate 1954, Viets 1965, Crowell 1961, and Mitchell 1954

*Unionicola (Unionicolella) stricta* (Wolcott 1898) in Vidrine 1980a and 1980b

*Unionicola (Unionicolides) stricta* (Wolcott 1898) in Vidrine 1986e and 1989a

Museum type number(s) and location-- Field Museum of Natural History, Chicago, Illinois, and Museum of Comparative Zoology, Harvard, Cambridge, Massachusetts.

Type locality and host-- From Nebraskan *Uniomerus* sp., since it is its only known host.

Etymology-- *Stricta* (Latin) means "to be drawn together" or "tight," and this refers either to the complete suture between the third and fourth coxal plates or to the simple the nature of the tips of tarsal claws in the first walking leg.

Diagnosis-- Character states of the subgenus; dorsum lacking obvious secondary sclerotization; posterior coxal group usually divided by a complete suture; genital fields lightly sclerotized; pedipalps moderately stout; legs moderately setose, but the first walking leg has few setae or hairs; all tarsal claws of walking legs simple; male and female first walking legs similar.

Male (6 specimens)-- Length including capitulum 725 (650-800); length of posterior coxal group 205 (180-230); dorsal lengths of pedipalp segments: Ti 85 (70-100); Ta 47 (40-50); dorsal lengths of leg segments: leg I: TFe 82 (75-90); Ge 120 (100-130); Ti 105 (90-120); Ta 130 (110-140); leg IV: TFe 118 (90-140); Ge 188 (150-220); Ti 195 (160-220); Ta 168 (150-180).

Female (6 specimens)-- Length including capitulum 817 (750-900); length of posterior coxal group 218 (200-230); dorsal lengths of pedipalp segments: Ti 97 (90-105); Ta 53 (50-55); dorsal lengths of leg segments: leg I: TFe 91 (90-95); Ge 135 (130-140); Ti 116 (110-130); Ta 140 (130-150); leg IV: TFe 148 (140-150); Ge 215 (210-220); Ti 215 (200-220); Ta 182 (170-190).

Notes-- Apparently only mussels belonging to the genus *Uniomerus* are hosts for this species. It is known from Nebraska, Florida, Louisiana, Alabama, Arkansas, and Texas. Its range is from the Mississippi Interior Basin and Gulf of Mexico drainages from the Yellow River in Florida to the central Texas drainages.

*Unionicola stricta* is readily separated from all other species by its simple tarsal claws of the walking legs and its uniquely bent tarsal claw of the first walking leg. A single infested host may

contain more than 100 individuals. It is important to note that Apalachicola and south Atlantic species in the genus *Uniomerus* contain two distantly related mites, *U. alleni* and *U. lasallei*.

Hosts:

*Uniomerus declivus* (Say): Louisiana and Texas (Vidrine 1980a).

*Uniomerus tetralasmus* (Say): *Unio Jamesianus* Lea, Nebraska (Wolcott 1899 and in Viets and Plate 1954); Louisiana, Alabama, Arkansas, and Texas (Vidrine 1980a).

The following records are dubious, i. e. the hosts and/or the mites were misidentified:

*Actinonaias ligamentina* (Lamarck): *Unio ligamentinus* Lamarck, Michigan (Wolcott 1899); *Ortmanniana carinata* (Barnes) in Viets and Plate 1954; identity of mites uncertain.

*Amblema plicata plicata* Say: *Unio undulatus* Barnes and *Unio plicatus* Lea, Michigan, Nebraska, and Illinois (Wolcott 1899 and in Viets and Plate 1954); *Quadrula plicata* (Lea), Iowa (Kelly 1899); these specimens are probably *U. tupara* and/or *U. amandita*.

*Fusconaia flava* (Rafinesque): *Unio coccineus* Hild. and *Unio rubiginosus* Lea, Michigan and Nebraska (Wolcott 1899 and in Viets and Plate 1954); these specimens were probably *U. parkeri*.

*Lampsilis cardium* Rafinesque: *Unio occidens* Lea, Michigan (Wolcott 1899); *Lampsilis ovata cardium* Rafinesque in Viets and Plate 1954; *Lampsilis ventricosus* Barnes, Iowa (Kelly 1899); these specimens are probably *U. hoesei*.

*Leptodea fragilis* (Rafinesque): *Lampsilis gracilis*, Iowa (Kelly 1899); these specimens are probably *U. hoesei* and/or *U. fulleri*.

*Obliquaria reflexa* Rafinesque: Iowa (Kelly 1899); these specimens are probably *U. vikitra*.

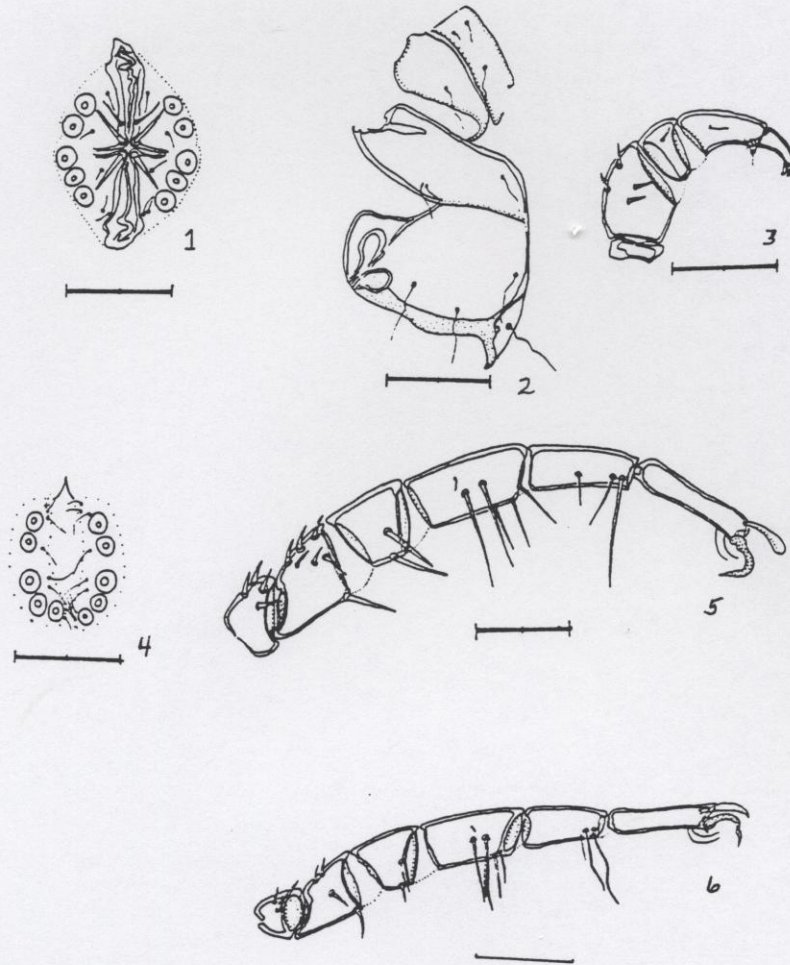
*Potamilus alatus* (Say): *Unio alatus* Say, Michigan (Wolcott 1899 and in Viets and Plate 1954); *Lampsilis alatus* (Say), Iowa (Kelly 1899); *Proptera alata* (Say), Missouri (Utterback 1916); these specimens are probably *U. hoesei* and/or *U. fulleri*.

*Quadrula pustulosa pustulosa* (Lea): *Unio schoolcrafti* Lea, Michigan (Wolcott 1899); *Pustulosa nodulata* Rafinesque in Viets and Plate 1954; Iowa (Kelly 1899); these specimens are probably *U. vikitra* and/or *U. vikitrella*.

*Quadrula quadrula* (Rafinesque): *Unio lachrymosus* Lea, Nebraska (Wolcott 1899 and in Viets and Plate 1954); *Quadrula lachrymosa* (Lea) and *Quadrula asperrima* (Lea), Iowa (Kelly 1899); these specimens are probably *U. vikitra* and/or *U. vikitrella*.

*Tritogonia verrucosa* (Rafinesque): *Unio verrucosus* Barnes, Michigan (Wolcott 1899 and in Viets and Plate 1954); *Quadrula tuberculata* (Rafinesque), Iowa (Kelly 1899); these specimens are probably *U. vamana*.

*Utterbackia imbecillis* (Say): *Anodonta imbecillus* Say, Iowa (Kelly 1899); I have no idea as to the identity of these specimens.



Figures 1-6. *Unionicola stricta* (Wolcott 1898). 1. Female genital field. 2. Coxal plates. 3. Pedipalp. 4. Male genital field. 5. Female first walking leg. 6. Male first walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1986d). Scale equals 100 micrometers.



Map 40. Known distribution of *Unionicola stricta* (Wolcott 1898) in North America.

*Unionicola (Unionicolides) tupara* Mitchell and Wilson 1965  
Plates 113-115 in Vidrine (1996a)

Synonymy--

*Unionicola (Pentatax) tupara* Mitchell and Wilson 1965, Dobson 1966, Habeeb 1967, and Vidrine 1979a, Calnan 1976

*Unionicola (Unionicolides) tupara* Mitchell and Wilson 1965 in Vidrine 1986e

*Unionicola (Unionicolella) tupara* Mitchell and Wilson 1965 in Vidrine 1980a

*U. tupara* (western morph) in Vidrine 1980a

*Unionicola* type E in Vidrine 1974a

Museum type number(s) and location-- Field Museum of Natural History, Chicago, Illinois.

Type locality and host-- Found in *Megalonaias gigantea* (Barnes)(= *Megalonaias nervosa* (Rafinesque 1820)) from 35.35N/86.47W, Duck River, Marshall County, Tennessee, collected on 25 August 1956 by J. L. Wilson.

Etymology-- from Sanskrit "tupara" meaning "unhorned" for the smallest diversity of types of setae on the legs (Mitchell and Wilson 1965)

Diagnosis-- Character states of the subgenus; dorsum with 2 pairs of short, linear apodemes; posterior coxal group usually divided by a complete suture; pedipalps slightly elongate and weakly sclerotized; genital field lightly sclerotized; legs moderately setose, but the first walking leg has few setae or hairs; tarsal claws of first walking legs bifid at tip; tarsal claws of posterior three pairs of walking legs appear simple; male and female walking legs similar.

Male (7 specimens)-- Length including capitulum 725 (650-800); length of posterior coxal group 216 (190-240); dorsal lengths of pedipalp segments: Ti 67 (60-80); Ta 54 (50-60); dorsal lengths of leg segments: leg I: TFe 67 (60-80); Ge 128 (110-145); Ti 101 (90-110); Ta 116 (110-120); leg IV: TFe 106 (90-120); Ge 187 (160-210); Ti 188 (160-210); Ta 174 (150-190).

Female (10 specimens)-- Length including capitulum 778 (550-950); length of posterior coxal group 228 (210-250); dorsal lengths of pedipalp segments: Ti 72 (60-80); Ta 60 (50-70); dorsal lengths of leg segments: leg I: TFe 83 (70-100); Ge 139 (120-160); Ti 106 (95-120); Ta 126 (120-130); leg IV: TFe 118 (90-150); Ge 206 (165-240); Ti 202 (160-240); Ta 180 (145-210).

Notes-- The most striking character of this species is the small, cylindrical pedipalps. Apalachicolan specimens match the Tennessee types, while more western specimens are smaller and have hairs instead of spines on the first walking legs. This species is apparently host specific for species belonging to three genera: *Amblema*, *Megalonaias*, and *Plectomerus*. A single infested host may contain more than 100 individuals. *Unionicola tupara* closely resembles *U. stricta* and *U. berezai*, but it has the distinctive combination of pedipalp and tarsal claw structures. The three species are considered to be less derived than other species within their respective taxa (Vidrine 1986d). It



would be most interesting to see the mites which infest the Mexican mussels, *Megalonaias nickliniana* (Lea); however, as yet, none have been searched to my knowledge.

Hosts:

*Amblema plicata* Say: Texas (Calnan 1976), Louisiana, Iowa, Illinois, Texas, Missouri, Mississippi, Ohio, Oklahoma, Wisconsin, and Minnesota (Vidrine 1980a).

*Arcidens confragosus* (Say): Louisiana (Vidrine 1980a).

*Elliptio strigosus* (Lea): Apalachicola (Dobson 1966).

*Elliptoideus sloatianus* (Lea): *Elliptio sloatianus* (Lea), Florida (Dobson 1966).

*Elliptio crassidens* (Lamarck): Tennessee.

*Elliptio dilatata* (Rafinesque): Tennessee (Vidrine and Wilson 1991).

*Fusconaia flava* (Rafinesque): Louisiana (Vidrine 1980a).

*Megalonaias boykiniana* (Lea): Apalachicola (Florida) (Dobson 1966 and Vidrine 1980a).

*Megalonaias nervosa* (Rafinesque): *Megalonaias gigantea* (Barnes), Tennessee (Mitchell and Wilson 1965, Vidrine and Wilson 1991), Texas (Calnan 1976, Louisiana (Vidrine 1974a);

*Amblema gigantea* (Barnes), Louisiana, Texas, Iowa, Missouri, Illinois, and Mississippi (Vidrine 1980a).

*Obliquaria reflexa* Rafinesque: Louisiana (Vidrine 1980a).

*Plectomerus dombeyanus* (Valenciennes): *Amblema dombeyana* (Valenciennes), Louisiana, Texas, Arkansas, and Mississippi (Vidrine 1980a); Louisiana (Vidrine 1974a).

*Plethobasus cooperianus* (Lea): Tennessee.

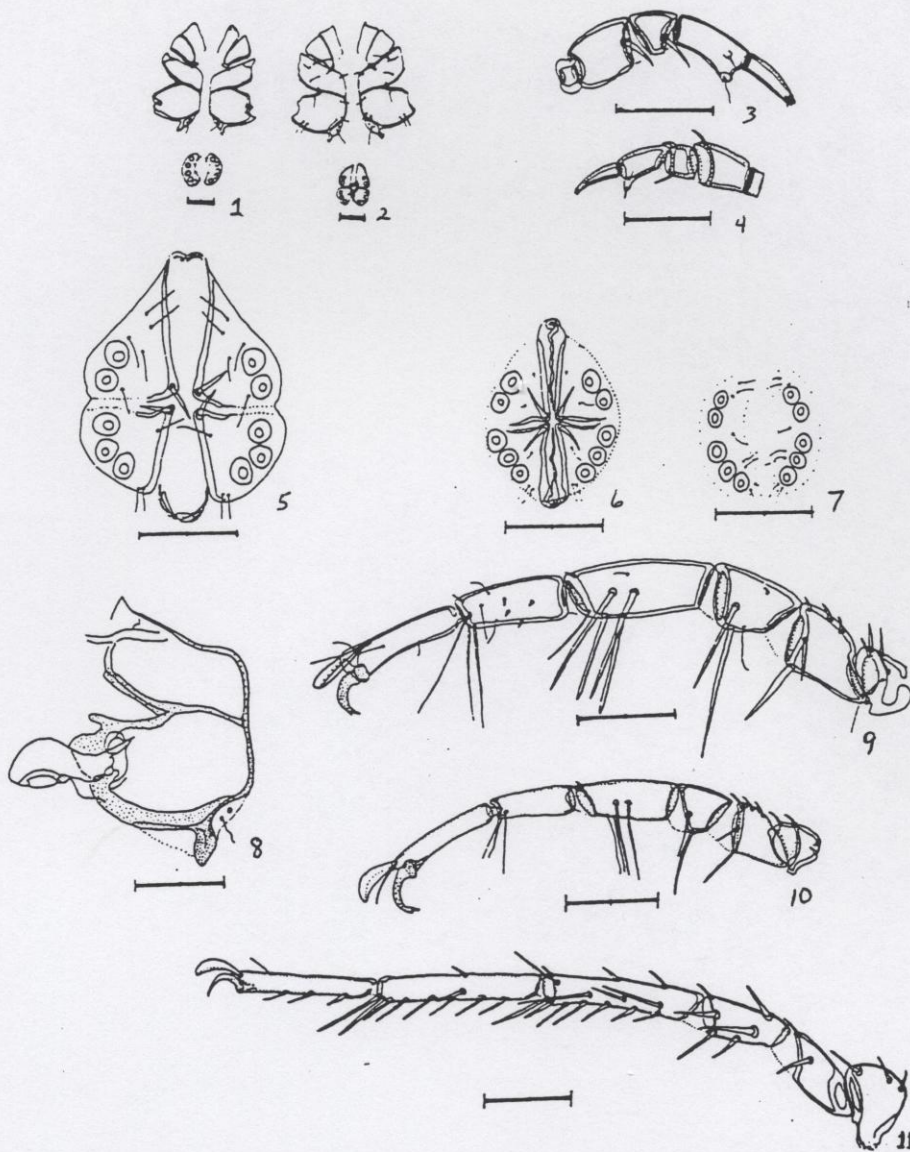
*Pleurobema riddelli* (Lea): Louisiana (Vidrine 1980a).

*Quadrula pustulosa pustulosa* (Lea): Texas (Calnan 1976) (host identity may be *Q. pustulosa mortoni*).

*Truncilla truncata* Rafinesque: Louisiana (Vidrine 1989a).

*Uniomerus tetralasmus* (Say): Texas (Calnan 1976).

*Villosa lienosa* (Conrad): Florida (Vidrine 1980a).



Figures 1-11. *Unionicola tupara* Mitchell and Wilson 1965. 1. Male venter. 2. Female venter. 3. Female pedipalp (Florida). 4. Female pedipalp (Louisiana). 5. Female genital field (Florida). 6. Female genital field (Louisiana). 7. Male genital field (Louisiana). 8. Posterior coxal plates. 9. Female first walking leg (Florida). 10. Female first walking leg (Louisiana). 11. Female fourth walking leg (Louisiana). (Reprinted with permission from the International Journal of Acarology: Vidrine 1986d). Scale equals 100 micrometers.



Map 41. Known distribution of *Unionicola tupara* Mitchell and Wilson  
1965 in North America.

*Unionicola (Unionicolides) vamana* Mitchell and Wilson 1965  
Plates 116-118 in Vidrine (1996a)

Synonymy--

*Unionicola (Pentatax) vamana* Mitchell and Wilson 1965, Habeeb 1967, Dobson 1966 (?)

*Unionicola* sp. II (in part) *sensu* Calnan 1976

*Unionicola* type F in Vidrine 1974a

*Unionicola (Unionicolella) vamana* Mitchell and Wilson 1965 *sensu stricto* in Vidrine 1980a

*Unionicola (Unionicolides) vamana* Mitchell and Wilson 1965, Vidrine 1986d and 1986e and 1987b

Museum type number(s) and location-- Field Museum of Natural History, Chicago, Illinois.

Type locality and host-- Found in *Tritogonia verrucosa* (Rafinesque 1820) from 35.35N/86.47W, Duck River, Marshall County, Tennessee, collected on 25 August 1956 by J. L. Wilson.

Etymology-- From Sanskrit, "dramana" meaning "dwarfish" (Mitchell and Wilson 1965)

Diagnosis-- Character states of the subgenus; chaetotaxy and leg segment ratios of the first walking leg distinctive; Ta of the first walking leg shorter than Ti; ventral setae on Ti shorter than width of segment; ventral setae of Ge unequal in length with one or two setae greater in length than the width of the segment; dorsal setae on Ge thick and prominent, usually 2 to 4 setae in a dorsal row; usually 2 or 3 setae in central row on Ge; all setae on Ge relatively pointed at tips; male and female legs similar, however, female legs may have one or two additional setae on Ge.

Male-- Length including capitulum 1100; length of posterior coxal group 410; dorsal lengths of pedipalp segments: Ti 150; Ta 70; dorsal lengths of leg segments: leg I: Ge 240; Ti 200; Ta 160; leg IV: Ge 350; Ti 450; Ta 400.

Female-- Length including capitulum 1150; length of posterior coxal group 420; dorsal lengths of pedipalp segments: Ti 140; Ta 65; dorsal lengths of leg segments: leg I: Ge 240; Ti 200; Ta 160; leg IV: Ge 360; Ti 460; Ta 400.

Notes: Male and female measurements were made upon mites from *Tritogonia verrucosa* (Rafinesque 1820) from Calcasieu River at Rte. LA 113, ca. 7 km west of Glenmora, Rapides Parish, Louisiana, collected on 11 October 1986 by M. F. Vidrine. The types are much smaller than the specimens reported here. While *U. vamana* is quite variable in size, it is rather consistent in leg chaetotaxy with minor variation in the number of setae on the first walking legs. *Unionicola vamana* is known from Arkansas, Louisiana, Mississippi, Tennessee, Texas, and Oklahoma. It appears to be commonly found only in a single host species *T. verrucosa*. Vidrine (1987b) divided *U. vamana sensu* Vidrine (1986d) into ten separate species.

Hosts:

*Tritogonia verrucosa* (Rafinesque): Tennessee (Mitchell and Wilson 1965, Vidrine and Wilson 1991); Texas (Calnan 1976); Louisiana, Arkansas, Texas, Mississippi, Wisconsin, and Oklahoma (Vidrine 1974a and 1980a).

Incidental records:

*Cyclonaias tuberculata* (Rafinesque): Tennessee (Vidrine and Wilson 1991).

*Lampsilis hydiana* (Lea): Louisiana (Vidrine 1989a).

*Potamilus ohioensis* (Rafinesque): *Potamilus laevis* (Lea): Louisiana (Vidrine 1989a).

*Quadrula cylindrica cylindrica* (Say): Tennessee (Vidrine and Wilson 1991).

*Quadrula quadrula* (Lea): Tennessee (Vidrine and Wilson 1991).

*Toxolasma texasensis* (Lea): *Carunculina parva* (Barnes), Louisiana (Vidrine 1989a).

*Truncilla truncata* Rafinesque: Louisiana (Vidrine 1989a).

*Truncilla donaciformis* (Lea): Louisiana (Vidrine 1989a).

Dobson's (1966) records for *U. vamana* (?) with my evaluations of specific species probably encountered:

*Elliptio mcMichaeli* Clench and Turner: specimens are either *U. gowani* and/or *U. alleni*.

*Elliptio strigosus* (Lea): *U. alleni*.

*Elliptio toumeyi* (Lea): specimens are either *U. gowani* and/or *U. alleni*.

*Lampsilis straminea claibornensis* (Lea): uncertain.

*Lampsilis teres* (Rafinesque): *Lampsilis anodontoides floridensis* (Lea), uncertain.

*Pleurobema strodeanum* (Wright): *U. gowani*.

*Quincuncina burkei* (Walker): *U. gowani*.

*Quincuncina infucata* (Conrad): uncertain.

*Toxolasma paulus* (Lea): uncertain.

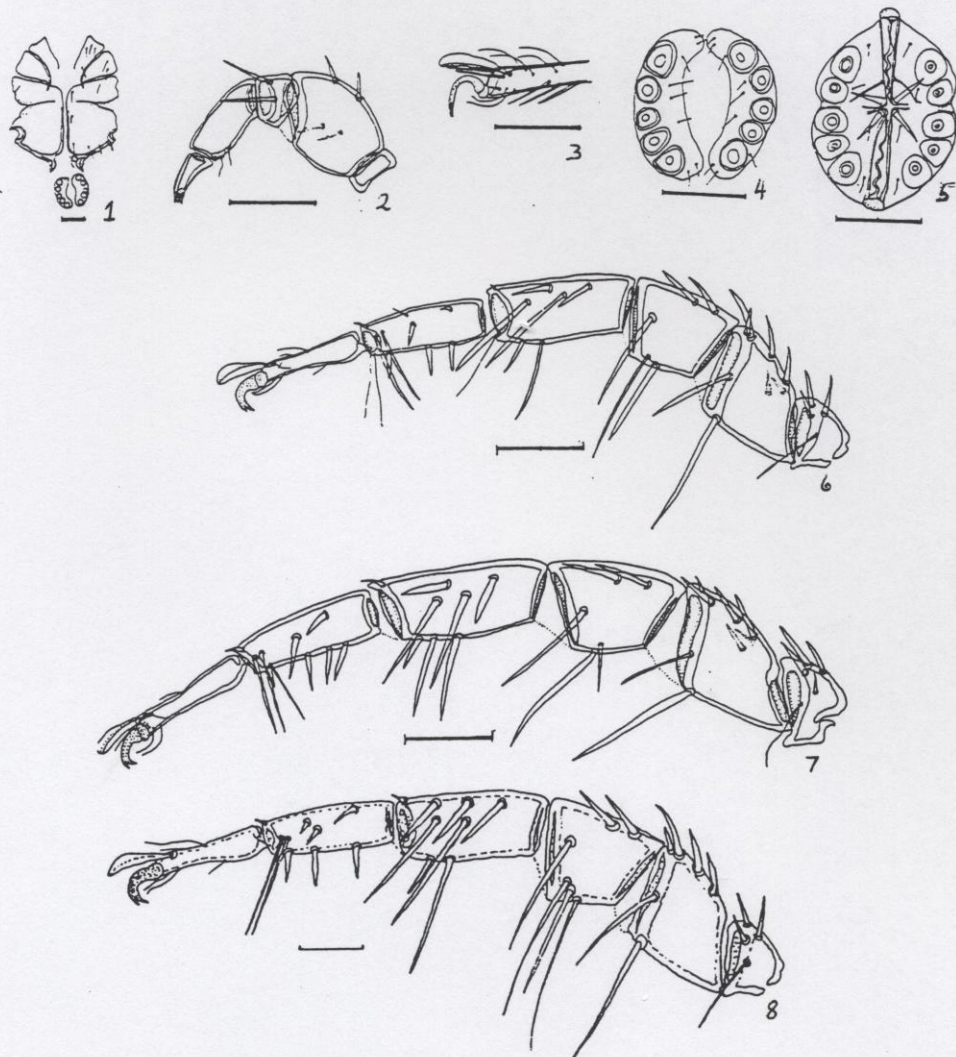
*Utterbackia peggyae* (Johnson): *Anodonta peggyae* Johnson, uncertain.

*Villosa lienosa* (Conrad): *U. gailae*.

*Villosa vibex* (Conrad): uncertain.

*Villosa villosa* (Wright): *U. poundsi*.





Figures 1-8. *Unionicola vama* Mitchell and Wilson 1965. 1. Male venter. 2. Pedipalp. 3. Tip of tarsus of fourth walking leg. 4. Male genital field. 5. Female genital field. 6. Male first walking leg. 7. Female first walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1986d). 8. Male first walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1987b). Scale equals 100 micrometers.



Map 42. Known distribution of *Unionicola vama* Mitchell and Wilson 1965 in North America.

*Unionicola (Unionicolides) vikitra* Mitchell and Wilson 1965  
Plates 119-121 in Vidrine (1996a)

Synonymy--

*Unionicola (Pentatax) vikitra* Mitchell and Wilson 1965, Habeeb 1967

*Unionicola* sp. I and II (in part) *sensu* Calnan 1976

*Unionicola* type F (in part) in Vidrine 1974a

*Unionicola (Unionicolides) vikitra* Mitchell and Wilson 1965, Vidrine 1986d, 1986e, and 1987b

*Unionicola (Unionicolella) vikitra sensu stricto* and group variable 2 in Vidrine 1980a

Museum type number(s) and location-- Field Museum of Natural History, Chicago, Illinois.

Type locality and host-- Found in *Quadrula pustulosa* (Lea 1831) from 35.35N/86.47W, Duck River, Marshall County, Tennessee, collected on 25 August 1956 by J. L. Wilson.

Etymology-- From Sanskrit, "vikitra" meaning "diverse" for the diversity of types of setae on the legs (Mitchell and Wilson 1965)

Diagnosis-- Character states of the subgenus; chaetotaxy and leg segment ratios of the first walking leg distinctive; Ta of the first walking leg shorter than Ti; ventral setae on Ti longer than width of segment; ventral setae of Ge unequal in length with the proximal setae longer than width of Ge; 3 or 4 dorsal setae on Ge usually thick and prominent; usually 2 or 3 setae in central row on Ge; all setae pointed at tips; male first walking leg usually less setose than female first leg.

Male-- Length including capitulum 1000; length of posterior coxal group 360; dorsal lengths of pedipalp segments: Ti 110; Ta 55; dorsal lengths of leg segments: leg I: Ge 180; Ti 160; Ta 125; leg IV: Ge 230; Ti 340; Ta 320.

Female-- Length including capitulum 1300; length of posterior coxal group 500; dorsal lengths of pedipalp segments: Ti 150; Ta 70; dorsal lengths of leg segments: leg I: Ge 270; Ti 210; Ta 150; leg IV: Ge 380; Ti 460; Ta 430.

Notes-- Male and female measurements were made upon mites from *Quadrula quadrula* (Rafinesque 1820) from the Mississippi River, river miles 386.5-395.0, Dallas City area (Green Bay station), Henderson and Hancock Counties, Illinois collected on 30-31 August and 1-7 September 1977 by S. L. H. Fuller. It is a common parasite in *Quadrula* spp. and occasionally in *T. verrucosa*. It is also found in *Obliquaria reflexa* Rafinesque 1820, when the host occurs in beds of *Quadrula*. *Unionicola vikitra* is known from Tennessee, Louisiana, Texas, Alabama, Arkansas, Mississippi, Iowa, Missouri, Illinois, Oklahoma, Wisconsin, Minnesota, and Ohio (Vidrine 1987). *Quadrula pustulosa mortoni* and *Q. refulgens* are also hosts (Vidrine 1993a). Vidrine (1987b) split *U. vikitra sensu* Vidrine 1986d and 1986e into two species: *U. vikitra* and *U. vikitrella*.

Hosts:

*Cyclonaias tuberculata* (Rafinesque): Tennessee (Vidrine and Wilson 1991).

*Fusconaia flava* (Rafinesque): Virginia (Vidrine 1980a).

*Obliquaria reflexa* Rafinesque: Louisiana, Iowa, Illinois, Missouri, Texas, Minnesota, Wisconsin, and Oklahoma (Vidrine 1980a).

*Pyganodon grandis* (Say): *Anodonta grandis* Say, Louisiana (Vidrine 1974a).

*Quadrula apiculata* (Say): Louisiana and Texas (Vidrine 1980a).

*Quadrula aurea* (Lea): Texas (Vidrine 1980a).

*Quadrula nodulata* Rafinesque: Wisconsin, Iowa, Missouri, Louisiana, and Texas (Vidrine 1980a).

*Quadrula pustulosa pustulosa* (Lea): Tennessee (Mitchell and Wilson 1965), Louisiana, Alabama, Arkansas, Texas, Iowa, Missouri, Illinois, Oklahoma, Minnesota, and Wisconsin (Vidrine 1974a and 1980a, Calnan 1976).

*Quadrula pustulosa mortoni* (Conrad): *Quadrula nodulata* Rafinesque, Louisiana (Vidrine 1974a); Louisiana and Texas (Vidrine 1980a).

*Quadrula quadrula* (Rafinesque): Texas (Calnan 1976); Louisiana, Texas, Ohio, Oklahoma, Iowa, Missouri, Illinois, Minnesota, and Wisconsin (Vidrine 1980a).

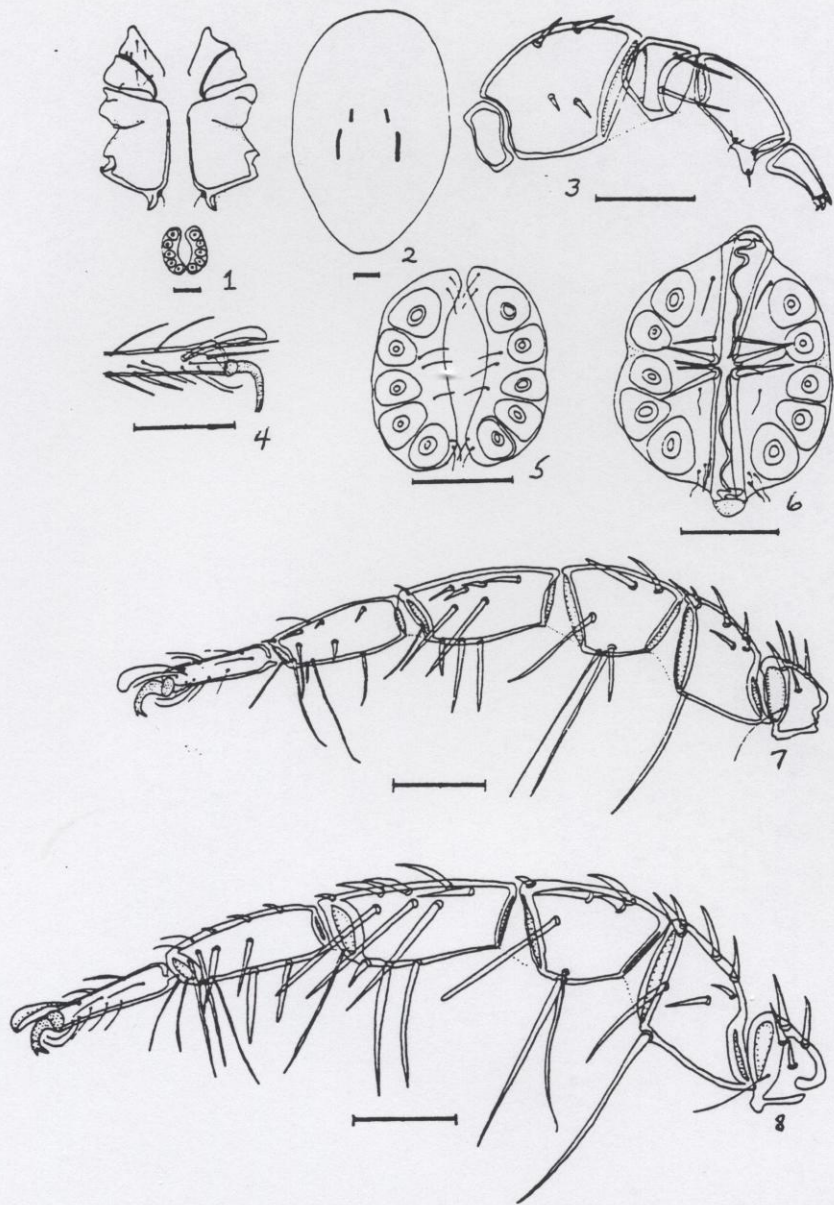
*Quadrula refulgens* (Lea): Mississippi and Louisiana (Vidrine 1980a).

*Quincuncina burkei* Walter: Florida.

*Toxolasma paulus* (Lea): Florida.

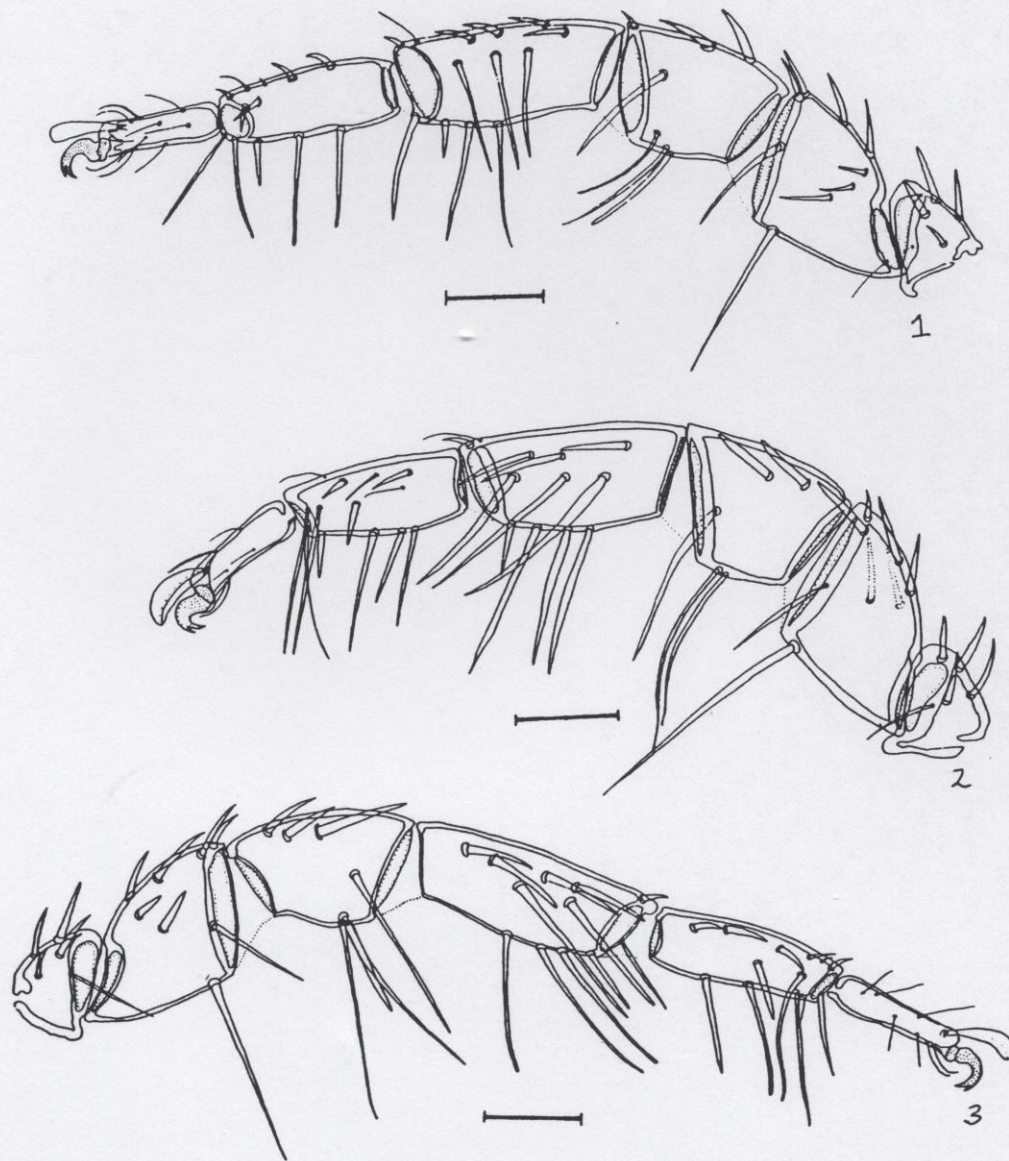
*Tritogonia verrucosa* (Rafinesque): Louisiana and Texas (Vidrine 1974a and 1980a, Calnan 1976).





Figures 1-8. *Unionicola vikitra* Mitchell and Wilson 1965. 1. Male venter. 2. Dorsal plates. 3. Pedipalp. 4. Tip of tarsus of fourth walking leg. 5. Male genital field. 6. Female genital field. 7. Male first walking leg. 8. Female first walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1986d). Scale equals 100 micrometers.





Figures 1-3. *Unionicola vikitra* Mitchell and Wilson 1965. 1. Male first walking leg. 2-3. Female first walking legs. (Reprinted with permission from the International Journal of Acarology: Vidrine 1986d). Scale equals 100 micrometers.



Map 43. Known distribution of *Unionicola vikitra* Mitchell and Wilson 1965 in North America.

*Unionicola (Unionicolides) vikitrella* Vidrine 1987b  
Plates 122-125 in Vidrine (1996a)

Synonymy--

*Unionicola vikitra* group variable 1 in Vidrine 1980a.

*Unionicola (Unionicolides) vikitra* Mitchell and Wilson 1965 (in part) in Vidrine 1986d and 1986e

*Unionicola (Unionicolides) vikitrella* Vidrine 1987

Museum type number(s) and location-- CNC 19671, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Found in *Quadrula pustulosa* (Lea 1831) from Tensas River at Rte LA 577, Madison Parish, Louisiana on 18 August 1974 by Blake and M. F. Vidrine.

Etymology-- Named to mark its small size and its great similarity to *U. vikitra*.

Diagnosis-- Character states of the subgenus; chaetotaxy and leg segment ratios of the first walking leg distinctive; Ta of the first walking leg shorter than Ti; ventral setae on Ti longer than width of Ti; ventral setae on Ge near equal in length and much longer than width of Ge; dorsal setae on Ge usually one or two short blunted setae; usually two setae in central row on Ge; central and ventral setae on Ge elongate and hairlike; male and female legs nearly identical.

Male (holotype)-- Length including capitulum 800; length of posterior coxal group 260; dorsal lengths of pedipalp segments: Ti 90; Ta 50; dorsal lengths of leg segments: leg I: Ge 160; Ti 130; Ta 110; leg IV: Ge 230; Ti 240; Ta 230.

Female (allotype)-- Length including capitulum 950; length of posterior coxal group 290; dorsal lengths of pedipalp segments: Ti 95; Ta 55; dorsal lengths of leg segments: leg I: Ge 170; Ti 140; Ta 115; leg IV: Ge 250; Ti 255; Ta 240.

Notes-- The obviously long and hairlike setae on the Ge and Ti of the first walking leg are diagnostic. It is a parasite of *Quadrula* spp. and cooccurs with *U. vikitra* in some hosts. *Unionicola vikitrella* is a sibling species with *U. vikitra* and *U. vamana*, and it is known from Louisiana, Texas, Iowa, Wisconsin, Minnesota, and Missouri (Vidrine 1987b).

Hosts:

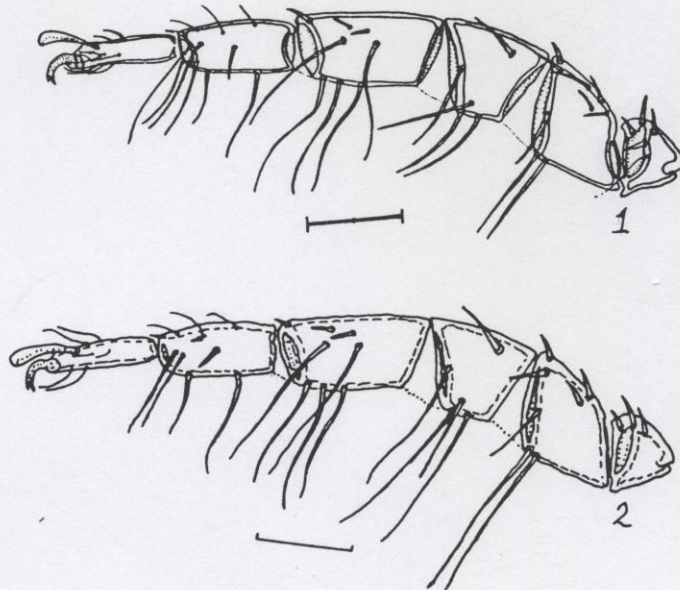
*Quadrula apiculata* (Say): Louisiana and Texas.

*Quadrula nodulata* Rafinesque: Wisconsin, Iowa, Missouri, Louisiana, and Texas. *Quadrula pustulosa pustulosa* (Lea): Louisiana, Iowa, Missouri, Illinois, Minnesota, and Wisconsin.

*Quadrula pustulosa mortoni* (Conrad): Louisiana and Texas.

*Quadrula quadrula* (Rafinesque): Louisiana, Texas, Iowa, Missouri, Illinois, Minnesota, and Wisconsin.





Figures 1-2. *Unionicola vikitrella* Vidrine 1987. 1. Male first walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1986d). 2. Male first walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1987b). Scale equals 100 micrometers.



Map 44. Known distribution of *Unionicola vikitrella* Vidrine 1987 in North America.



Subgenus *Berezatax* Vidrine 1985a

TYPE SPECIES--*U. berezai* Vidrine 1985a

ETYMOLOGY-- Named to honor Daniel J. Bereza.

DIAGNOSIS--Genital acetabula 4-6 pairs; female genital field with a single pair of acetabular plates; each plate with at least one seta on the inner margin resulting in a central complex of setae in the genital field; male genital field similar to *Unionicola*; pedipalps dorsoventrally flattened and weakly sclerotized ventrally; male and female legs similar.

HABITAT--Parasites of Unionidae.

DISTRIBUTION--North America (southern United States and Mexico).

DISCUSSION--*Berezatax* is morphologically intermediate between *Unionicolides* and *Atacella*. *Berezatax* has female genital fields similar to those of *Unionicolides* and pedipalps similar to those of *Atacella*.

ADDITIONAL SPECIES INCLUDED-- *U. acylindrotarsa* Vidrine 1985a and *U. latipalpa* Vidrine 1985a.

*Unionicola (Berezatax) acylindrotarsa* Vidrine 1985a  
Plates 126-128 in Vidrine (1996a)

Synonymy--

*Atacella (Atacella) sp. nov.* type II (Vidrine 1980a and Vidrine and Bereza 1980).

*Unionicola (Berezatax) acylindrotarsa* Vidrine 1985a, Vidrine 1986e

Museum type number(s) and location-- CNC 18688, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Popenaias* sp. from a small river (locally called Arroyo los Gatos) (Panuco River system) at Rte. MX 80 in Nuevo Morelos, ca. 1.0 km from the sign on the west end of town and ca. 17.0 km along Rte. MX 80 west of Antiguo Morelos, Tamaulipas, Mexico, collected on 13 November 1978 by Daniel J. Bereza.

Etymology-- Named to mark the acylindrical shape of the tarsus of the first walking legs as the major diagnostic character.

Diagnosis-- Character states of the subgenus; pedipalp Ta with 3 distal clawlets; first walking leg with few setae, especially the Ge, Ti, and Ta with several, small, hairlike setae; fourth walking leg more densely setigerous; Ta of first walking leg swollen proximally and acylindrical and longer than Ti; tarsal claw of first walking leg bifid at tip with strongly divergent prongs; claws of posterior walking legs finely bifid at the tip (the prongs appear to be lateral to one another and equal in length) and appearing simple.

Male (3 specimens)-- Length including capitulum 658 (550-725); dorsal shield (plate) 300 long;

length of posterior coxal group 203 (200-210); dorsal lengths of pedipalp segments: Ge 35; Ti 61; Ta 41 (40-42); dorsal lengths of leg segments: leg I: TFe 68 (65-70); Ge 100 (90-110); Ti 77 (75-80); Ta 102 (95-110); leg IV: TFe 107 (100-110); Ge 148 (135-160); Ti 152 (140-160); Ta 122 (115-130).

Female (3 specimens)-- Length including capitulum 733 (700-800); dorsal shield 300 long; length of posterior coxal group 218 (210-225); dorsal lengths of pedipalp segments: Ti 75; Ta 40; dorsal lengths of leg segments: leg I: TFe 71 (65-75); Ge 98 (95-100); Ti 80; Ta 107 (105-110); leg IV: TFe 109 (107-110); Ge 157 (155-160); Ti 155 (150-160); Ta 120.

Notes-- *Unionicola acylindrotarsa* occurs as one or 2 mites in each infested host. The eggs are deposited in the ventral edge of the outer demibranchs of the gills of their hosts. This mite is known from a number of localities in the Panuco River system and from single localities in the Rio Tuxpan and Rio Carrizal systems. Of the 40 specimens known, only one has been found in a host other than *Popenaias* sp. This specimen was collected in *Nephronaias* sp. Additional paratypes studied and measured are from *Popenaias* sp. from: a small river (locally called Rio Vallejares) draining into Rio Ganina at bridge of Estacion Rascon-Damian Carmona Road ca. 1.3 km north of railroad crossing in Estacion Rascon, San Luis Potosi, Mexico, collected 4 November 1978 by Daniel Bereza; an arroyo (locally called Rio Estero) at Rte. MX 110 ca. 25.0 km east of intersection of Rte. MX 110 and 85 in Ciudad Vallez, San Luis Potosi, Mexico, collected 2 February 1982 by Daniel Bereza, S. V. Hensley, and M. F. Vidrine; Rio Carrizal at Rte. MX 180, north of Aldama, Tamaulipas, Mexico, collected 27 January 1982 by Daniel Bereza, S. V. Hensley, and M. F. Vidrine; and Rio Pantepec at Alamo (due west of Tuxpan) (Rio Tuxpan system) (mussels collected ca. 300 to 500 m upstream), Vera Cruz, Mexico, collected 23 February 1982 by Daniel J. Bereza, S. V. Hensley, R. T. Hensley, and M. F. Vidrine. This species closely resembles *U. berezai*, but the tarsal claw and tarsal shapes of the first walking legs are diagnostic. This species is known only from small tributaries.

Hosts:

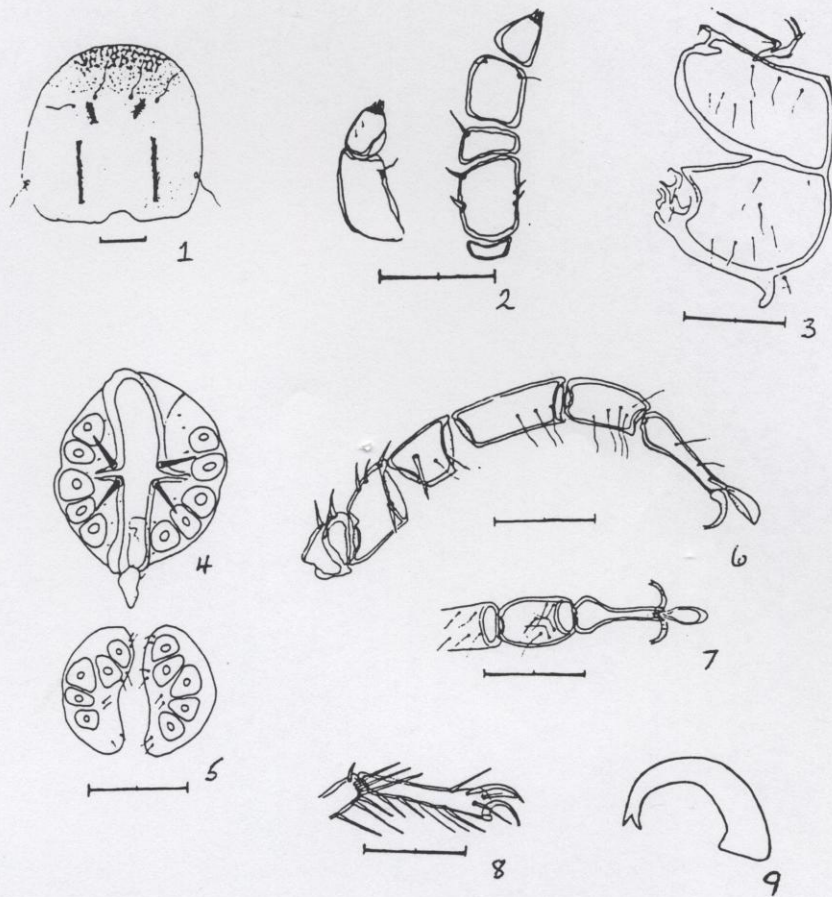
*Nephronaias coyensis* (Pilsbry): Mexico.

*Popenaias metallica* (Say): Mexico.

*Popenaias metallica ganina* (Pilsbry): Mexico (Vidrine 1980a and Vidrine and Bereza 1980).

*Popenaias popei* (Lea): Mexico.

*Popenaias* sp.: *Popenaias* sp. nov., Mexico (Vidrine 1980a and Vidrine and Bereza 1980).



Figures 1-9. *Unionicola acylindrotarsa* Vidrine 1985. 1. Dorsal plate. 2. Pedipalp. 3. Posterior coxal plates. 4. Female genital field. 5. Male genital field. 6. First walking leg. 7. Distal segments of first walking leg. 8. Tarsus of fourth walking leg. 9. Tarsal claw of first walking leg. (Reprinted with permission from the International Journal of Acarology; Vidrine 1985a). Scale equals 100 micrometers.



Map 45. Known distribution of *Unionicola acylindrotarsa* Vidrine  
1985 in North America.

*Unionicola (Berezatax) berezai* Vidrine 1985a  
Plates 129-131 in Vidrine (1996a)

Synonymy--

*Atacella (Atacella) sp. nov.* type I (Vidrine 1980a and Vidrine and Bereza 1980).

*Unionicola (Berezatax) berezai* Vidrine 1985a, Vidrine 1986e

Museum type number(s) and location-- CNC 18687, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Popenaias popei* (Lea) from Devil's River (Rio Grande drainage) ca. 0.7 km below Baker's Crossing, Val Verde County, Texas, collected on 5 June 1976 by Samuel L. H. Fuller and Daniel J. Bereza.

Etymology-- Named to honor Daniel J. Bereza.

Diagnosis-- Character states of the subgenus; pedipalp Ta with 3 distal clawlets; first walking leg with few setae, especially the Ge, Ti, and Ta with several, small, hairlike setae; fourth walking leg more densely setigerous; Ta of first walking leg cylindrical and longer than Ti; tarsal claw of first walking leg with a small, distal prong giving the claw tip a reverse uncinatate shape; claws of posterior walking legs appearing simple but finely bifid at the tip (the prongs appear to be lateral to one another and equal in length).

Male (4 specimens)-- Length including capitulum 656 (600-700); dorsal shield (plate) 410 (400-420) long, 418 (400-425) wide; length of posterior coxal group 244 (225-260); dorsal lengths of pedipalp segments: Ge 35 (30-40); Ti 74 (70-80); Ta 42 (40-45); dorsal lengths of leg segments: leg I: TFe 77 (70-81); Ge 109 (100-120); Ti 100 (95-110); Ta 125 (115-134); leg IV: TFe 126 (107-140); Ge 173 (150-187); Ti 183 (165-195); Ta 151 (133-170).

Female (5 specimens)-- Length including capitulum 863 (700-950); dorsal shield 400 (350-425) long, 450 wide; length of posterior coxal group 243 (210-265); dorsal lengths of pedipalp segments: Fe 73; Ge 35; Ti 69 (62-80); Ta 45 (44-45); dorsal lengths of leg segments: leg I: TFe 79 (78-80); Ge 114 (110-120); Ti 104 (94-108); Ta 130 (128-132); leg IV: TFe 137 (130-145); Ge 190 (172-200); Ti 195 (172-210); Ta 159 (150-165).

Notes-- *Unionicola berezai* usually occurs as one or 2 mites in each infested host. The eggs are deposited in the ventral edge of the outer demibranchs of the gills of their hosts. This mite was also collected in *Nephronaias* sp. in the Rio Panuco drainage in eastern Mexico and from a number of other mussel genera in the eastern Mexican Gulf drainages, including the Rio Papaloapan and Laguna Catemaco in southern Mexico. Additional paratypes studied and measured are from mussels at the following stations: Rio Huichihuayan (Moctezuma River system in the Rio Panuco drainage) at road to Xilitla off Rte. Mexico 85, San Luis Potosi, Mexico, collected 30 January 1982 by D. J. Bereza, S. V. Hensley, and M. F. Vidrine; Rio San Juan (Rio Papaloapan drainage) ca. 29.0



km south of Santiago Tuxtla (junction of Rte. MX 25 and 180) on Rte. MX 25 and ca. 23.0 km from the junction of Rte. MX 25 and 145, Vera Cruz Province, Mexico, collected 15 February 1982 by D. J. Berezina, S. V. Hensley, R. T. Hensley, and M. F. Vidrine. Many species of uncertain identification status were found to be parasitized with these mites (Vidrine 1996b). The southern range of this species is unknown, but intensive search has not produced a single specimen north or east of southern Texas. This species is similar to *U. tupara*, and it has been discussed in part by Vidrine and Berezina (1980).

Hosts:

*Barynaias opacata* (Crosse and Fischer): *Barynaias* sp.: Mexico.

*Cyrtonaias tampicoensis* (Lea): Mexico.

*Disconaias purpurata* (Say): Mexico (Vidrine 1980a and Vidrine and Berezina 1980).

*Elliptio plexus distinctus* (Conrad): Mexico.

*Elliptio liebmanni* (Philippi): Mexico.

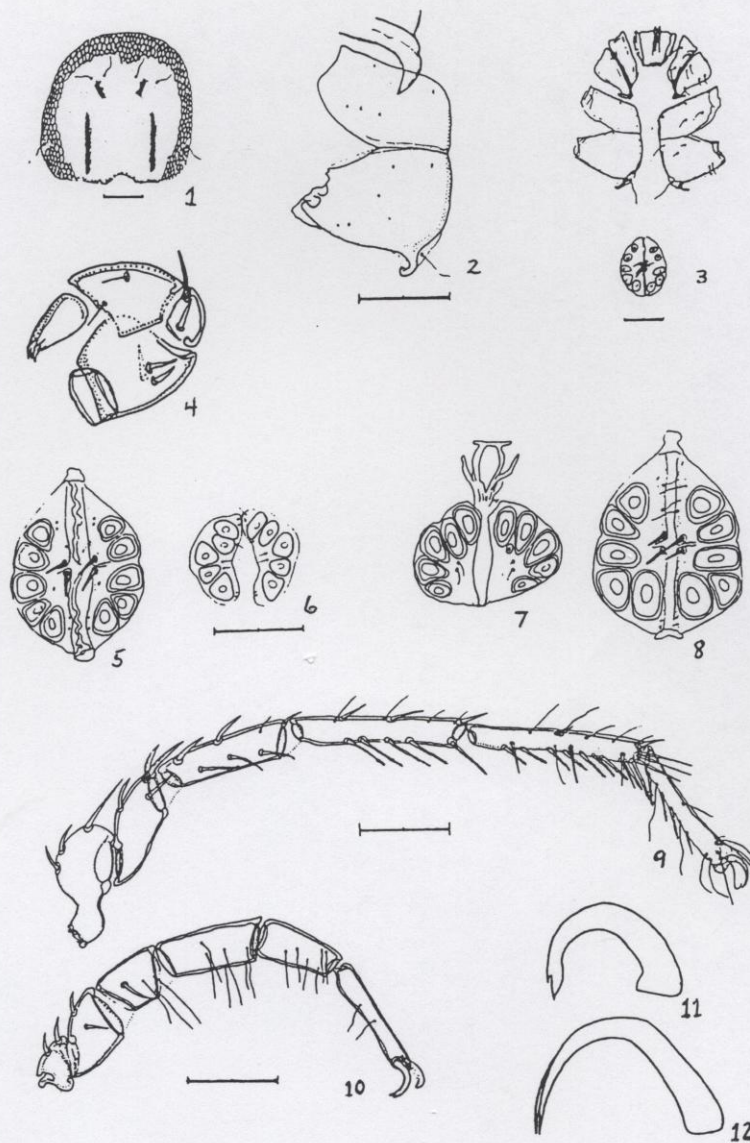
*Elliptio plexus* (Conrad): *Elliptio* spp.: Mexico.

*Nephronaias coyensis* (Pilsbry): *Nephronaias* sp.: Mexico (Vidrine 1980a and Vidrine and Berezina 1980).

*Nephronaias signata* (Pilsbry): Mexico.

*Popenaias popei* (Lea): Texas and Mexico (Vidrine 1980a and Vidrine and Berezina 1980).

*Quadrula couchiana* (Lea): Mexico.



Figures 1-12. *Unionicola berezai* Vidrine 1985. 1. Dorsal plate. 2. Posterior coxal plates. 3. Female venter. 4. Pedipalp. 5. Female genital field. 6. Male genital field. 7. Male genital field. 8. Female genital field. 9. Fourth walking leg. 10. First walking leg. 11. Tarsal claw of first walking leg. 12. Tarsal claw of fourth walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985a). Scale equals 100 micrometers.



Map 46. Known distribution of *Unionicola berezai* Vidrine 1985 in North America.

*Unionicola (Berezatax) latipalpa* Vidrine 1985a  
Plates 132-135 in Vidrine (1996a)

Synonymy--

*Atacella (Atacella) sp. nov.* type III (Vidrine 1980a and Vidrine and Bereza 1980).

*Unionicola latipalpa* Dobson 1966 (manuscript name)

*Unionicola* sp. III Calnan 1976

*Unionicola (Berezatax) latipalpa* Vidrine 1985a, Vidrine 1986e

Museum type number(s) and location-- CNC 18689, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Carunculina* (= *Toxolasma*) *paulus* from Ochlockonee River at Rte. FL 263, Gadsden and Leon Counties, Florida, collected on 17 July 1977 by Marc Imlay, D. J. Bereza, and M. F. Vidrine.

Etymology-- Named to acknowledge Dobson's name, but the descriptive nature of the name is perfect in describing the dorsoventrally flattened pedipalps.

Diagnosis-- Character states of the subgenus; pedipalp Ta with 4 distal clawlets; first walking leg with 2 rows of hairlike setae, and Ti longer than Ta; posterior pairs of legs with more spinelike setae; claw of first walking leg with a small, dorsal prong giving the bifid tip a reverse uncinat shape; claws of posterior legs finely bifid at the tip and appearing simple--the prongs appear to be lateral to one another.

Male (3 specimens)-- Length including capitulum 900 (800-1100); dorsal shield (plate) 600 long; length of posterior coxal group 292 (250-325); dorsal lengths of pedipalp segments: Ge 45; Ti 85; Ta 54 (47-60); dorsal lengths of leg segments: leg I: TFe 87 (82-95); Ge 131 (120-145); Ti 108 (105-115); Ta 98 (85-107); leg IV: TFe 163 (160-165); Ge 208 (200-220); Ti 216 (207-230); Ta 192 (180-205).

Female (3 specimens)-- Length including capitulum 1063 (990-1200); dorsal shield 550 long, 490 wide; length of posterior coxal group 308 (265-335); dorsal lengths of pedipalp segments: Ge 45 (40-50); Ti 75 (65-85); Ta 49 (47-50); dorsal lengths of leg segments: leg I: TFe 92 (82-100); Ge 145 (130-160); Ti 115 (105-125); Ta 101 (92-110); leg IV: TFe 168 (154-185); Ge 218 (205-235); Ti 224 (210-235); Ta 204 (190-215).

Notes-- *Unionicola latipalpa* occurs as one or 2 (seldom 3) mites in each infested host, with *Toxolasma* spp. as the only known host genera. The eggs are deposited in the ventral edge of the demibranchs of the gills of their hosts. Additional paratypes studied and measured are from: Burnt Corn Creek at Rte. U. S. 84, ca. 7.0 km east of Repton, Conecuh County, Alabama, collected 21 July 1977 by D. J. Bereza and M. F. Vidrine; a rice irrigation canal at China on Rte. U. S. 90, Jefferson County, Texas, collected 24 August 1978 by M. F. Vidrine; and Nestor Ranch Tanks,

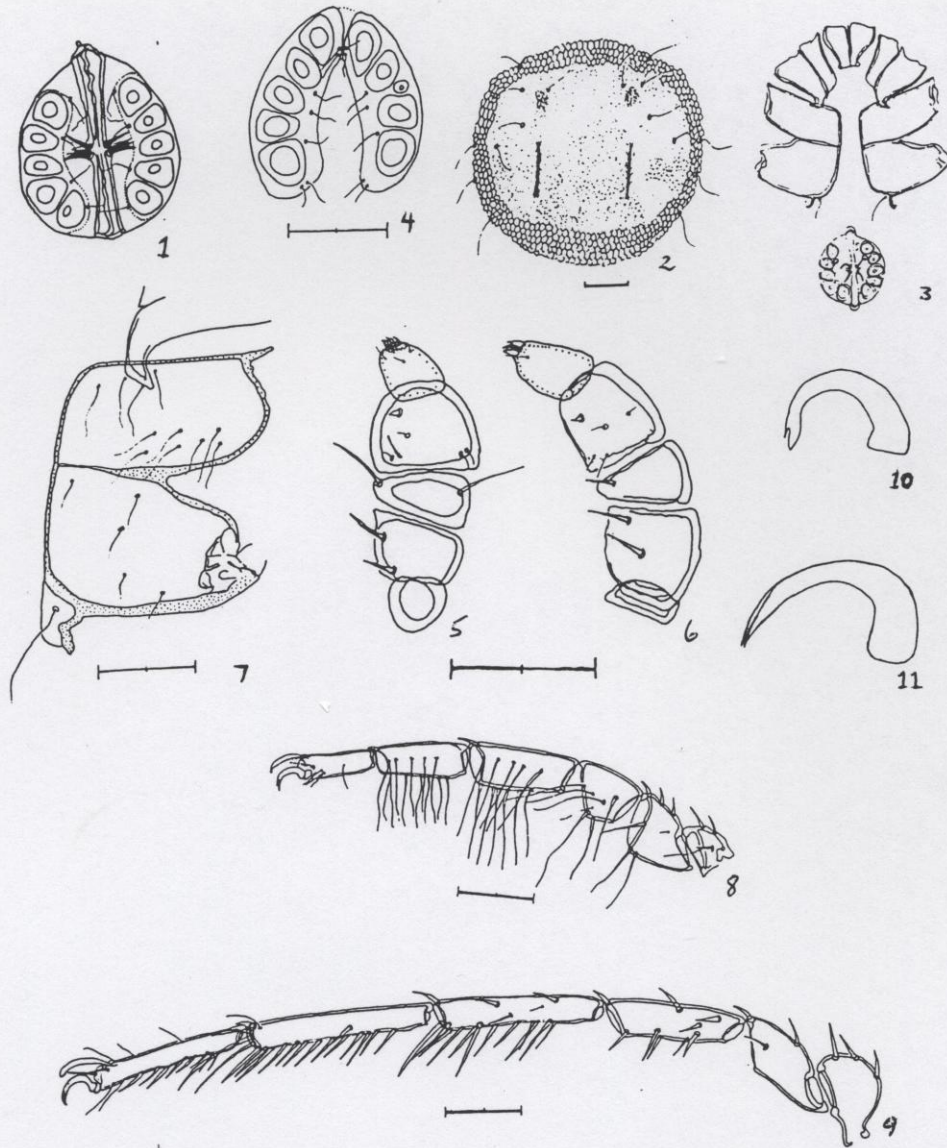
D'Harris, Uvalde County, Texas, collected 1978 by Alan Neumann. Texas specimens are larger than the Florida and Alabama specimens. This species resembles *U. berezai* and *U. acylindrotarsa*, but it is much larger and its legs are more setose. Although there are chaetotaxic differences between specimens of Texas and Florida populations, these differences do not appear to be sufficient for separation of the two populations into distinct species.

Hosts:

*Toxolasma paulus* (Lea): *Carunculina paula* Lea, Florida and Alabama (Dobson 1966);  
*Carunculina parva* (Barnes), Florida and Alabama (Vidrine 1980a).

*Toxolasma texasensis* (Lea): *Carunculina parva* (Barnes), Texas (Calnan 1976 and Vidrine 1980a).





Figures 1-11. *Unionicola latipalpa* Vidrine 1985. 1. Female genital field. 2. Dorsal plate. 3. Female venter. 4. Male genital field. 5-6. Pedipalps. 7. Posterior coxal plates. 8. First walking leg. 9. Fourth walking leg. 10. Tarsal claw of first walking leg. 11. Tarsal claw of fourth walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985a). Scale equals 100 micrometers.



Map 47. Known distribution of *Unionicola latipalpa* Vidrine 1985 in North America.

### Subgenus *Atacella* Lundblad 1937

TYPE SPECIES--*U. clathrata* (Lundblad 1937)

ETYMOLOGY-- Referring to the small size of these mites of genus *Unionicola* (formerly *Atax*) or to small acetabula in the genital field.

DIAGNOSIS--Genital acetabula 5-6 pairs; female genital field with one or two pairs of acetabular plates; setae not centrally located in female genital field, but usually displaced posteriorly; pedipalps dorsoventrally flattened and weakly sclerotized ventrally; male genital field similar to *Unionicola*; male and female legs similar, except for a single species with fourth walking leg with Ge, Ti and Ta modified.

HABITAT--Parasites of Hyriinae and Mycetopodidae.

DISTRIBUTION--North America (Mexico), Central America and South America.

DISCUSSION--*Atacella* has females with unique combination of dorsoventrally flattened pedipalps and unique genital fields. The genital fields of some species are similar to those of the subgenus *Australatax*. *Atacella* is the subgenus which is typical of South American mussel mites, such that they are found in most communities. The Rio Jutai locality (Vidrine 1985d) indicates the potential complexity of mussels and mites in the Amazon drainage. The resurrection of the subgenus *Polyatacides* Lundblad 1941 for *U. prominens* (Koenike 1890), another South American mussel mite species, is here recommended. The species has divergent genital field and pedipalp morphologies sufficient to warrant Lundblad's designation as a separate subgenus (Cook 1974). This remarkable genus of mites is typical of South American mussel mites. Recently Terry Gledhill and Bruno Borsari have found mites in mutelid mussels in tropical Africa--they are a new subgenus and distinctly different from South American mites.

ADDITIONAL SPECIES INCLUDED--*U. crassiparma* Vidrine 1985d, *U. entrerrianensis* (Rosso de Ferradas 1976), *U. fissipes* (Koenike 1891), *U. granadosi* Hoffman and Cramer 1979, *U. gigantea* (Caches and Mane-Garzon 1973), *U. nelsoni* Vidrine 1985d, *U. neoperforata* Vidrine 1985d, *U. parmaphora* Vidrine 1985d, *U. perforata* (Koenike 1890), *U. petita* Vidrine 1985d, *U. quadriplaca* Vidrine 1985d, *U. recta* Vidrine 1985d, *U. redfordi* Vidrine 1985d, *U. rosewateri* Vidrine 1985d, *U. rugosa* (Koenike 1890), *U. schubarti* (Viets 1954) and *U. subrecta* (Caches and Mane-Garzon 1973).

*Unionicola (Atacella) entrerrianensis* (Rosso de Ferradas 1976)  
Plates 136-138 in Vidrine (1996a)

Synonymy--

*Atacella entrerrianensis* Rosso de Ferradas 1976 in Vidrine 1980a and Vidrine and Bereza 1980, Viets 1986

*Unionicola (Atacella) entrerrianensis* (Rosso de Ferradas 1976), Vidrine 1985d and 1986e

Museum type number(s) and location-- Rosso de Ferradas collection.

Type locality and host-- *Anodontites trapesialis spixii* (D'Orbigny) in Entre Rios, Argentina, South America.

Etymology-- Named for the province from which it was obtained.

Diagnosis-- Character states of the subgenus; dorsum with a lightly sclerotized plate; coxal plates well sclerotized and with distinct posterior projectios; coxal plate I with an inner, sclerotized projection; female genital field with a single pair of acetabular plates, each bearing 5 acetabula and 2, large spines on the inner margin; male genital field with a pair of acetabular plates, each bearing 5 acetabula; 4 small tarsal clawlets on pedipalps; tarsal claws of the first walking legs bifid, with the dorsal prong shorter than the ventral prong; tarsal claws of fourth walking legs bifid, with lateral prongs near equal; first walking leg highly setigerous; Ge of the first walking leg with distinct rows of setae; distal, large setae on the Ge and Ti of fourth walking leg; pectinate setae on legs.

Male (4 specimens)-- Length including capitulum 888 (800-1000); dorsal plate 506 (450-600) long; length of posterior coxal group 250 (225-275); dorsal lengths of pedipalp segments: Ge 22; Ti 70; Ta 48 (40-60); dorsal lengths of leg segments: leg I: TFe 80 (72-90); Ge 109 (100-120); Ti 90 (85-100); Ta 93 (90-100); leg IV: TFe 159 (145-180); Ge 185 (170-200); Ti 148 (130-165); Ta 115 (105-130).

Female (4 specimens)-- Length including capitulum 1088 (900-1300); dorsal plate 638 (600-700) long; length of posterior coxal group 304 (290-325); dorsal lengths of pedipalp segments: Ge 30; Ti 86 (84-90); Ta 49 (40-55); dorsal lengths of leg segments: leg I: TFe 95 (90-100); Ge 119 (110-125); Ti 101 (100-105); Ta 99 (95-100); leg IV: TFe 198 (190-205); Ge 219 (215-220); Ti 172 (160-180); Ta 129 (120-135).

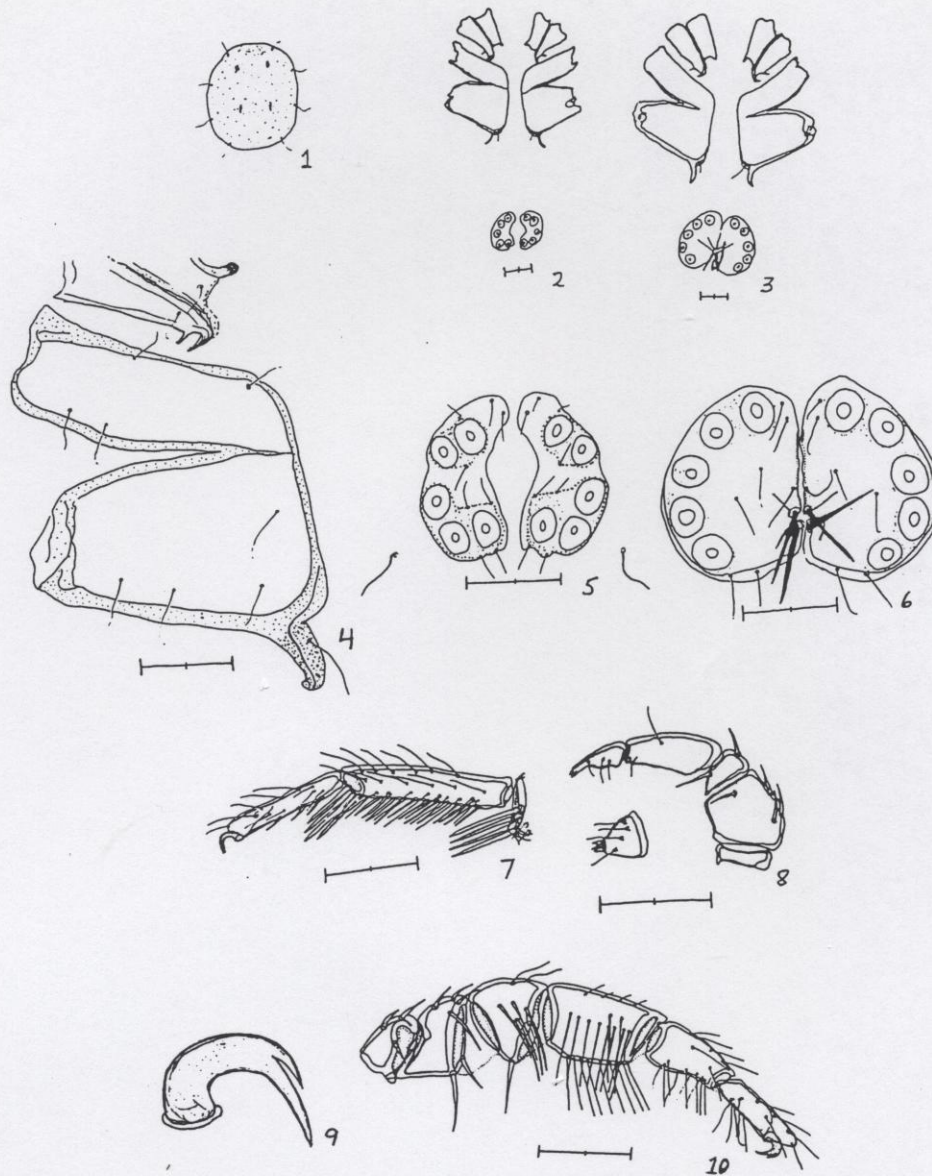
Notes-- *Unionicola entrerrianensis* from Mexico closely match the original description made from Argentine specimens. The specimens measured are from *Anodontites trapesialis glaucus* (Valenciennes) from 5 localities in eastern Mexico: small river (locally called Arroyo los Gatos)(Casas River system--Panuco River system) at Rte. MX 80 in Nuevo Morelos, ca. 1.0 km from the west end of town, and ca. 18.0 km along Rte. MX 80 west of Antiguo Morelos, Tamaulipas Province, Mexico, collected 5 and 13 November 1978 by D. J. Bereza; small river

(locally called Arroyo de Oxitipa) at paved road ca. 3.0 km east of Aquismon, San Luis Potosi Province, Mexico, collected 9 November 1978 by D. J. Berezal; Rio Cotaxtla (upper Rio Atoyac) at Rte. Veracruz 149 in Cotaxtla (turnoff to road to Cotaxtla from Rte. MX 140 is ca. 41.7 km southwest of divergence of Rte. MX 150 and Rte. MX 140 south of Veracruz City), Veracruz Province, Mexico, collected 12 February 1982 by D. J. Berezal, S. V. Hensley, R. T. Hensley, and M. F. Vidrine; spillway pool off left side of Rio Papaloapan along Rte. MX 175 in Cosamaloapan, Veracruz Province, Mexico, collected 17 February 1982 by D. J. Berezal, S. V. Hensley, R. T. Hensley, and M. F. Vidrine; and creek reached by turning west at north end of bridge at Rte. MX 130 (ca. 1.5 km north of intersection of Rte. MX 130 and Rte. MX 180 in Poza Rica), and going west for 1.1 km and turning south for 0.8 km, Veracruz Province, Mexico, collected 22 February 1982 by D. J. Berezal, S. V. Hensley, R. T. Hensley, and M. F. Vidrine. Usually one or 2 mites were found in each infested host. This mite is known from Argentina and eastern Mexico (Vidrine and Berezal 1980, Vidrine 1985d). It most closely resembles *U. granadosi* Hoffman and Cramer 1979 from Columbia. However, *U. granadosi* lacks a dorsal plate and has distinctive coxal plates. *Unionicola entrerrianensis* also resembles *U. gigantea* (Caches and Mane-Garzon 1973) from Uruguay. *Unionicola granadozi*, *U. entrerrianensis*, and *U. gigantea* are apparently sibling species.

#### Hosts:

*Anodontites trapesialis glaucus* (Valenciennes 1833): Mexico (Vidrine 1980a and Vidrine and Berezal 1980).





Figures 1-10. *Unionicola entrerrianensis* (Rosso de Ferradas 1976). 1. Dorsal plate. 2. Male venter. 3. Female venter. 4. Posterior coxal plates. 5. Male genital field. 6. Female genital field. 7. Tibia and tarsus of fourth walking leg. 8. Pedipalp. 9. Tarsal claw of first walking leg. 10. Male first walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985d). Scale equals 100 micrometers.



Map 48. Known distribution of *Unionicola enterrianensis* (Rosso de Ferradas 1976) in North America.

*Unionicola (Atacella) fissipes* (Koenike 1891)  
Plates 139-140 in Vidrine (1996a)

Synonymy--

*Atacella fissipes* (Koenike 1891), Vidrine 1980a and Vidrine and Bereza 1980, K. Viets 1956, K. O. Viets 1986

*Unionicola (Atacella) fissipes* (Koenike 1891), Vidrine 1985d and 1986e

Museum type number(s) and location-- Koenike collection.

Type locality and host-- From *Anodontites patagonicus patagonicus* (Lamarck) in Brasil, South America.

Etymology-- *Fiss* (Latin) refers to having a distinct cleft, and the obvious cleft is probably the one between the lateral edges of the third and fourth coxal plates.

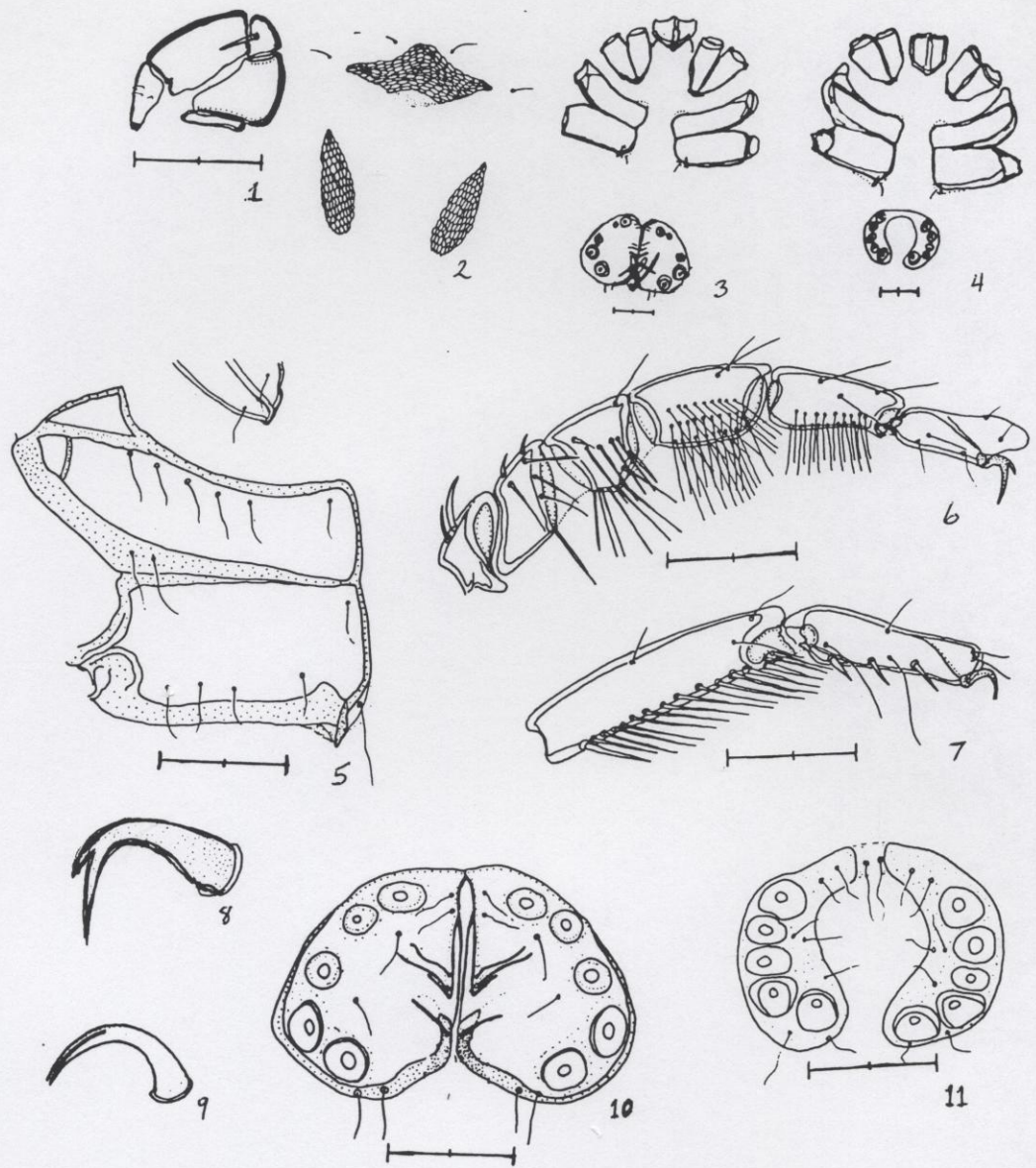
Diagnosis-- Character states of the subgenus; dorsum with 3 plates; coxal plates III and IV nearly equal in size, well sclerotized, and without distinct posterior projections; female genital field with a single pair of acetabular plates, each bearing 5 acetabula and 3 slightly thickened setae on the inner margin; male genital field with a pair of acetabular plates, each bearing 5 acetabula; 3 small tarsal clawlets on pedipalps; tarsal claws of the first walking legs bifid, with the dorsal prong shorter than the ventral prong; tarsal claws of fourth walking legs bifid, with lateral prongs near equal; first walking leg highly setigerous; fourth walking leg with distinct row of ventral setae.

Male (3 specimens)-- Length including capitulum 800; anterior dorsal plate 100 long, 250 wide; length of posterior coxal group 200 (185-210); dorsal lengths of pedipalp segment: Ta 80; dorsal lengths of leg segments: leg I: TFe 77 (70-80); Ge 110 (105-115); Ti 103 (100-105); Ta 100; leg IV: TFe 190 (175-200); Ge 208 (200-215); Ti 203 (200-205); Ta 150 (140-160).

Female (3 specimens)-- Length including capitulum 817 (800-850); dorsal plate 80 long, 200 wide; length of posterior coxal group 160 (150-175); dorsal lengths of pedipalp segments: Ta 50; dorsal lengths of leg segments: leg I: TFe 70 (65-75); Ge 96 (95-100); Ti 93 (90-100); Ta 93 (90-100); leg IV: TFe 163 (155-170); Ge 184 (175-200); Ti 170 (160-180); Ta 133 (125-140).

Notes-- The specimens measured are from *Anodontites* sp. (mussel lot USNM 803120) from Chamelecon River, 0.2 km downstream from Chamelecon, Honduras, collected 16 January 1980 by A. H. Clarke. This mussel's name was misspelled by Vidrine (1985) as *Anodontoides* sp. The three mussels contained approximately 5 specimens between each pair of gills. *Unionicola fissipes* is also known from Brazil, Paraguay, Argentina, and western Mexico, where it commonly parasitizes members of the genus *Anodontites* (Vidrine and Bereza 1980 and Rosso de Ferradas 1976). Discussions of this species in Lundblad (1942) and Rosso de Ferradas (1976) adequately introduce and figure this species.





Figures 1-11. *Unionicola fissipes* (Koenike 1891). 1. Pedipalp. 2. Dorsal plate. 3. Female venter. 4. Male venter. 5. Posterior coxal plates. 6. Male first walking leg. 7. Tibia and tarsus of fourth walking leg. 8. Tarsal claw of first walking leg. 9. Tarsal claw of fourth walking leg. 10. Female genital field. 11. Male genital field. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985d). Scale equals 100 micrometers.



Map 49. Known distribution of *Unionicola fissipes* (Koenike 1891) in North America.



Kevin Cummings (Illinois Natural History Survey) recently sent me specimens of *U. fissipes* from several specimens of *Anodontites cf. trapesialis* (INHS-16974-1 thru 3) from prestamo (Rio San Carlos Dr.) Mapuey, 6.0 km west San Carlos, off road from Acarigua to San Carlos, Distrito San Carlos Cojedes, Venezuela. These were collected on January 29, 1995, by Anielo Barbarino. These mites are the first records of *Unionicola* from Venezuela.

Hosts:

*Anodontites trapesialis glaucus* (Valenciennes 1833): Mexico (Vidrine 1980a and Vidrine and Bereza 1980).

*Anodontites* sp.: Honduras.

*Unionicola (Atacella) neoperforata* Vidrine 1985d  
Plate 141 in Vidrine (1996a)

Synonymy--

*Atacella perforata sensu* Vidrine 1980d and Vidrine and Bereza 1980

*Unionicola (Atacella) neoperforata* Vidrine 1985d, Vidrine 1986e

Museum type number(s) and location-- CNC 18826, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) from *Anodontites trapesialis glaucus* from small river (locally called Arroyo los Gatos) (Casas River system--Panuco River system) at Rte. MX 80 in Nuevo Morelos, ca. 1.0 km from the west end of town, and ca. 18.0 km along Rte. MX 80 west of Antiguo Morelos, Tamaulipas Province, Mexico, collected 5 November 1978 by D. J. Bereza.

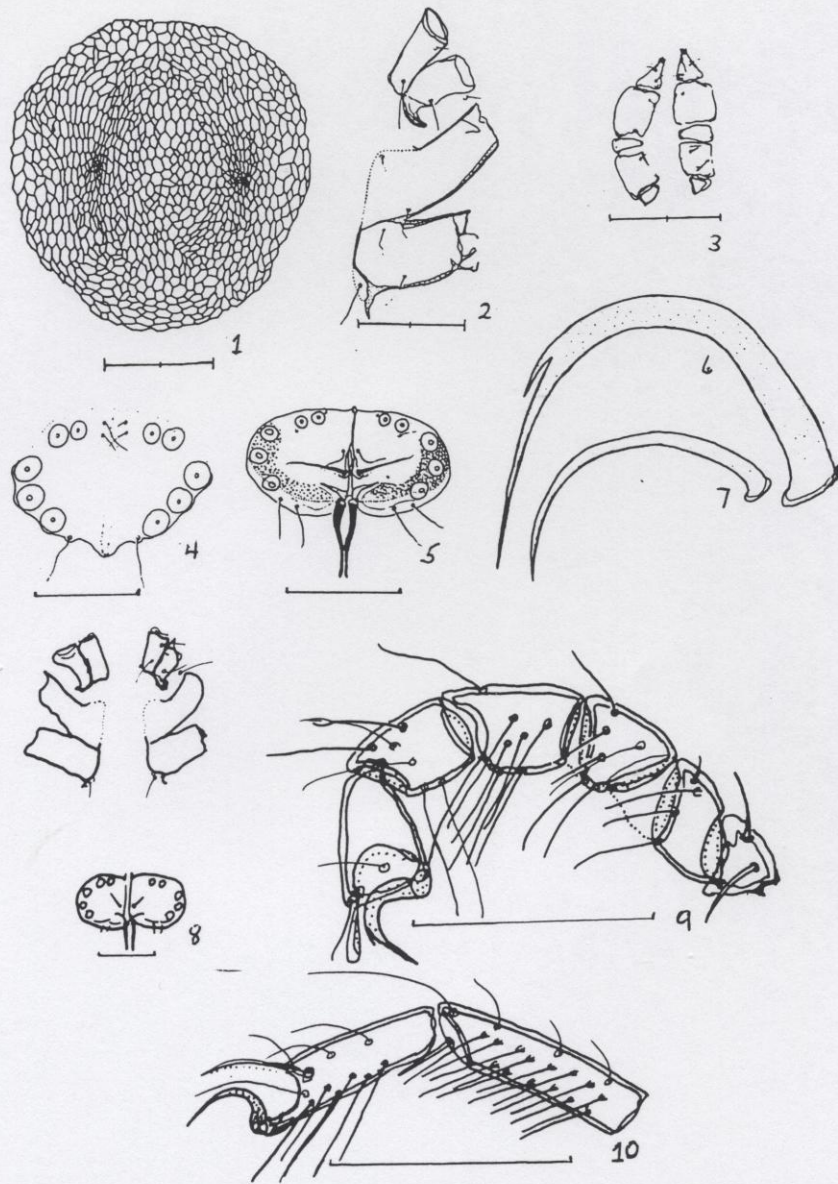
Etymology-- Named for its similarity to *U. perforata* or to indicate that it may be just a new form of that species.

Diagnosis-- Character states of the subgenus; dorsum with thick, reticulate, dorsal plate; coxal plate III with inner margin not well sclerotized, coxal plate IV well sclerotized; coxal plate IV with posterior projection; female genital field with 2 acetabular plates, each bearing 5 acetabula and 2, large spines on inner margin; male genital field with a pair of lightly sclerotized acetabular plates, each bearing 5 acetabula; 4 small tarsal clawlets on pedipalps; tarsal claws of the first walking legs bifid, with small dorsal prong; tarsal claws of fourth walking legs appearing simple; first walking leg with few setae; fourth walking leg with tarsal claw on a ventral projection.

Male (2 specimens)-- Length including capitulum 475; dorsal plate 278 (275-280) long; length of posterior coxal group 123 (120-125); dorsal lengths of pedipalp segments: Ti 45; Ta 34 (32-35); dorsal lengths of leg segments: leg I: TFe 43 (40-45); Ge 53 (50-56); Ti 48 (45-50); Ta 50 (47-52); leg IV: TFe 91 (88-94); Ge 97 (95-98); Ti 83 (80-85); Ta 63 (60-65).

Female (3 specimens)-- Length including capitulum 558 (550-575); dorsal plate 293 (290-300) long; length of posterior coxal group 125; dorsal lengths of pedipalp segments: Ti 40; Ta 28 (25-30); dorsal lengths of leg segments: leg I: TFe 43 (42-45); Ge 53 (50-55); Ti 46 (45-46); Ta 52 (50-54); leg IV: TFe 90 (88-91); Ge 100 (100-101); Ti 88 (85-89); Ta 65.

Notes-- Additional specimens (paratypes) measured are from a medium-sized creek at Rte. MX 85, ca. 0.5 km south of Palmira (Panuco River system), and ca. 33.0 km south of junction of Rte. MX 85 and Rte. MX 70 in Ciudad Vallez, San Luis Potosi Province, Mexico, collected on 8 and 9 November 1978 by D. J. Bereza. All specimens were found in *A. trapesialis glaucus*. One or two individuals were found in each infested host. *Unionicola neoperforata* resembles *U. perforata*, but it is a larger mite with a smaller dorsal plate. It uniquely possesses the tarsal claws of the second, third and fourth walking legs on ventral projections of the tarsi.



Figures 1-10. *Unionicola neoperforata* Vidrine 1985. 1. Dorsal plate. 2. Coxal plates. 3. Pedipalps. 4. Male genital field. 5. Female genital field. 6. Tarsal claw of first walking leg. 7. Tarsal claw of fourth walking leg. 8. Female venter. 9. Female first walking leg. 10. Tibia and tarsus of female fourth walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985d). Scale equals 100 micrometers.



Map 50. Known distribution of *Unionicola neoperforata* Vidrine 1985 in North America.

Hosts:

*Anodontites trapesialis glaucus* (Valenciennes 1833): Mexico.



*Unionicola (Atacella) petita* Vidrine 1985d  
Plates 142-143 in Vidrine (1996a)

Synonymy--

*Unionicola (Atacella) petita* Vidrine 1985d in Vidrine 1986e

Museum type number(s) and location-- CNC 18827, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada (female). The allotype is in my collection.

Type locality and host-- Holotype (female) from *Anodontites trapesialis glaucus* from Rio Cotaxtla (upper Rio Atoyac) at Rte. Veracruz 149 (turnoff to road to Cotaxtla from Rte. MX 140 is ca. 41.7 km southwest of divergence of Rte. MX 150 and Rte. MX 140 south of the city of Veracruz), Veracruz Province, Mexico, collected on 12 February 1982 by D. J. Bereza, S. V. Hensley, R. T. Hensley, and M. F. Vidrine. Allotype (male) from small river (locally called Arroyo de Oxitipa) at paved road ca. 2.1 road miles east of Aquismon, San Luis Potosi, Mexico, collected on 9 November 1978 by D. J. Bereza, R. Herschler, and C. E. Dunn.

Etymology-- Named for its extremely small size; *petite* is French for small.

Diagnosis-- Character states of the subgenus; dorsum with lightly sclerotized, circular, dorsal plate and lacks obvious dorsal apodemes; coxal plates without posterior projections; male genital field with 2 plates each bearing 5 acetabula; female genital field with 2 acetabular plates, each bearing 5 acetabula and 3, large spines on inner margin; 3 tarsal clawlets on pedipalps; first walking leg with few setae and large, bifid tarsal claws, with the dorsal prong nearly one-half as long as the ventral prong; fourth walking leg with a small, simple tarsal claw that is not borne on a ventral projection.

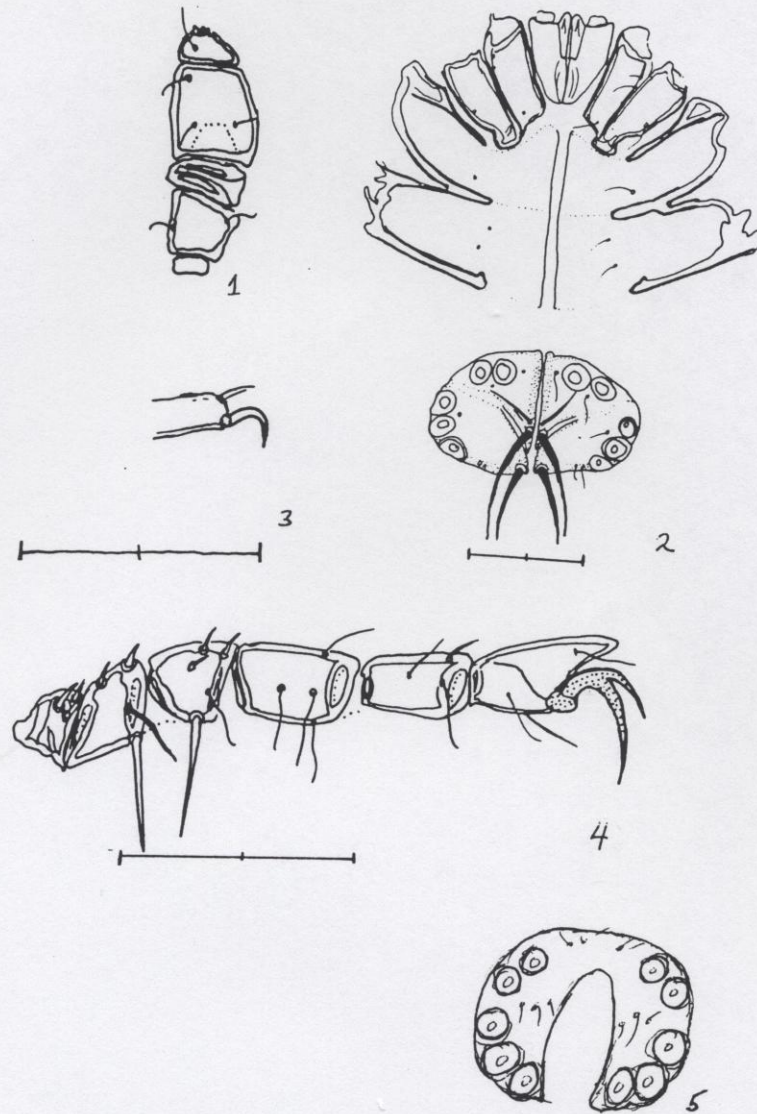
Male (allotype)-- Length including capitulum 380; length of dorsal plate 320; length of posterior coxal group 120; dorsal lengths of pedipalp segments: Ti 60; Ta 20; dorsal lengths of segments of walking legs: leg I: TFe 40; Ge 60; Ti 50; Ta 65; leg IV: TFe 80; Ge 110; Ti 90; Ta 100.

Female (holotype)-- Length including capitulum 450; length of posterior coxal group 130; dorsal lengths of pedipalp segments: Ti 45; Ta 25; dorsal lengths of leg segments: leg I: TFe 40; Ge 55; Ti 50; Ta 60; leg IV: TFe 85; Ge 110; Ti 91; Ta 100.

Notes-- *Unionicola petita* resembles *U. perforata* and *U. neoperforata* but the former possesses unique coxal plate morphology and distinctive tarsal morphology on the fourth walking leg.

Hosts:

*Anodontites trapesialis glaucus* (Valenciennes 1833): Mexico (Vidrine 1985d).



Figures 1-5. *Unionicola petita* Vidrine 1985. 1. Pedipalp. 2. Female venter. 3. Distal tip of tarsus of fourth walking leg. 4. Female first walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985d). 5. Male genital field. Scale equals 100 micrometers.



Map 51. Known distribution of *Unionicola petita* Vidrine 1985 in North America.

Subgenus *Ampullariatax* Vidrine 1985c

TYPE SPECIES-- *U. ampullariae* (Koenike 1890)

ETYMOLOGY-- Named for the occurrence of these mites within the snail family Ampullaridae (= Pilidae).

DIAGNOSIS-- Genital acetabula many pairs; female genital field with 2 pairs of acetabular plates; all 4 female plates similar with more than 10 acetabula and an inner, small flap with short, hairlike setae; male genital field with a single pair of acetabular plates; pedipalps subcylindrical and well-sclerotized with Ta relatively short and bearing small clawlets; pedipalp Ta tapered distally; male and female legs similar.

HABITAT-- Parasites of apple snails (Cyclophoracea: Pilidae).

DISTRIBUTION-- Central and South America.

DISCUSSION-- *Ampullariatax* has distinctive female genital fields. The males are apparently similar to males of *Polyatax* and *Parasitatax*. Specimens from Argentina are apparently a separate species (Rosso de Ferradas 1974). This subgenus contains snail mites, which are distantly related to snail mites from other regions: *Polyatax* (Asia and North America) and *Baderatax* (Africa).

ADDITIONAL SPECIES INCLUDED-- *U. thompsoni* Cook 1974.

*Unionicola (Ampullariatax) thompsoni* Cook 1974

Synonymy-- *Unionicola (Polyatax) thompsoni* Cook 1974

Museum type number(s) and location-- Dave Cook's Collection.

Type locality and host-- Adult male from snail *Pomacea* sp. in Lago de Yajoa, Province Cortes, Honduras, collected by Fred G. Thompson. Allotype and one male and three females from type locality.

Etymology-- Named to honor Fred Thompson.

Diagnosis-- Character states of the subgenus; female genital field with 4 plates, male with 2 somewhat fused plates; acetabula numerous; tarsal claws of first walking legs simple; male and female legs similar.

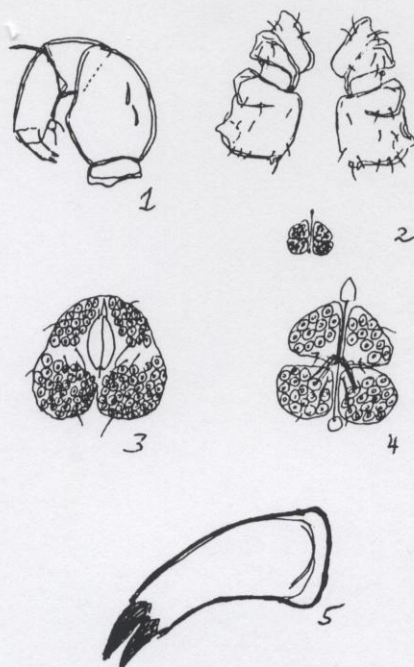
Male (2 specimens)-- Length of body 790-988; length of coxal area 608-755; dorsal lengths of pedipalp segments: Ge 96-133; Ti 163-200; Ta 96-111; dorsal lengths of leg segments: leg I: Ge 364-440; Ti 319-365; Ta 228-266.

Female (4 specimens)-- Length of body 912-1216; length of coxal area 610-866; dorsal lengths of pedipalp segments: Ge 82-111; Ti 148-163; Ta 89-96; dorsal lengths of leg segments: leg I: Ge 304-380; Ti 289-334; Ta 228-264.



Notes-- This species is closely related to *U. ampullariae*, but it differs in possessing simple claws on the first walking leg and more numerous acetabula in the male (approximately 45-52 pairs in the former species, and 18-20 pairs in the latter species). Specimens from Argentina considered as *U. ampullariae* possess 30 pairs of acetabula and are apparently distinctive (Rosso de Ferradas 1974).

Host: *Pomacea* sp.: Honduras.



Figures 1-5. *Unionicola thompsoni* Cook 1974. 1. Pedipalp. 2. Female venter. 3. Male genital field. 4. Female genital field. 5. Tarsus of pedipalp. (Redrawn after Cook 1974).





Map 52. Known distribution of *Unionicola thompsoni* Cook 1974 in North America.

### Subgenus *Polyatax* Viets 1933

TYPE SPECIES--*U. japonensis* Viets 1933

ETYMOLOGY--*Polyatax* literally means "many acetabula."

DIAGNOSIS--Genital acetabula many pairs; female genital field with 2 pairs of acetabular plates; female anterior plates with an elongate, inner flap that is heavily sclerotized and bears one or 2, short, thick, spinous setae; female posterior plate modified with many acetabula; pedipalp subcylindrical and well-sclerotized with tarsus usually nearly quadrate in outline with large, obvious clawlets; most species with obvious dorsal plates; male genital field resembles those of *Pentatax*, but these have more than 5 pairs of acetabula; first walking legs with large prominent setae; male fourth walking leg modified in some species; tarsal claws of walking legs deeply bifid in some species; coxal plates with obvious borders.

HABITAT--Parasites of freshwater snails (Cyclophoracea: Viviparidae).

DISTRIBUTION--Asia and North America.

DISCUSSION-- Vidrine (1994) has revised this subgenus and divided it into 5 subgenera. Studied species of *Polyatax* oviposit in mantle and foot epithelia of their hosts. The snail mites include three subgenera: *Polyatax* in Asia and North America, *Ampullariatax* Vidrine 1985c in Central and South America, and *Baderatax* Vidrine 1988a in Africa. Species of *Polyatax* are illustrated in Imamura (1953a), Marshall (1935) and Vidrine (1985c). The worldwide systematics and host-associations of snail mites is ripe for study. It reveals a very different radiation of *Unionicola* than that currently developing for species parasitizing either sponges or mussels. A number of other snail species have been searched for mites in North America. Species belonging to the genera *Io*, *Pleurocera*, *Anculosa*, *Physa*, *Lymnaea*, *Neritina*, *Helisoma*, and others have been search. Recently, Steven Christman (personal communication, 1994) searched *Tulatoma magnifica* (Conrad) and found no mites.

ADDITIONAL SPECIES INCLUDED-- *U. campelomaicola* Marshall 1935, *U. dobsoni* Vidrine 1985c, and *U. viviparaicola* Vidrine 1985c.

*Unionicola (Polyatax) campelomaicola* Marshall 1935  
Plates 144-145 in Vidrine (1996a)

Synonymy--

*Unionicola campelomaicola* Marshall 1935

*Unionicola aculeata* Chandler (1934)? (Koenike considered this to be *U. campelomaicola*)

*Unionicola (Polyatax) campelomaicola* Viets and Plate 1954, Mitchell 1954, Viets 1956 and 1957, Crowell 1961, ?Dobson 1966, and Vidrine 1980a, 1985c, 1986e, and 1994.

Museum type number(s) and location-- Marshall Collection, Field Museum of Natural History, Chicago, Illinois.

Type locality and host-- From *Campeloma* sp., probably *C. decisum*.

Etymology-- Named to indicate its host, *Campeloma*, with the name meaning literally to live within *Campeloma*.

Diagnosis-- Character states of the subgenus; males are ca. 600 long while females are ca. 800 long; legs have small bifid tarsal claws; females with 7-9 pairs of genital acetabula with 2 pairs on the anterior genital plates; male fourth walking legs not apparently sexually dimorphic (after Marshall 1935).

Female (2 specimens)-- Length of posterior coxal group 315 (310-320); dorsal lengths of pedipalp segments: Ti 120; Ta 30; dorsal lengths of leg segments: leg I: Ge 175; Ti 135 (130-140); Ta 120; leg IV: Ta 200.

Notes-- The specimens measured are from a single lot from Whiskey Chitto Creek, Calcasieu River system, Louisiana in *Campeloma decisum*. Additional lots have been obtained from two populations of *Campeloma* from the Calcasieu River itself. Males are yet to be found in Louisiana. Fried and Boddorff (1975) worked with this species and referred to females mites from New Jersey measuring approximately 1.0 mm in length. Louisiana specimens are nearly half the length. I am not sure what species they were studying. The snail mites are poorly known and need study.

Hosts:

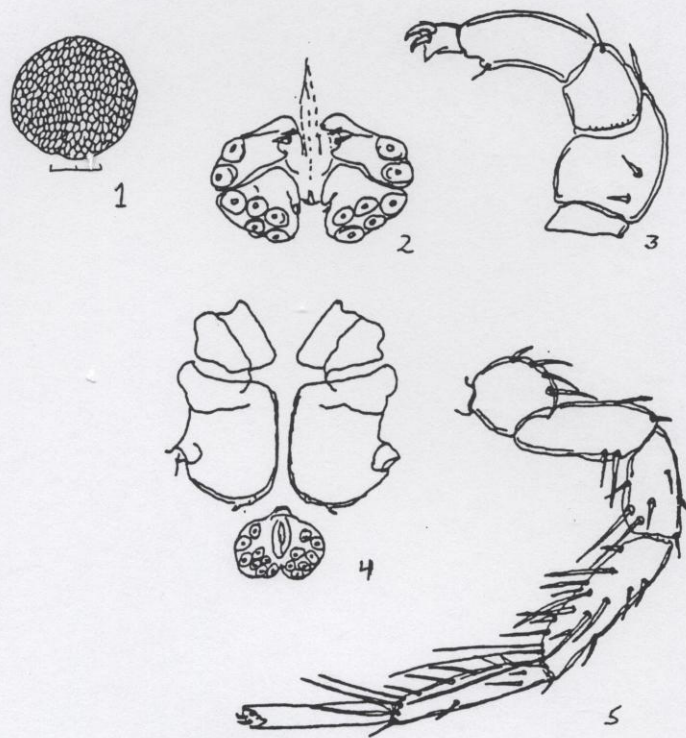
*Campeloma decisum* (Say): North Carolina (Chandler 1934); Louisiana (Vidrine 1980a); New Jersey (Fried and Boddorff 1975).

*Campeloma* sp. (probably *decisum*): Ontario, Canada (Marshall 1935 and Viets and Plate 1954)

*Campeloma* sp.: *Campeloma floridense* (Call), Louisiana (Vidrine 1974a) (this mite was a nymph and its specific determination is uncertain).

*Obovaria jacksoniana* (Frierson): *Obovaria castenea* (Lea), Louisiana (Vidrine 1980a).

*Utterbackia peggyae* (Johnson): Florida (Dobson 1966) (identification of mite uncertain).



Figures 1-5. *Unionicola campelomaicola* Marshall 1935. 1. Female dorsal plate (Reprinted with permission from the International Journal of Acarology; Vidrine 1985c). 2. Female genital field. 3. Pedipalp. 4. Male venter. 5. Male fourth walking leg. (Figures 2-5 redrawn after Marshall 1935). Scale equals 100 micrometers.





Map 53. Known distribution of *Unionicola campelomaicola* Marshall  
1935 in North America.



*Unionicola (Polyatax) dobsoni* Vidrine 1985c  
Plates 146-149 in Vidrine (1996a)

Synonymy--

*Unionicola campelomaicola sensu* Dobson (1966) (identification uncertain)

*Unionicola (Polyatax) sp. nov.* type 1 Vidrine 1980a

*Unionicola (Polyatax) dobsoni* Vidrine 1985c in Vidrine 1986e and Vidrine 1994

Museum type number(s) and location-- CNC 18821, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Campeloma geniculum* (Conrad) from Holmes Creek at Rte. U. S. 90 near Chipley, Holmes County, Florida, collected 7 July 1977 by M. F. Vidrine.

Etymology-- Named to honor Robert Dobson.

Diagnosis-- Character states of the subgenus; dorsum with a reticulated plate; coxal plates well sclerotized and with distinct posterior projections; female genital field with anterior acetabular plates each bearing 2 acetabula and a pair of short, thick spines, posterior acetabular plates each bearing 6 acetabula and a single, short, hairlike seta; male genital field with 6-7 acetabula per acetabular plate; pedipalp with tarsal claws nearly equal in length to the length of the Ta; tarsal claws of the walking legs bifid with the dorsal prongs ca. one-half the length of the ventral prongs; fourth walking leg of the male sexually dimorphic with Ge appearing slightly concave dorsally and bearing 6, large, dorsal spines, and with Ti bearing 2, large, dorsal spines.

Male (holotype)-- Length including capitulum 800; dorsal plate 375 long, 250 wide; length of posterior coxal group 375; dorsal lengths of pedipalp segments: Ge 55; Ti 120; Ta 30; dorsal lengths of leg segments: leg I: TFe 170; Ge 235; Ti 200; Ta 170; leg IV: TFe 175; Ge 290; Ti 230; Ta 260.

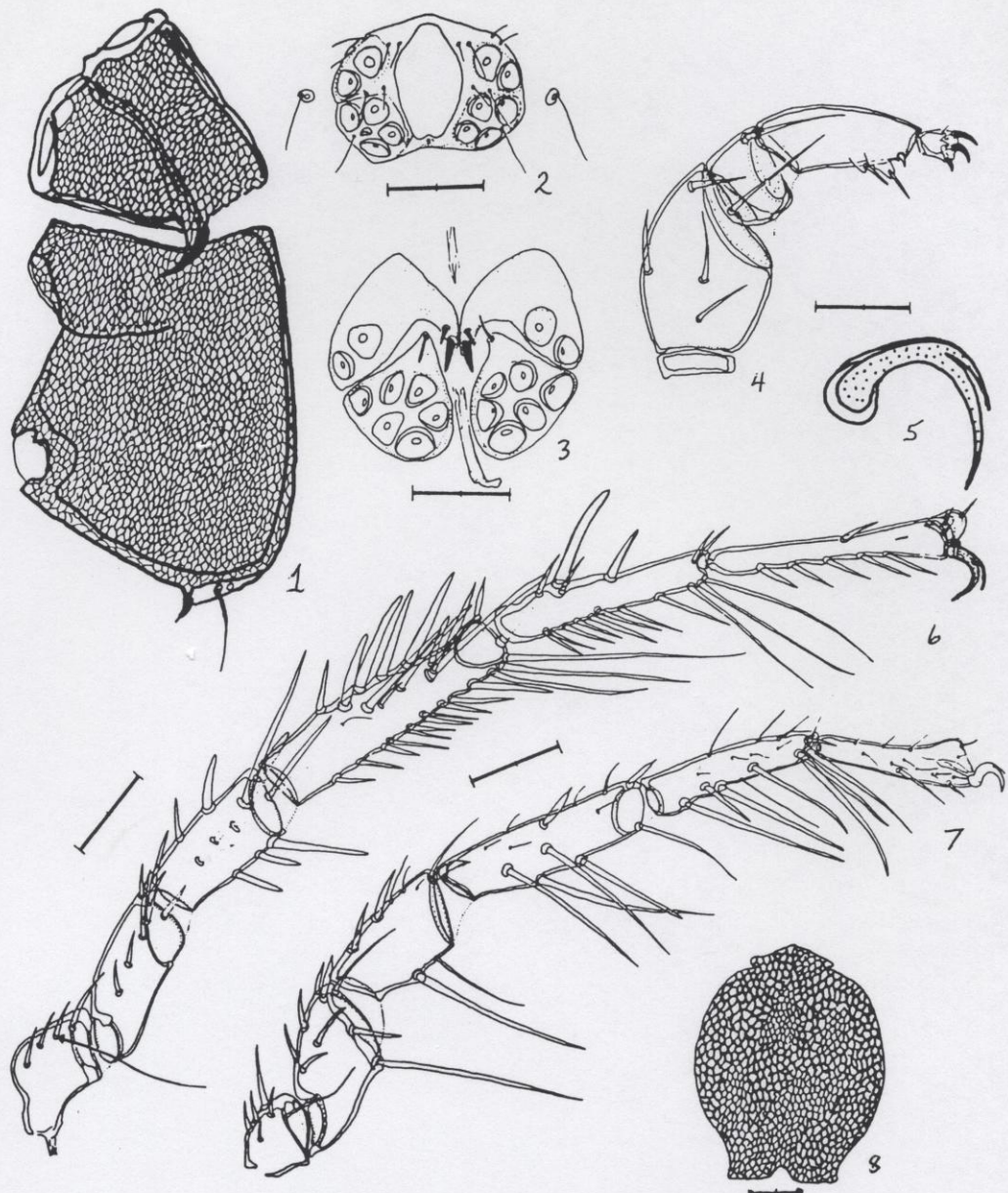
Female (2 specimens)-- Length including capitulum 1125 (1100-1150); dorsal plates 400 long, 350 wide; length of posterior coxal group 475 (450-500); dorsal lengths of pedipalp segments: Ge 75; Ti 168 (165-170); Ta 38 (35-40); dorsal lengths of leg segments: leg I: TFe 228 (225-230); Ge 330 (320-340); Ti 263 (250-275); Ta 215 (210-220); leg IV: TFe 233 (230-235); Ge 363 (350-375); Ti 383 (375-390); Ta 313 (310-315).

Notes-- *Unionicola dobsoni* vaguely resembles the much smaller *U. campelomaicola*, but the males of the former species have distinctive sexual dimorphism in the walking legs. There also is a substantial size difference between the species.

Hosts:

*Campeloma geniculum* (Conrad): Florida (Vidrine 1980a and 1985c)

*Utterbackia peggyae* (Johnson): *Anodonta peggyae* Johnson, Florida (Dobson, 1966) (identification of mite uncertain).



Figures 1-8. *Unionicola dobsoni* Vidrine 1985. 1. Coxal plates. 2. Male genital field. 3. Female genital field. 4. Pedipalp. 5. Tarsal claw of first walking leg. 6. Male fourth walking leg. 7. Male first walking leg. 8. Female dorsal plate (Reprinted with permission from the International Journal of Acarology: Vidrine 1985c). Scale equals 100 micrometers.



Map 54. Known distribution of *Unionicola dobsoni* Vidrine 1985 in North America.

*Unionicola (Polyatax) viviparaicola* Vidrine 1985c  
Plates 150-153 in Vidrine (1996a)

Synonymy--

*Unionicola (Polyatax) sp. nov.* type K in Vidrine 1980a and 1983

*Unionicola (Polyatax) viviparaicola* Vidrine 1985c in Vidrine 1986e and 1994

Museum type number(s) and location-- CNC 18822, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Viviparus subpurpureus* (Say) from Louisiana Irrigation Canal ca. 5.0 km north of Iowa at Rte. LA 383, Jefferson Davis Parish, Louisiana, collected 2 May 1981 by Macky and M. F. Vidrine.

Etymology-- Named to relate this species to its preferred host genus.

Diagnosis-- Character states of the subgenus; female dorsum with 2 plates; male dorsum with a reticulated plate; coxal plates well sclerotized and with distinct posterior projections; female genital fields with a large acetabulum on each acetabular plate near the outer edge; female genital field with anterior acetabular plates each bearing 5-10 acetabula and a pair of short, thick spines on the inner margins; posterior acetabular plates (female) each bearing 13-20 acetabula and a single, short, hairlike seta on the inner margin; male genital field with two clusters of acetabula per acetabular plate, anterior cluster with 5-9 acetabula and posterior clusters with 11-16 acetabular; pedipalp with tarsal claws shorter than the length of the Ta; tarsal claws of the walking legs bifid with the dorsal prongs nearly equal in length with the ventral prongs; fourth walking leg of the male sexually dimorphic with Ge appearing slightly concave dorsally and bearing 3, thick, dorsal spines, and with Ti bearing one, large, dorsal spine.

Male (3 specimens)-- Length including capitulum 1233 (1150-1400); dorsal plate 567 (500-600) long, 342 (300-375) wide; length of posterior coxal group 690 (650-770); dorsal lengths of pedipalp segments: Ge 55 (50-60); Ti 167 (160-180); Ta 53 (50-60); dorsal lengths of leg segments: leg I: TFe 252 (220-275); Ge 350 (320-380); Ti 263 (240-290); Ta 217 (210-220); leg IV: TFe 257 (240-275); Ge 420 (390-450); Ti 398 (370-425); Ta 340 (320-350).

Female (3 specimens)-- Length including capitulum 1417 (1300-1500); dorsal plates 375 (350-400) long, 133 (115-150) wide; length of posterior coxal group 773 (750-820); dorsal lengths of pedipalp segments: Ti 185 (180-190); Ta 53 (50-55); dorsal lengths of leg segments: leg I: TFe 285 (280-300); Ge 395 (380-420); Ti 292 (280-300); Ta 237 (230-240); leg IV: TFe 300 (290-310); Ge 460 (440-490); Ti 463 (440-490); Ta 365 (350-375).

Notes-- *Unionicola viviparaicola* vaguely resembles the much smaller *U. campelomaicola*, but the former has numerous genital acetabula. A striking similarity between *U. viviparaicola* and *U.*



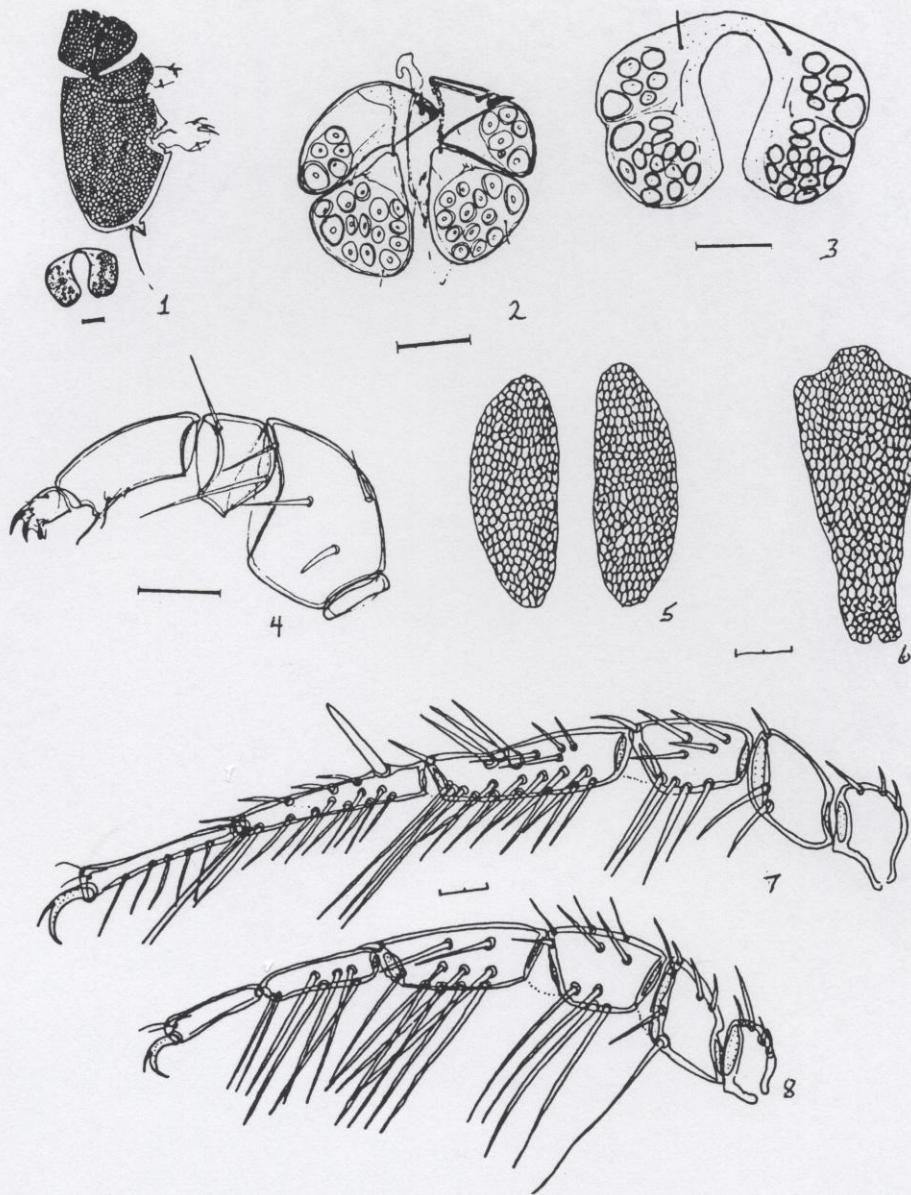
*serrata* exists, but the tarsal claw structure of the walking legs and the obvious sexual dimorphism of the male fourth walking legs of the former species are distinctive. The females of *Unionicola viviparaicola* are distinguished from *U. dobsoni* by the coxal plate, genital field, and dorsal plate structures. Males have different fourth walking legs. The species also have significantly different numbers of genital acetabula.

Vidrine (1983) reports oviposition by this mite in the mantle tissues near the head of its hosts. In several stations including a rice irrigation canal near my home, there are thousands of host snails, and each snail appears to be infested by at least one mite.

Hosts:

*Anodonta suborbiculata* (Say): Louisiana (Vidrine 1989a).

*Viviparus subpurpureus* (Say): Louisiana, Arkansas, Illinois, and Texas (Vidrine 1974a and 1980a).



Figures 1-8. *Unionicola viviparaicola* Vidrine 1985. 1. Male venter. 2. Female genital field. 3. Male genital field. 4. Pedipalp. 5. Female dorsal plates. 6. Male dorsal plate. 7. Male fourth walking leg. 8. Male first walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985c). Scale equals 100 micrometers.



Map 55. Known distribution of *Unionicola viviparaicola* Vidrine 1985 in North America.

Subgenus *Neoatax* Lundblad 1941

TYPE SPECIES-- *U. indistincta* (Wolcott 1898)

ETYMOLOGY-- Named as a new group within the former genus *Atax*.

DIAGNOSIS-- Genital acetabula 3 to many pairs; female genital field with 2 pairs of acetabular plates; female anterior plates with an elongate, inner flap that is heavily sclerotized and bears one or 2, short, thick, spinous setae; female posterior plate modified and resembling *Polyatax* but with fewer acetabula; coxal plates variable, with *U. abnormipes* lacking obvious borders; pedipalp subcylindrical and well-sclerotized with tarsus usually nearly quadrate in outline with large, obvious clawlets; dorsum with obvious dorsal plates; male genital field as in *Polyatax*; male fourth walking leg modified with tibia bearing one or two large blunt spines; tarsal claws of walking legs bifid; first walking legs with large setae (Cook 1974 and Vidrine 1994).

HABITAT-- Parasites of Unionidae.

DISTRIBUTION-- North America.

DISCUSSION-- I had reduced this subgenus (Vidrine 1985c), but recently I have had the opportunity to examine more species of world-wide mantle mites. Revisiting my past decisions with new information led to my resurrecting this subgenus (Vidrine 1994). This subgenus is rather uniform in that the fourth walking legs of the males are very similarly modified in each of the species. Species are illustrated in Wolcott (1898 and 1899) and Vidrine (1985c). Downes (1991) has studied the ecology of *U. abnormipes*. Members of this subgenus have niches that are different from all other mites. Their niches vaguely resemble those of the subgenus *Anodontinatax*, but these mites are quite divergent. *Neoatax* does share some niche characters with *Causeyatax* and *Polyatax*, but too little is known about these mites. *Neoatax* is generally restricted to mussels of genera in the Tribe Lampsilini, but they are apparently able to infest most genera in the subfamily Ambleminae. Under stressful conditions, they apparently leave their hosts and are found as vagrants (strays) in a variety of hosts.

ADDITIONAL SPECIES INCLUDED--*U. abnormipes* (Wolcott 1898), *U. australindistincta* Vidrine 1985c, and *U. causeyae* Vidrine 1985c.



*Unionicola (Neoatax) abnormipes* (Wolcott 1898)  
Plates 154-156 in (Vidrine 1996a)

Synonymy--

*Atax abnormipes* Wolcott 1898, (Wolcott 1898 and 1899), Piersig (1901)

*Unionicola aculeata*, Faust (1918) (error in identification)

*Unionicola abnormipes* (Wolcott 1898), Marshall (1926 and 1933b), Mitchell (1954 and 1955), and Habeeb (1967).

*Unionicola (Neoatax) abnormipes* (Wolcott 1898), Viets and Plate 1954, Viets 1956, Crowell 1961, Dobson 1966, Calnan 1976, Vidrine 1974a, 1980a, and 1994

*Unionicola (Polyatax) abnormipes* (Wolcott 1898), Vidrine 1985c and 1986e.

Museum type number(s) and location-- Marshall Collection, Field Museum of Natural History, Chicago, Illinois.

Type locality and host-- Nebraska (no specific host named).

Etymology-- Named to indicate its abnormal body shape, leg structure, and coxal plates.

Diagnosis-- Character states of the subgenus; dorsum with obvious dorsal plates; male and female genital fields with 5 pairs of acetabula; fourth coxal plates with indistinct posterior borders and extending posteriorly to and about the anterior edge of the genital field; claws appear simple, but they are finely bifid approximately one-third of distance from the tip; fourth walking legs of males distinctly sexually dimorphic with the Ti shortened and bearing 2, large, heavy, blunt, dorsal setae.

Male (6 specimens)-- Length of posterior coxal group 430 (360-470); dorsal lengths of pedipalp segments: Ti 108 (100-110); Ta 27 (25-30); dorsal lengths of leg segments: leg I: Ge 145 (130-160); Ti 109 (90-120); Ta 120 (100-130); leg IV: Ta 222 (170-250).

Female (8 specimens)-- Length of posterior coxal group 460 (430-510); dorsal lengths of pedipalp segments: Ti 119 (110-140); Ta 30; dorsal lengths of leg segments: leg I: Ge 163 (140-185); Ti 126 (110-145); Ta 131 (110-150); leg IV: Ta 208 (170-240).

Notes-- This species is generally very common in its hosts and may number in excess of 100 individuals in a single infested host. Eggs are deposited in the mantle and foot epithelium. The broad host and geographic ranges suggest that this species may be an *Artenkreis* or a *Rassenkreis*.

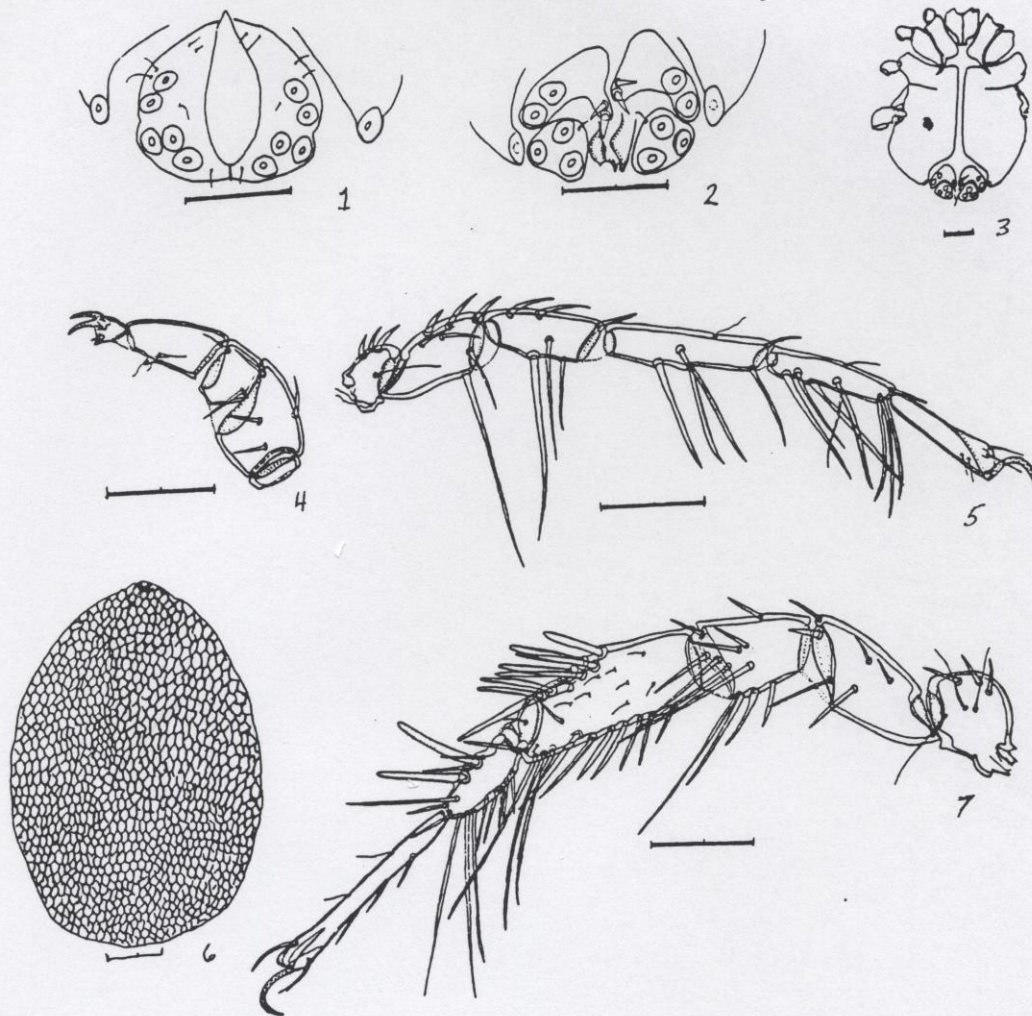
Hosts:

*Actinonaias ligamentina* (Lamarck): *Unio ligamentinus* Lamarck, Michigan (Wolcott 1899 and Viets and Plate 1954); *Actinonaias carinata* (Barnes) in Vidrine 1980a.

*Actinonaias pectorosa* (Conrad): Tennessee (Vidrine and Wilson 1991).

*Amblema plicata* (Say): *Unio undulatus* Barnes, Michigan (Wolcott 1899 and in Viets and Plate 1954); Texas (Calnan 1976).

*Arcidens confragosus* (Say): Texas (Calnan 1976).



Figures 1-7. *Unionicola abnormipes* (Wolcott 1898). 1. Male genital field. 2. Female genital field. 3. Female venter. 4. Pedipalp. 5. Male first walking leg. 6. Female dorsal plate. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985c). 7. Male fourth walking leg. Scale equals 100 micrometers.



Map 56. Known distribution of *Unionicola abnormipes* (Wolcott 1898) in North America.

*Cyclonaias tuberculata* (Rafinesque): Tennessee (Vidrine and Wilson 1991).  
*Cyrtonaias tampicoensis* (Lea): Texas (Calnan 1976); Rio Grande system, Mexico (Vidrine 1980a).  
*Elliptio buckleyi* (Lea): Florida (Vidrine 1980a).  
*Elliptio jayensis* (Lea): Florida (Vidrine 1980a).  
*Elliptio strigosus* (Lea): Alabama (Vidrine 1980a).  
*Elliptio* sp.: Florida (Vidrine 1980a).  
*Fusconaia askewi* (Marsh): *Fusconaia lananensis* (Frierson), Louisiana (Vidrine 1980a).  
*Fusconaia cerina* (Conrad): *Fusconaia flava* (Rafinesque), Mississippi (Vidrine 1980a).  
*Glebula rotundata* (Lamarck): Louisiana (Vidrine 1989a).  
*Lampsilis abrupta* (Say): *Lampsilis orbiculata* (Hildreth), Tennessee, Vidrine and Wilson (1991).  
*Lampsilis australis* Simpson: Alabama (Dobson 1966).  
*Lampsilis cardium* Rafinesque: *Unio ventricosus* Barnes, Michigan and New York, and *Unio occidentalis*, Michigan and Illinois (Wolcott 1899); *Lampsilis ovata cardium* Rafinesque in Viets and Plate 1954; *Lampsilis ventricosus* (Barnes), Iowa and Pennsylvania (Kelly 1899); Arkansas, Mississippi, Minnesota, and Wisconsin (Vidrine 1980a); Maryland (form *cohongoronta*) (Vidrine 1980a).  
*Lampsilis higginsii* (Lea): Minnesota and Wisconsin (Vidrine 1980a).  
*Lampsilis hydiana* (Lea): *Lampsilis radiata* (Barnes), Louisiana (Vidrine 1974a); Louisiana, Arkansas, and Texas (Vidrine 1980a).  
*Lampsilis ornata* (Conrad): *Lampsilis excavata* Lea, Apalachicola (Dobson 1966).  
*Lampsilis ovata/cardium* (Stones/Duck Rivers): Tennessee (Vidrine and Wilson 1991).  
*Lampsilis radiata radiata* (Gmelin): *Unio luteolus* Lamarck, Michigan, Wisconsin, and New York (Wolcott 1899); *Ligumia fasciata* Rafinesque in Viets and Plate 1954; Faust (1918).  
*Lampsilis satur* (Lea): Texas and Louisiana (Vidrine 1974a and 1980a).  
*Lampsilis siliquoidea* (Barnes): Michigan (Mitchell 1955); *Lampsilis luteola*, Lake Okoboji, Iowa (Marshall 1926); *Lampsilis radiata siliquoidea* (Barnes), Ohio, Arkansas, Minnesota, and Wisconsin (Vidrine 1980a).  
*Lampsilis splendida* (Lea): *Lampsilis radiata splendida* (Lea), South Carolina (Vidrine 1980a).  
*Lampsilis straminea claibornensis* (Lea): *Lampsilis claibornensis* (Lea), Apalachicola (Dobson 1966); Alabama, Florida, Louisiana, and Mississippi (Vidrine 1980a).  
*Lampsilis streckeri* Frierson: Arkansas (Vidrine 1980a).  
*Lampsilis teres* (Rafinesque): *Unio anodontoides* Lea, Illinois (Wolcott 1899); *Ligumia teres* Rafinesque in Viets and Plate 1954; *Lampsilis anodontoides* (Lea), Iowa (Kelly 1899) and Texas (Calnan 1976); *Lampsilis anodontoides anodontoides* and *Lampsilis anodontoides floridensis*, Apalachicola (Dobson 1966); Louisiana, Arkansas, Texas, Oklahoma, Mississippi, and Florida (Vidrine 1974a and 1980a).  
*Lampsilis* sp.: Alabama (Vidrine 1980a).  
*Leptodea ochracea* (Say): *Lampsilis ochracea* (Say), North Carolina (Vidrine 1980a).  
*Leptodea fragilis* (Rafinesque): *Unio gracilis* Barnes, Wisconsin and Illinois (Wolcott 1899 and in Viets and Plate 1954); *Lampsilis gracilis*, Iowa (Kelly 1899); Texas (Calnan 1976); Louisiana, Arkansas, and Texas (Vidrine 1974a and 1980a).  
*Ligumia recta* (Lamarck): *Unio rectus* Lamarck, Michigan (Wolcott 1899 and in Viets and Plate 1954); Louisiana (Vidrine 1980a); Tennessee (Vidrine and Wilson 1991).



*Ligumia subrostrata* (Say): Louisiana and Oklahoma (Vidrine 1980a).  
*Obovaria jacksoniana* (Frierson): *Obovaria castenea* (Lea), Louisiana (Vidrine 1980a).  
*Obovaria unicolor* (Lea): Mississippi (Vidrine 1980a).  
*Potamilus alatus* (Say): *Unio alatus* Say, Michigan (Wolcott 1899 and in Viets and Plate 1954);  
*Proptera alata* (Say), upper Mississippi River (Fuller 1978), Minnesota and Wisconsin (Vidrine 1980a).  
*Potamilus amphichaenus* (Frierson): *Proptera amphichaena* (Frierson), Louisiana and Texas (Vidrine 1980a).  
*Potamilus ohioensis* (Rafinesque): *Proptera laevissima* (Lea), Arkansas and Louisiana (Vidrine 1980a).  
*Potamilus purpuratus* (Lamarck): *Proptera purpurata* (Lamarck), Texas (Calnan 1976); Arkansas, Texas, and Louisiana (Vidrine 1980a).  
*Ptychobranhus fasciolaris* (Rafinesque): *Unio phaseolus* Hild., New York (Wolcott 1899 and in Viets and Plate 1954).  
*Ptychobranhus occidentalis* (Conrad): *Ptychobranhus fasciolaris* (Rafinesque), Arkansas (Vidrine 1980a).  
*Pyganodon cataracta* (Say): *Anodonta cataracta* Say, South Carolina (Vidrine 1980a).  
*Pyganodon grandis* (Say): *Anodonta plana* Lea, New York (Wolcott 1899); Viets and Plate 1954; *Anodonta grandis* Say, Louisiana and Texas (Vidrine 1980a); *Anodonta hallenbecki* (Lea), Apalachicola (Dobson 1966).  
*Quadrula metanevra* (Rafinesque): *Orthonymus metanevra* (Rafinesque), Arkansas (Vidrine 1980a).  
*Quadrula pustulosa mortoni* (Conrad): *Quadrula pustulosa* group variable, Louisiana (Vidrine 1980a).  
*Strophitus subvexus* (Conrad): Louisiana (Vidrine 1980a).  
*Strophitus undulatus* (Say): Minnesota (Vidrine 1980a).  
*Toxolasma parvus* (Barnes): *Carunculina parva* (Barnes) (in part), Louisiana and Texas (Calnan 1976, Vidrine 1974a, 1980a, and 1989a).  
*Toxolasma paulus* (Lea): Apalachicola (Dobson 1966).  
*Toxolasma texasensis* (Lea): *Carunculina parva* (Barnes) (in part), Louisiana and Texas (Calnan 1976, Vidrine 1974a, 1980a, and 1989a).  
*Tritogonia verrucosa* (Rafinesque): Louisiana and Arkansas (Vidrine 1974a and 1980a).  
*Unioemerus declivus* (Say): Texas (Vidrine 1980a).  
*Utterbackia imbecillis* (Say): *Anodonta imbecillus* Say, Iowa (Kelly 1899) and Apalachicola (Dobson 1966).  
*Utterbackia peggyae* (Johnson): *Anodonta peggyae* Johnson, Florida (Vidrine 1980a).  
*Villosa amygdala* (Lea): Florida (Vidrine 1980a).  
*Villosa delumbis* (Conrad): South Carolina (Vidrine 1980a).  
*Villosa iris* (Lea): Arkansas (Vidrine 1980a).  
*Villosa lienosa* (Conrad): Louisiana (Vidrine 1989a).  
*Villosa vibex* (Conrad): Apalachicola (Dobson 1966); Georgia, Louisiana, and Mississippi (Vidrine 1980a).  
*Villosa villosa* (Wright): Alabama and Florida (Vidrine 1980).

*Unionicola (Neoatax) australindistincta* Vidrine 1985c  
Plates 157-159 in Vidrine (1996a)

Synonymy--

*Unionicola indistincta* forms N and NI in Vidrine 1980a

*Unionicola (Polyatax) australindistincta* Vidrine 1985c in Vidrine 1986e

*Unionicola (Neoatax) australindistincta* Vidrine 1985c in Vidrine 1994

Museum type number(s) and location-- CNC 18825, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Proptera* (= *Potamilus*) *purpuratus* (Lamarck) from Louisiana Irrigation Canal ca. 5.0 km north of Iowa at Rte. LA 383, Jefferson Davis Parish, Louisiana, collected 2 May 1981 by Macky and M. F. Vidrine.

Etymology-- Named to indicate that it may be merely a southern form of *U. indistincta*.

Diagnosis-- Character states of the subgenus; dorsum with 1-6 plates with varied amounts of fusion along borders; coxal plates well sclerotized and not partially surrounding the genital field; female genital field with anterior acetabular plates bearing 2-4 acetabula and 2, short, thick spines on the inner margin, posterior acetabular plates each bearing 3-8 acetabula and a small, hairlike seta on the inner margin; male genital field with 2 acetabular plates each bearing 5-11 acetabula; tarsal claws of pedipalps shorter than the length of the Ta; tarsal claws of all walking legs minutely bifid with short, dorsal prongs; fourth walking leg of male sexually dimorphic with the Ge bearing 6-9, large, dorsal spines, and Ti bearing 2, large, dorsal spines.

Male (3 specimens)-- Length including capitulum 816 (750-900); dorsal plate 617 (500-750) long, 525 (500-550) wide; length of posterior coxal group 373 (350-400); dorsal lengths of pedipalp segments: Ge 62 (60-65); Ti 112 (100-120); Ta 34 (30-35); dorsal lengths of leg segments: leg I: TFe 137 (130-145); Ge 187 (175-200); Ti 137 (125-155); Ta 137 (120-155); leg IV: TFe 150 (140-160); Ge 265 (240-290); Ti 147 (130-160); Ta 360 (350-380).

Female (4 specimens)-- Length including capitulum 863 (800-900); length of posterior coxal group 364 (330-425); dorsal lengths of pedipalp segments: Ge 68 (55-75); Ti 118 (105-125); Ta 35; dorsal lengths of leg segments: leg I: TFe 160 (140-175); Ge 211 (190-235); Ti 158 (140-180); Ta 150 (130-170); leg IV: TFe 169 (150-180); Ge 261 (235-280); Ti 286 (275-310); Ta 303 (290-320).

Notes-- *Unionicola australindistincta* was also measured from paratypes from the same host mussel from 1. Strawberry River at Rte. U. S. 167, ca. 3.0 km north of Evening Shade, Sharp County, Arkansas, collected 14 August 1979 by D. J. Bereza and M. F. Vidrine, and 2. Tombigbee River at Rte. U. S. 82, Columbus, Lowndes County, Mississippi, collected 1 July 1978 by Darryl and Beth Clark, Bill Bell, and M. F. Vidrine. Infested hosts usually contained 10-100 mites. Eggs are deposited in the entire mantle and foot tissues of the hosts. Although several species of mussels

were infested, *P. purpuratus* was most commonly and most intensely infested. The mite is known from Texas, Mississippi, Arkansas, Oklahoma, and Louisiana (Vidrine 1985c). Vidrine and Wilson (1991) added a key new host, *P. alatus*, from Tennessee. This is a highly variable species, and it may actually represent a cluster of species. It is closely related to *U. indistincta* and varies mainly in the number of spines on the Ti of the modified fourth walking legs of the males. However, a variety of dorsal plate structures were noted (Vidrine 1985c), and this set of differences as well as the variety of genital field modifications, namely populations with 5 pairs of genital acetabula and populations with 6-9 pairs of genital acetabula, may further indicate that at least two sibling species are included in *U. australindistincta*.

#### Hosts:

*Amblema plicata* (Say): Texas (Vidrine 1980a).

*Lampsilis hydiana* (Lea): *Lampsilis radiata* (Barnes), Louisiana (Vidrine 1974a).

*Lampsilis satur* (Lea): *Lampsilis ovata* (Say), Texas (Vidrine 1980a).

*Leptodea fragilis* (Rafinesque): Texas and Louisiana (Vidrine 1980a).

*Lampsilis teres* (Rafinesque): Texas (Vidrine 1980a).

*Potamilus alatus* (Say): Tennessee (Vidrine and Wilson 1991).

*Potamilus amphichaenus* (Frierson): *Proptera amphichaena* (Frierson), Texas (Vidrine 1980a).

*Potamilus inflatus* (Lea): Amite River, Louisiana (I received 8 specimens from Paul Hartfield of the Endangered Species Office in the autumn of 1995).

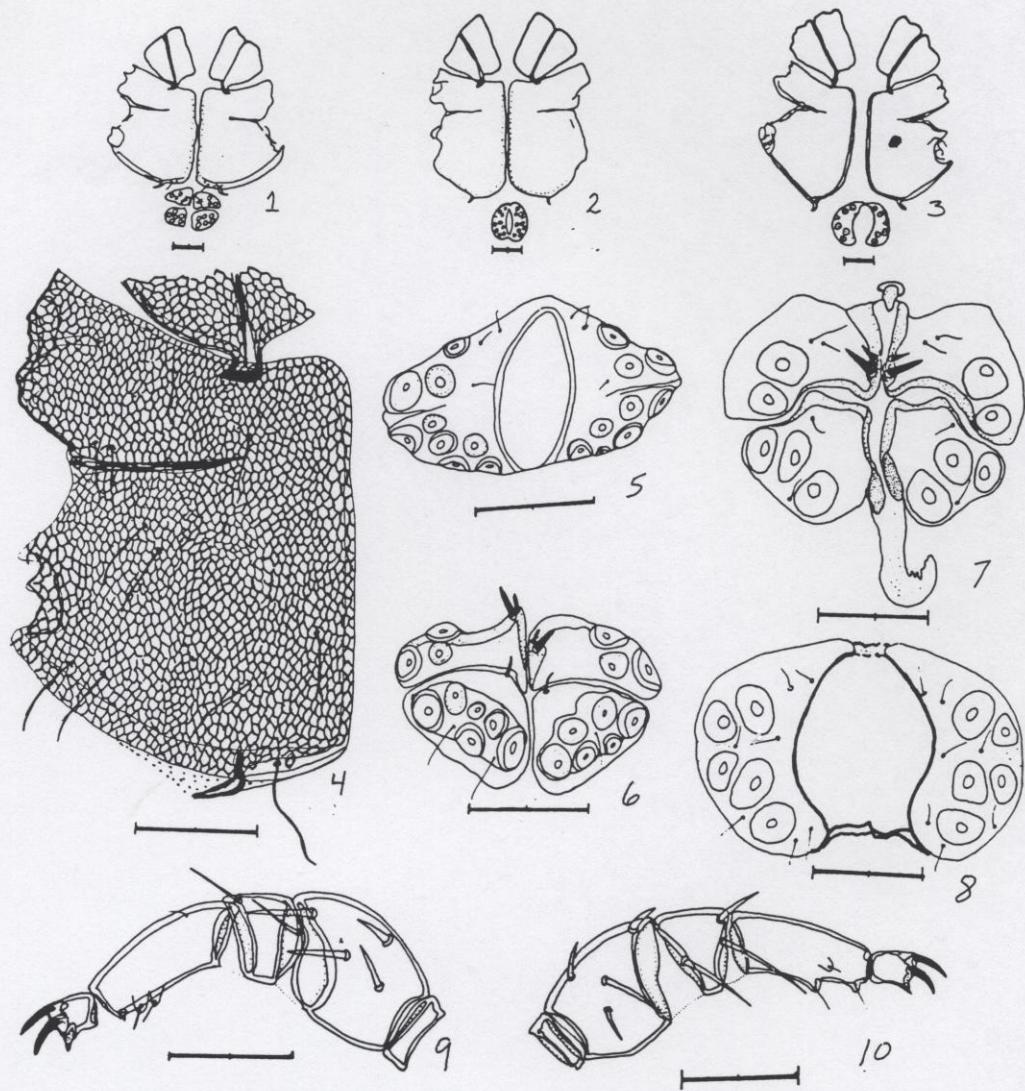
*Potamilus ohiensis* (Rafinesque): Louisiana.

*Potamilus purpuratus* (Lamarck): *Proptera purpurata* (Lamarck), Arkansas, Texas, Louisiana, Mississippi, and Oklahoma (Vidrine 1980a).

*Pyganodon grandis* (Say): *Anodonta grandis* Say, Texas (Vidrine 1980a).

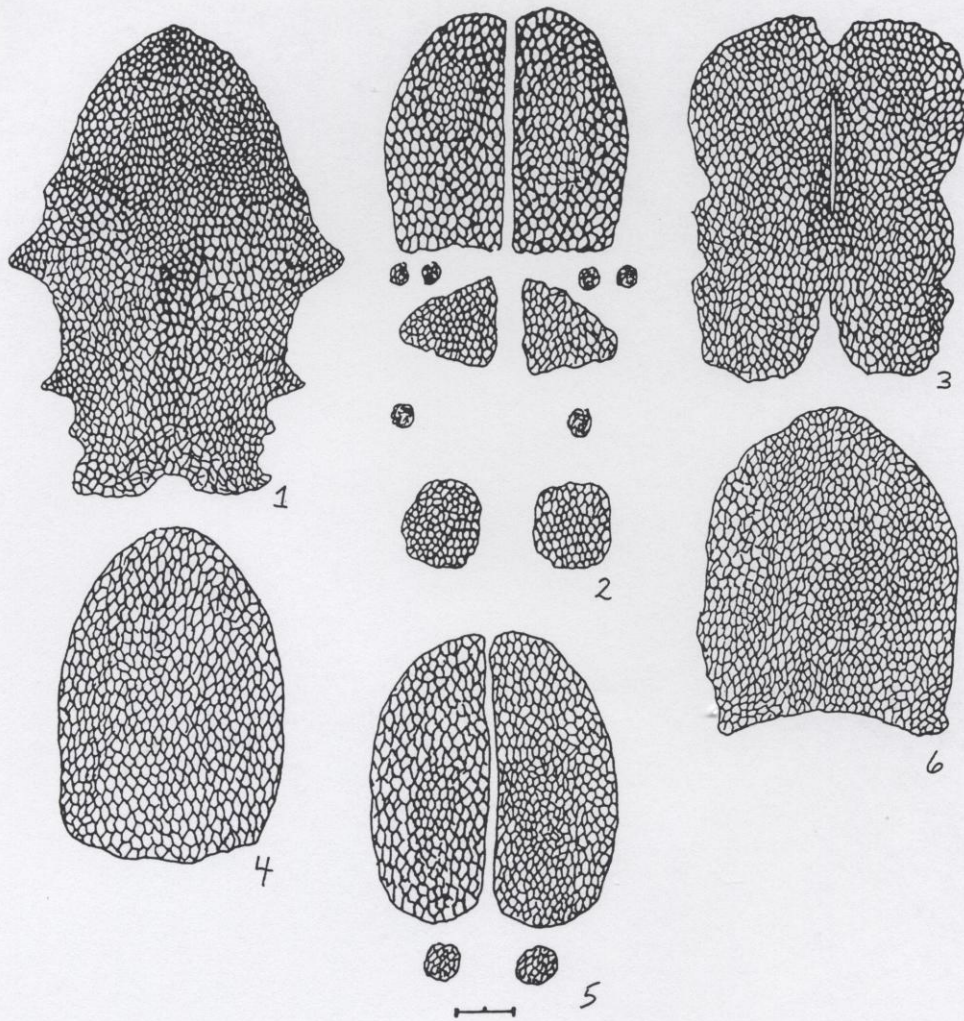
*Strophitus undulatus* (Say): Louisiana (Vidrine 1980a).

*Villosa lienosa* (Conrad): Louisiana (Vidrine 1980a).

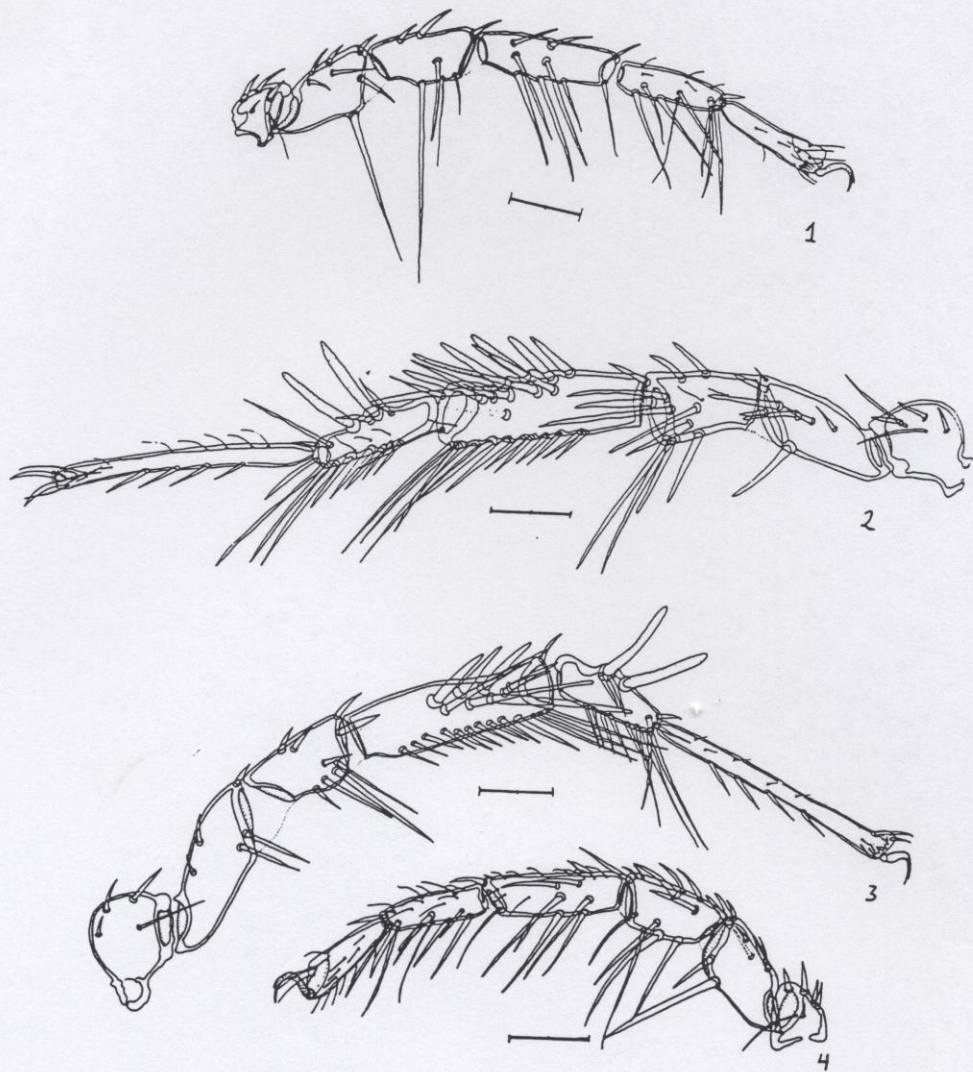


Figures 1-10. *Unionicola australindistincta* Vidrine 1985. 1. Female venter (Arkansas). 2. Male venter (Arkansas). 3. Male venter (Louisiana). 4. Female posterior coxal group (Arkansas). 5. Male genital field (Arkansas). 6. Female genital field (Arkansas). 7. Female genital field (Louisiana). 8. Male genital field (Louisiana). 9. Male pedipalp (Arkansas). 10. Male pedipalp (Louisiana). (Reprinted with permission from the International Journal of Acarology: Vidrine 1985c). Scale equals 100 micrometers.





Figures 1-6. *Unionicola australindistincta* Vidrine 1985. 1. Male dorsal plate (Louisiana). 2. Female dorsal plates (Louisiana). 3. Female dorsal plate (Arkansas). 4. Male dorsal plate (Mississippi). 5. Female dorsal plates (Mississippi). 6. Male dorsal plate (Arkansas). (Reprinted with permission from the International Journal of Acarology: Vidrine 1985c). Scale equals 100 micrometers.



Figures 1-4. *Unionicola australindistincta* Vidrine 1985. 1. Male first walking leg (Louisiana). 2. Male fourth walking leg (Arkansas). 3. Male fourth walking leg (Louisiana). 4. Male first walking leg (Arkansas). (Reprinted with permission from the International Journal of Acarology: Vidrine 1985c). Scale equals 100 micrometers.





Map 57. Known distribution of *Unionicola australindistincta* Vidrine 1985 in North America.

*Unionicola (Neoatax) causeyae* Vidrine 1985c  
Plates 160-162

Synonymy--

*Unionicola* sp. nov. type A in Vidrine 1980a

*Unionicola (Polyatax) causeyae* Vidrine 1985c in Vidrine 1986e

*Unionicola (Neoatax) causeyae* Vidrine 1985c in Vidrine 1994

Museum type number(s) and location-- CNC 18824, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Carunculina* (= *Toxolasma*) *parvus* (Barnes) from Louisiana Irrigation Canal ca. 5.0 km north of Iowa at Rte. LA 383, Jefferson Davis Parish, Louisiana, collected 2 May 1981 by Macky and M. F. Vidrine.

Etymology-- Named to honor the late Nell B. Causey, my major professor for my Master's Degree. She first introduced me to *Unionicola*.

Diagnosis-- Character states of the subgenus; dorsum with 4, lightly sclerotized, nearly circular plates; coxal plates well-sclerotized and with posterior projections; posterior coxal group not elongate nor extending posterior to the genital field; female genital field with anterior acetabular plates bearing 2 acetabula and 2, short, thick spines on the inner margin, posterior acetabular plates each bearing 1-2 acetabula and a small, hairlike seta on the inner margin; male genital field with 2 acetabular plates each bearing 4 acetabula; tarsal claws of pedipalps longer than the length of the Ta; tarsal claws of all walking legs minutely bifid with short, dorsal prongs; Ti of male walking leg III with three large distal spines; fourth walking leg of male sexually dimorphic with the Ge bearing 3-6, large, dorsal spines, and Ti bearing 2, large, dorsal spines.

Male (3 specimens)-- Length including capitulum 567 (550-600); anterior dorsal plate 60 (50-70) in diameter; posterior dorsal plate 28 (25-30) in diameter; length of posterior coxal group 215 (320-350); dorsal lengths of pedipalp segments: Ge 33 (30-35); Ti 85 (75-95); Ta 17 (15-20); dorsal lengths of leg segments: leg I: TFe 90 (80-100); Ge 125 (105-140); Ti 93 (85-105); Ta 103 (100-105); leg IV: TFe 92 (85-100); Ge 147 (130-175); Ti 73 (70-75); Ta 210 (180-235).

Female (4 specimens)-- Length including capitulum 606 (550-650); anterior dorsal plates 70 (50-90) in diameter; posterior dorsal plates 38 (25-50) in diameter; length of posterior coxal group 200 (180-220); dorsal lengths of pedipalp segments: Ge 40 (35-45); Ti 90 (84-97); Ta 18 (15-20); dorsal lengths of leg segments: leg I: TFe 94 (90-100); Ge 130 (120-140); Ti 109 (100-115); Ta 113 (105-120); leg IV: TFe 100 (95-105); Ge 150 (140-160); Ti 165 (155-175); Ta 160 (150-170).

Notes-- *Unionicola causeyae* has been found in 9 genera of freshwater mussels from Mississippi, Arkansas, Texas, Florida, Maryland, Delaware, North Carolina, and Louisiana (Vidrine 1985). Vidrine and Wilson (1991) added hosts from Tennessee. Usually 6-10 mites occur in each infested



host. Eggs are deposited in an area usually less than 1.0 cm in diameter in the center of the host's mantle. It is readily distinguished by the number of acetabula, usually 4 pairs. It most closely resembles *U. abnormipes*, but the latter has a dorsal plate that covers the entire dorsum and coxal plates obviously fused with the genital fields. Whereas, the males of the two species have nearly identical sexual dimorphism of the male walking legs, *U. abnormipes* deposits its eggs throughout the entire mantle.

Hosts:

*Cyclonaias tuberculata* (Rafinesque): Tennessee (Vidrine and Wilson 1991).

*Elliptio arctata* (Conrad): Florida.

*Elliptio buckleyi* (Lea): Florida (Vidrine 1980a).

*Elliptio complanata* (Lightfoot): Maryland (Vidrine 1980a).

*Elliptio strigosus* (Lea): Florida (Vidrine 1980a).

*Elliptio* sp.: Florida (Vidrine 1980a).

*Ligumia nasuta* (Say): Delaware and North Carolina (Vidrine 1980a).

*Ligumia subrostrata* (Say): *Villosa vibex* (Conrad), Louisiana (Vidrine 1974a); Louisiana and Mississippi (Vidrine 1980a).

*Ptychobranhus fasciolaris* (Rafinesque): Tennessee (Vidrine and Wilson 1991).

*Pyganodon grandis* (Say): *Anodonta grandis* Say, Louisiana (Vidrine 1980a).

*Quadrula pustulosa pustulosa* (Lea): Tennessee (Vidrine and Wilson 1991).

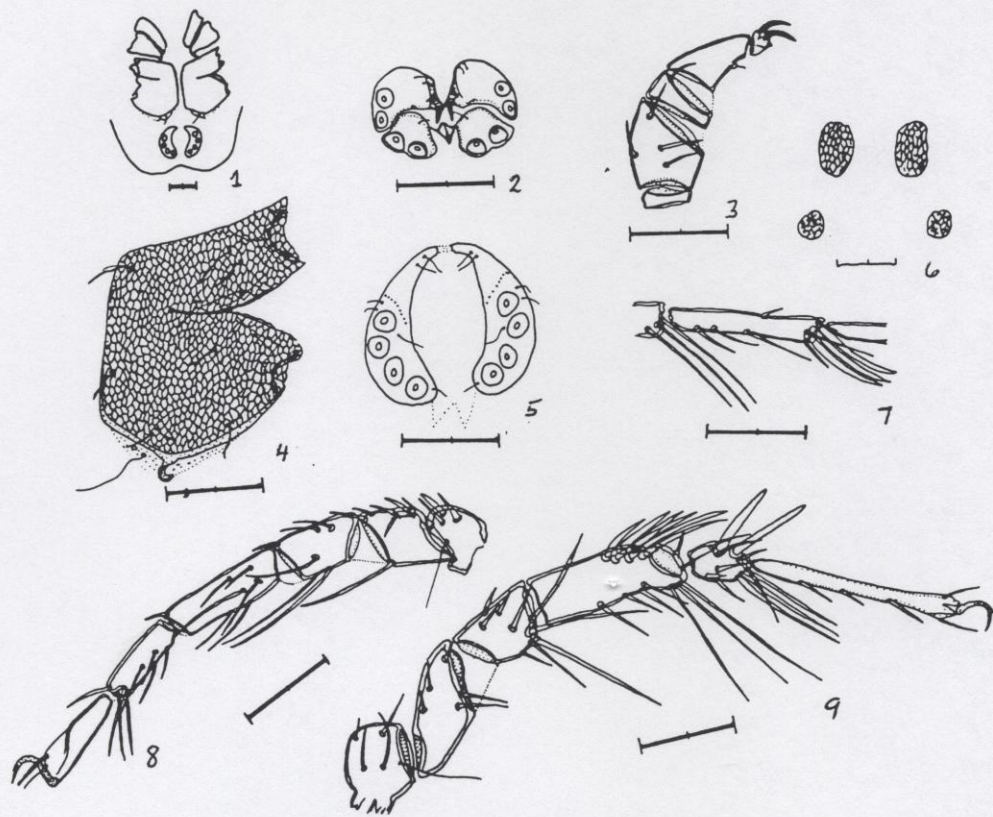
*Toxolasma parvus* (Barnes): *Carunculina parva* (Barnes), Louisiana and Mississippi (Vidrine 1974a and 1980a). Most of these specimens are actually *T. texasensis*.

*Toxolasma texasensis* (Lea): Louisiana and Mississippi.

*Uniomerus obesus* (Lea): Florida.

*Uniomerus tetralasmus* (Say): Louisiana, Arkansas, and Alabama (Vidrine 1980a).

*Villosa lienosa* (Conrad): Louisiana (Vidrine 1980a).



Figures 1-9. *Unionicola causeyae* Vidrine 1985. 1. Male venter. 2. Female genital field. 3. Pedipalp. 4. Posterior coxal plates. 5. Male genital field. 6. Female dorsal plates. 7. Male tibia of third walking leg. 8. Male first walking leg. 9. Male fourth walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985c). Scale equals 100 micrometers.



Map 58. Known distribution of *Unionicola causeyae* Vidrine 1985 in North America.

*Unionicola (Neoatax) indistincta* (Wolcott 1898)  
Plates 163-164 in Vidrine (1996a)

Synonymy--

*Atax indistinctus* Wolcott 1898, (Wolcott 1898 and 1899) and Piersig 1901

*Unionicola (Neoatax) indistinctus* (Wolcott 1898), Lundblad 1941b

*Unionicola (Neoatax) indistincta* (Wolcott 1898), Mitchell (1954), Viets and Plate 1954, Crowell 1961, Habeeb 1967, Cook 1974, and Vidrine 1980a and 1994

*Unionicola (Polyatax) indistincta* (Wolcott 1898) in Vidrine 1985c and 1986e

Museum type number(s) and location-- Wolcott collection/Marshall collection, Field Museum of Natural History, Chicago, Illinois.

Type locality and host-- ? *Potamilus alatus* in Illinois.

Etymology-- Named to indicate its indistinctiveness at the time of its description since Wolcott only had females.

Diagnosis-- Character states of the subgenus; obvious, large dorsal plates; with 7-9 pairs of genital acetabula; fourth walking leg of males obviously dimorphic with Ti shortened and possessing a single large, dorsal, blunt seta; posterior border of coxal plate IV distinct and not extending posteriorly to the genital field.

Male (2 specimens)-- Length of posterior coxal group 385 (380-390); dorsal lengths of pedipalp segments: Ti 135 (130-140); Ta 40; dorsal lengths of leg segments: leg I: Ge 190; Ti 135; Ta 150; leg IV: Ta 370 (365-375).

Female (4 specimens)-- Length of posterior coxal group 370 (350-390); dorsal lengths of leg segments: leg I: Ge 207 (200-210); Ti 155 (150-160); Ta 155 (150-160); leg IV: Ta 315 (290-340).

Notes-- This mite is a common parasite of *Potamilus alatus* in the upper Mississippi and Tennessee River systems. Dorsal plates and the male fourth walking legs are sufficient to distinguish this species from the previous species, including the very close relative *U. australindistincta*.

Hosts:

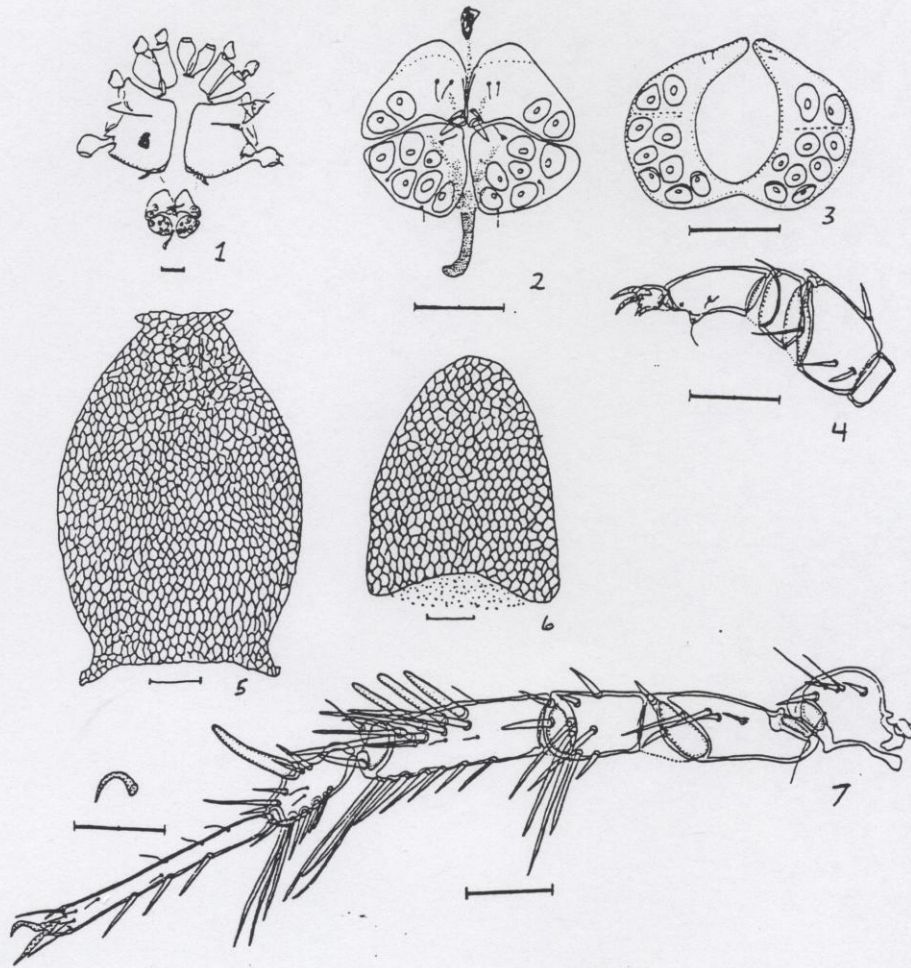
*Leptodea fragilis* (Rafinesque): *Unio gracilis* Barnes, Illinois (Wolcott 1899 and Viets and Plate 1954); *Leptodea gracilis* (Barnes), Iowa (Kelly 1899); Iowa, Illinois, and Missouri (Fuller 1978 and Vidrine 1980a).

*Potamilus alatus* (Say): *Unio alatus* Say, Illinois (Wolcott 1898 and 1899 and in Viets and Plate 1954); *Lampsilis alatus* (Say), Iowa (Kelly 1899); *Proptera alata* (Say), Iowa, Illinois, Missouri, Minnesota, Wisconsin, and Tennessee (Fuller 1978 and Vidrine 1980a).

*Pyganodon grandis* (Say): *Anodonta grandis* Say, Illinois (Fuller 1978 and Vidrine 1980a).

*Utterbackia imbecillis* (Say): *Anodonta imbecillus* Say, Iowa (Kelly 1899).





Figures 1-7. *Unionicola indistincta* (Wolcott 1898). 1. Male venter. 2. Female genital field. 3. Male genital field. 4. Pedipalp. 5. Female dorsal plate. 6. Male dorsal plate. 7. Male fourth walking leg and tarsal claw. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985c). Scale equals 100 micrometers.



Map 59. Known distribution of *Unionicola indistincta* (Wolcott 1898) in North America.

Subgenus *Causeyatax* Vidrine 1994

TYPE SPECIES-- *U. hensleyi* Vidrine 1985c

ETYMOLOGY-- Named to honor the late Nell B. Causey, my major professor for my Master's Degree. She first introduced me to *Unionicola*.

DIAGNOSIS-- Genital acetabula 5 pairs; female genital field with 2 pairs of acetabular plates; female anterior plates with an slightly elongate, inner flap that is heavily sclerotized and bears one or 2, short, thick, spinous setae; female posterior plate unmodified; pedipalp subcylindrical and well-sclerotized with tarsus usually elongate quadrate in outline with large, obvious clawlets; dorsum with obvious dorsal plates; male genital field as in *Polyatax*; male fourth walking leg modified, especially Ge, but the Ti is essentially unmodified; tarsal claws of walking legs bifid; coxal plates with obvious borders.

HABITAT-- Parasites of Unionidae.

DISTRIBUTION-- North America.

DISCUSSION-- This subgenus is closely related to *Neoatax*, but the distinctive leg modifications in the fourth walking leg of the males require its placement into a separate clade.

*Unionicola (Causeyatax) hensleyi* Vidrine 1985c  
Plates 165-168 in Vidrine (1996a)

Synonymy--

*Unionicola* sp. nov. type 2 in Vidrine 1980a

*Unionicola (Polyatax) hensleyi* Vidrine 1985c in Vidrine 1986e

*Unionicola (Causeyatax) hensleyi* Vidrine 1985c in Vidrine 1994

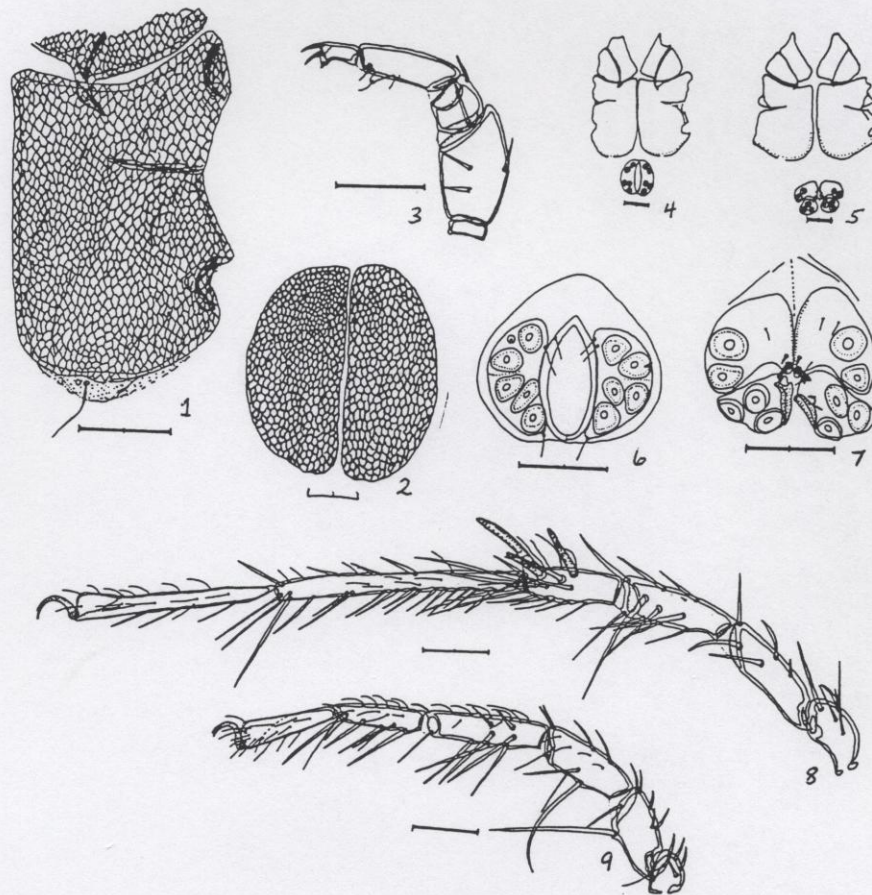
Museum type number(s) and location-- CNC 18823, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Friersonia iridella* (Pilsbry and Frierson) from a small river (locally called Arroyo de Oxitipa) at paved road ca. 3.0 km east of Aquismon, San Luis Potosi Province, Mexico, collected 9 November 1978 by D. J. Bereza.

Etymology-- Named to honor Steven and Robley Hensley.

Diagnosis-- Character states of the subgenus; dorsum with 2 plates; coxal plates well sclerotized and with coxal plate IV slightly elongate; female genital fields with anterior plates each bearing 2 acetabula and 2, short, thick spines on the inner margin, posterior acetabular plates each bearing 3 acetabula and a small, hairlike seta on the inner margin; male genital field with acetabular plates each bearing 5-6 acetabula; pedipalp with tarsal claws shorter than the length of the Ta; tarsal claws of the walking legs bifid with small dorsal prongs; fourth walking leg of the male sexually dimorphic with Ge bearing 3 large spines and with Ti elongate.





Figures 1-9. *Unionicola hensleyi* Vidrine 1985. 1. Male posterior coxal group. 2. Female dorsal plates. 3. Male pedipalp. 4. Male venter. 5. Female venter. 6. Male genital field. 7. Female genital field. 8. Male fourth walking leg. 9. Male first walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985c). Scale equals 100 micrometers.





Map 60. Known distribution of *Unionicola hensleyi* Vidrine 1985 in North America.

Male (2 specimens)-- Length including capitulum 675 (650-700); dorsal plate 600 long; length of posterior coxal group 335 (320-350); dorsal lengths of pedipalp segments: Ge 55; Ti 105; Ta 35; dorsal lengths of leg segments: leg I: TFe 148 (145-150); Ge 183 (175-190); Ti 133 (130-135); Ta 140 (130-150); leg IV: TFe 168 (160-175); Ge 153 (150-155); Ti 353 (330-375); Ta 275 (250-300).

Female (3 specimens)-- Length including capitulum 800 (750-850); dorsal plates 450 (400-500) long, 238 (225-250) wide; length of posterior coxal group 350; dorsal lengths of pedipalp segments: Ge 68 (65-70); Ti 118 (115-120); Ta 45; dorsal lengths of leg segments: leg I: TFe 165 (160-170); Ge 212 (210-215); Ti 170 (165-175); Ta 160 (150-170); leg IV: TFe 208 (205-210); Ge 255 (250-260); Ti 395 (390-400); Ta 295 (275-310).

Notes-- *Unionicola hensleyi* was also found in the same host from Rio Carrizal at Rte. MX 180 in Nuevo Progreso, ca. 30.0 km north of road divergence (on Rte. MX 80) to Aldama and Est. Manuel, Tamaulipas Province, Mexico, collected 27 January 1982 by D. J. Bereza, S. V. Hensley, and M. F. Vidrine. *Unionicola hensleyi* is only known from the Rio Panuco and the Rio Carrizal systems in Mexico. Eggs are deposited in the mantle and foot tissues of the hosts. More than 10 individuals were found in each infested host. It is readily separated from all other species by the unique sexual dimorphism in the fourth walking leg of the males and by the unique dorsal plate structure.

#### Hosts:

*Disconaias purpuratus* (Say): Mexico.

*Friersonia iridella* (Pilsbry and Frierson): Mexico (Vidrine 1980a).

*Friersonia moctezumensis* (Pilsbry): Mexico.

*Utterbackia imbecillis* (Say): Mexico.

Subgenus *Breadatax* Vidrine 1994

TYPE SPECIES-- *U. megachela* Vidrine 1985c

ETYMOLOGY-- Named to honor Thomas P. Breaud.

DIAGNOSIS-- Genital acetabula 5 pairs; female genital field with 2 pairs of acetabular plates; female anterior plates with an elongate, inner flap that is heavily sclerotized and bears one or 2, short, thick, spinous setae; female posterior plate unmodified; pedipalp subcylindrical and well-sclerotized with tarsus miniscule but bearing large, obvious clawlets; dorsum with obvious dorsal plates; male genital field as in *Neoatax*; male fourth walking leg slightly modified with genu and tibia with enlarged dorsal spines; first walking leg with short, thick setae and similar in both sexes; tarsal claws of walking legs very large and simple.

HABITAT-- Parasites of Unionidae.

DISTRIBUTION-- North America.

DISCUSSION-- This species lives in the area of the labial palps of their hosts. It has numerous serrated spines and unique tarsal claws and leg structure. The modifications in the fourth walking legs of the males are much less obvious than in *Neoatax*; however, these are yet apparent. Its pedipalps closely resemble those of *U. causeyae*.

*Unionicola (Breaudatax) megachela* Vidrine 1985c  
Plates 169-173 in Vidrine (1996a)

Synonymy--

*Unionicola* sp. nov. type R in Vidrine 1974a and 1980a

*Unionicola (Polyatax) megachela* Vidrine 1985c and 1986e

*Unionicola (Breaudatax) megachela* Vidrine 1985c in Vidrine 1994

Museum type number(s) and location-- CNC 18820, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Amblema* (= *Plectomerus*) *dombeyana* (Valenciennes) from Louisiana Irrigation Canal ca. 5.0 km north of Iowa at Rte. LA 383, Jefferson Davis Parish, Louisiana, collected by Macky and M. F. Vidrine.

Etymology-- Named for the extremely enlarged tarsal claws of the walking legs.

Diagnosis-- Character states of the subgenus; male and female dorsum with 4 lightly sclerotized plates; coxal plates reticulate, well sclerotized and possessing posterior projections; female genital field with anterior acetabular plates each bearing 2 acetabula and a pair of short, thick spines, posterior acetabular plates each bearing 3 acetabula and a single, short, hairlike seta; male genital field with 5 acetabula per acetabular plate; serrate spines on walking legs and pedipalps; pedipalps thick and with tarsal claws longer than the length of the tarsus; tarsal claws of walking legs large and simple; male fourth walking leg sexually dimorphic with the Ge bearing 2, slightly enlarged, dorsal spines, and the Ti bearing a single, slightly enlarged, dorsal spine.

Male (3 specimens)-- Length including capitulum 667 (650-700); dorsal anterior plates 70 (60-80) long, 53 (40-65) wide; dorsal posterior plates 60 long, 40 wide; length of posterior coxal group 290; dorsal lengths of pedipalp segments: Ge 50; Ti 90 (85-95); Ta 12 (10-15); dorsal lengths of leg segments: leg I: TFe 80 (75-85); Ge 100 (95-105); Ti 95 (90-100); Ta 100 (95-105); leg IV: TFe 88 (85-89); Ge 132 (130-135); Ti 148 (145-150); Ta 147 (145-150).

Female (3 specimens)-- Length including capitulum 767 (700-800); dorsal anterior plates 65 long, 50 wide; dorsal posterior plates 50 long, 40 wide; length of posterior coxal group 225; dorsal lengths of pedipalp segments: Ge 53 (50-55); Ti 94 (90-95); Ta 13 (10-15); dorsal lengths of leg segments: leg I: TFe 90 (85-95); Ge 108 (108-110); Ti 102 (100-105); Ta 107 (100-115); leg IV: TFe 93 (90-100); Ge 142 (140-145); Ti 157 (150-160); Ta 155 (150-165).

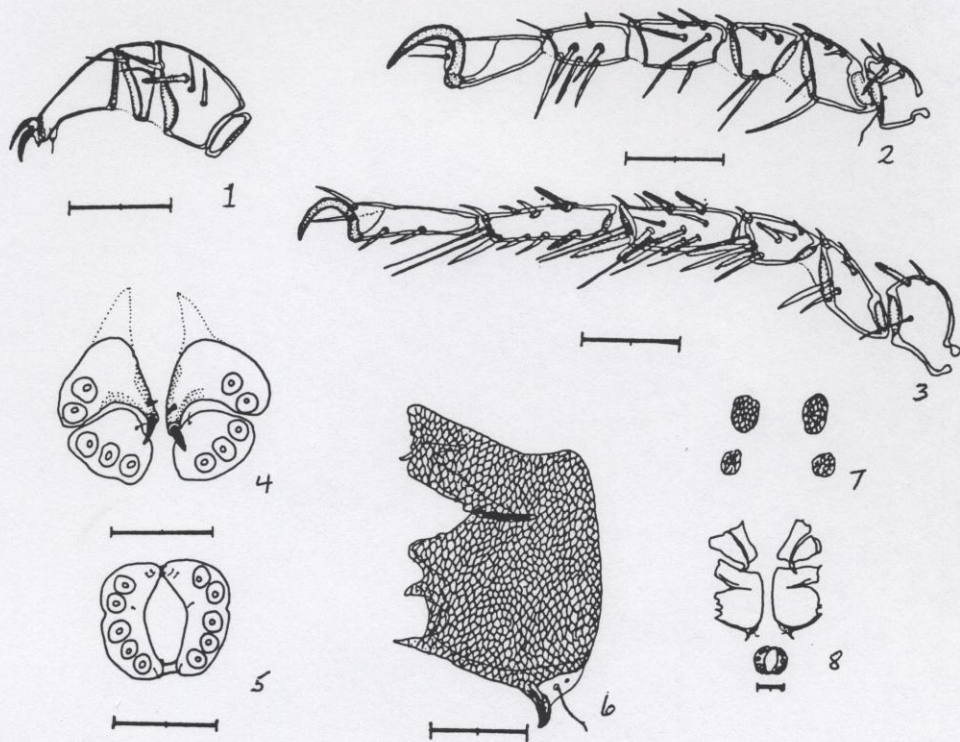
Notes-- *Unionicola megachela* lives between the labial palps of its hosts, and the adults are commonly found in the hosts during the winter months. Eggs are deposited in the hosts' mantle tissue in the proximity of the labial palps. Usually 1-5 individuals are found between the labial palps of an infested host. Hosts include members of 16 genera of freshwater mussels from



Louisiana, Mississippi, Arkansas, and Texas. *U. megachela* is readily diagnosed by its large tarsal claws on the walking legs, serrated spines, and pedipalpal tarsal structure. It occupies a similar habitat to that of *U. serrata* (Vidrine 1980a and 1983); however, the habitats of the infested mussels differ in that *U. serrata* usually occurs in mussels in sandy to rocky bottom streams, while *U. megachela* usually occurs in mussels in muddy or clayey bottom streams (Vidrine 1985c). This trend slowly becomes less apparent with additional collecting.

Hosts:

*Amblema plicata plicata* Say: Louisiana (Vidrine 1980a)(includes *A. p. perplicata*).  
*Anodonta suborbiculata* Say: Louisiana (Vidrine 1980a).  
*Arcidens confragosus* (Say): Louisiana (Vidrine 1989a).  
*Fusconaia askewi* (Marsh): *Fusconaia lananensis* (Frierson), Louisiana (Vidrine 1980a).  
*Fusconaia flava* (Rafinesque): Louisiana (Vidrine 1989a).  
*Glebula rotundata* (Lamarck): Louisiana and Mississippi (Vidrine 1980a).  
*Lampsilis hydiana* (Lea): Louisiana (Vidrine 1989a).  
*Lampsilis teres* (Rafinesque): Louisiana (Vidrine 1980a).  
*Leptodea fragilis* (Rafinesque): Louisiana (Vidrine 1980a).  
*Megaloniais nervosa* (Rafinesque): *Amblema gigantea* (Barnes), Louisiana (Vidrine 1980a).  
*Obliquaria reflexa* Rafinesque: Louisiana and Texas (Vidrine 1980a).  
*Plectomerus dombeyanus* (Valenciennes): *Amblema dombeyana* (Valenciennes), Louisiana, Mississippi, Arkansas, and Texas (Vidrine 1980a).  
*Potamilus purpuratus* (Lamarck): *Proptera purpurata* (Lamarck), Louisiana (Vidrine 1980a).  
*Pyganodon grandis* (Say): *Anodonta grandis* Say, Louisiana (Vidrine 1980a).  
*Quadrula apiculata* (Say): Louisiana (Vidrine 1980a).  
*Quadrula nodulata* Rafinesque: Louisiana (Vidrine 1980a).  
*Quadrula pustulosa pustulosa* (Lea): Louisiana (Vidrine 1980a).  
*Quadrula pustulosa mortoni* (Conrad): Louisiana (Vidrine 1989a).  
*Quadrula quadrula* (Rafinesque): Louisiana (Vidrine 1980a).  
*Toxolasma texasensis* (Lea): *Carunculina parva* (Barnes): Louisiana and Texas (Vidrine 1974a and 1980a).  
*Tritogonia verrucosa* (Rafinesque): Louisiana (Vidrine 1989a).  
*Truncilla donaciformis* (Lea): Louisiana (Vidrine 1980a).  
*Truncilla truncata* Rafinesque: Louisiana (Vidrine 1980a).



Figures 1-8. *Unionicola megachela* Vidrine 1985. 1. Male pedipalp. 2. Male first walking leg. 3. Male fourth walking leg. 4. Female genital field. 5. Male genital field. 6. Male posterior coxal group. 7. Female dorsal plates. 8. Male venter. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985c). Scale equals 100 micrometers.



Map 61. Known distribution of *Unionicola megachela* Vidrine 1985 in North America.

Subgenus *Clarkatax* Vidrine 1994

TYPE SPECIES-- *U. serrata* (Wolcott 1898)

ETYMOLOGY-- Named to honor Darryl R. Clark.

DIAGNOSIS-- Genital acetabula many pairs; female genital field with 2 pairs of acetabular plates; female anterior plates with an elongate, inner flap that is heavily sclerotized and bears one or 2, short, thick, spinous setae; female posterior plate modified with many acetabula; pedipalp subcylindrical and well-sclerotized with tarsus usually nearly quadrate in outline with large, obvious clawlets; dorsum with obvious dorsal plates; male genital field as in *Polyatax*; male and female legs similar; tarsal claws of walking legs bifid; coxal plates with distinctive borders.

HABITAT-- Parasites of Unionidae.

DISTRIBUTION-- North America.

DISCUSSION-- This species has numerous serrated spines. The nymphs are unusual with 3-5 pairs of "genital" acetabula. This species lives in the area of the labial palps of their hosts. The species is illustrated in Wolcott (1899). Downes (1991) and Mitchell (1965) studied the ecology of this species.



*Unionicola (Clarkatax) serrata* (Wolcott 1898)  
Plates 174-178 in Vidrine (1996a)

Synonymy--

*Atax serratus* Wolcott 1898, Wolcott 1898 and 1899, Kelly 1899

*Unionicola serrata* (Wolcott, 1898) Marshall 1933b and Dobson 1966

*Unionicola (Parasitatax) serrata* (Wolcott, 1898) Viets and Plate 1954, Mitchell 1954, 1955, and 1965, Viets 1956, Crowell 1961, and Habeeb 1967.

*Unionicola (Polyatax) serrata* (Wolcott 1898) Viets 1957, Cook 1974, Vidrine 1978a, 1980a, and 1986e, Vidrine and Bereza 1978b, Lieux and Vidrine 1980

*Unionicola* sp. type I in Vidrine 1974a.

*Unionicola (Clarkatax) serrata* (Wolcott 1898), Vidrine 1994

Museum type number(s) and location-- Marshall Collection, Field Museum of Natural History, Chicago, Illinois.

Type locality and host-- ? *Lampsilis radiata radiata* in Michigan.

Etymology-- *Serrata* indicates saw-teeth-like projections; which are numerous on the spines of the pedipalps and walking legs in this species.

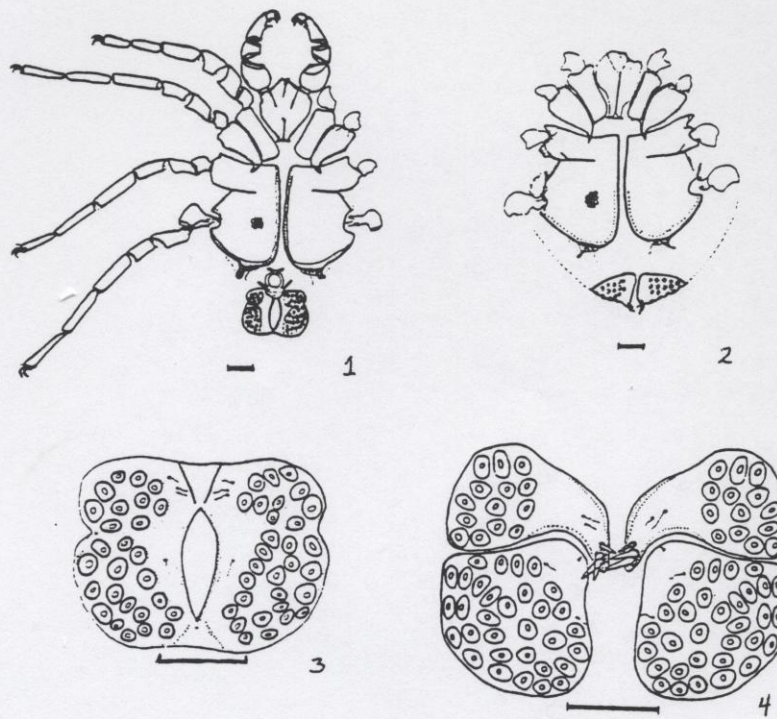
Diagnosis-- Character states of the subgenus; large reticulate dorsal plate or plates; tarsal claws of walking legs slightly bifid; serrated spines on pedipalps and legs; adults with more than 15 pairs of acetabula; nymphs with 4-6 pairs of acetabula.

Male (6 specimens)-- Length of posterior coxal group 405 (310-480); dorsal lengths of pedipalp segments: Ti 150 (120-170); Ta 25 (20-30); dorsal lengths of leg segments: leg I: Ge 166 (150-210); Ti 125 (110-150); Ta 120 (100-140); leg IV: Ta 187 (150-240).

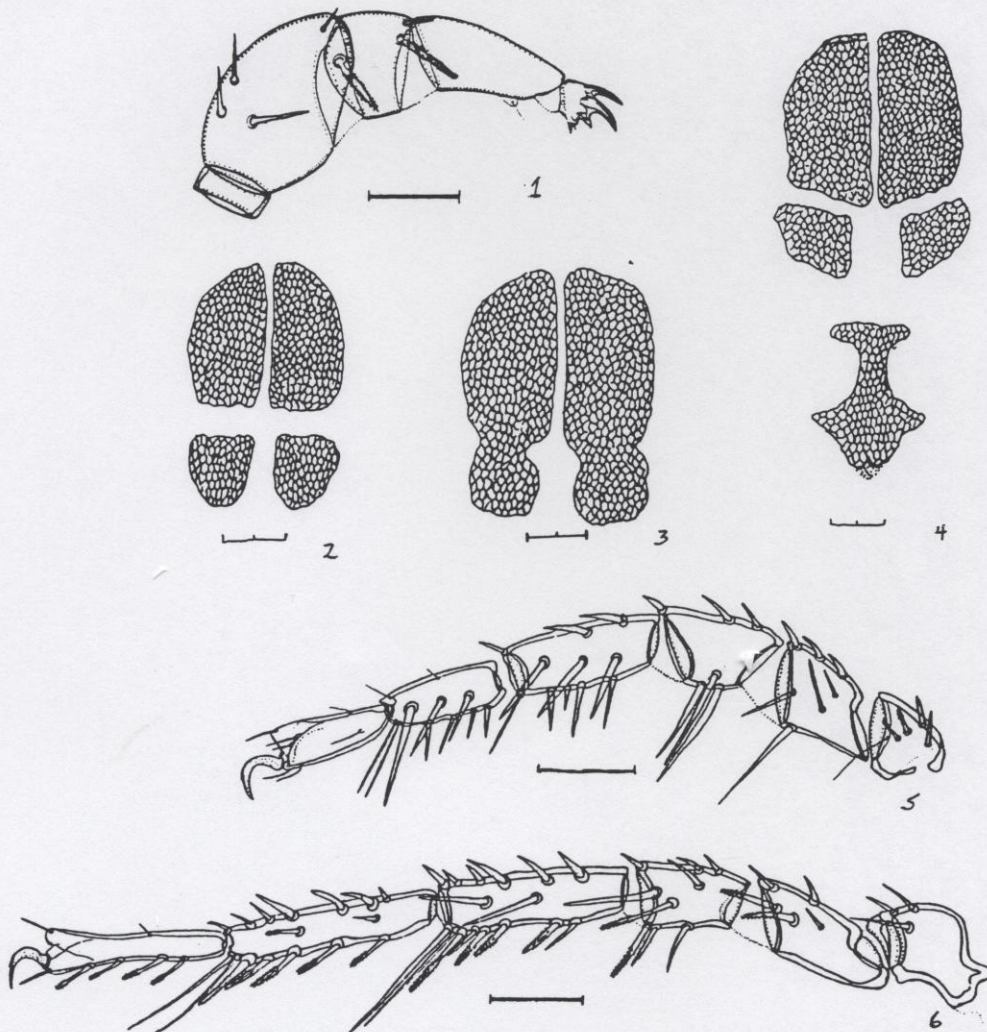
Female (9 specimens)-- Length of posterior coxal group 445 (240-270); dorsal lengths of pedipalp segments: Ti 171 (140-200); Ta 28 (20-35); dorsal lengths of leg segments: leg I: Ge 187 (150-230); Ti 145 (120-170); Ta 134 (120-155); leg IV: Ta 215 (190-265).

Notes-- This species is probably an *Artenkreis* of sibling species, which have restricted host preferences and/or ranges within the currently accepted, long list of hosts and vast geographic range of this species. The variety in dorsal plate morphology and numerous hosts indicate a high potential for adaptive radiation. Based upon preliminary observations, differences in electrophoretic migrations of proteins (allozymes) appear to evidence several species among presently recognized populations of this species (Ronald V. Dimock Jr., personal communication, 1994). Downes (1991) discussed behavior of a Florida population.

This species was reported from Iowa and Wisconsin (Marshall 1933b). Kelly (1899) also reported it from Iowa. Mitchell (1955 and 1965) studied the biology of this mite. It infests the labial palps of its mussel hosts, and it oviposits in the mantle tissue adjacent to the labial palps (Vidrine 1983). A single male usually occurs in each host, with one or two females. In winter and spring, nymphs are also common between the labial palps. Eggs are oviposited in the mantle tissue adjacent to the labial palps.



Figures 1-4. *Unionicola serrata* (Wolcott 1898). 1. Male venter. 2. Female venter. 3. Male genital field. 4. Female genital field. Scale equals 100 micrometers.



Figures 1-6. *Unionicola serrata* (Wolcott 1898). 1. Female pedipalp. 2. Female dorsal plates. 3. Female dorsal plates. 4. Male dorsal plates. 5. Male first walking leg. 6. Male fourth walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1985c). Scale equals 100 micrometers.





Map 62. Known distribution of *Unionicola serrata* (Wolcott 1898) in North America.



Hosts:

*Actinonaias ligamentina* (Lamarck): *Actinonaias carinata* (Barnes), Arkansas (Vidrine 1980a).  
*Actinonaias pectorosa* (Conrad): Tennessee (Vidrine and Wilson 1991).  
*Alasmidonta viridis* (Rafinesque): *Margaritana deltoides* Lea, Michigan (Wolcott 1899);  
*Pressodonta calceola* Lea in Viets and Plate 1954; *Alasmidonta calceola* (Lea) in Vidrine 1980a.  
*Amblema plicata plicata* (Say): *Unio undulatus* Barnes, Michigan (Wolcott 1899 and in Viets and Plate 1954); Louisiana and Arkansas (Vidrine 1978a and 1980a).  
*Cyclonaias tuberculata* (Rafinesque): Tennessee (Vidrine and Wilson 1991).  
*Cyprogenia aberti* (Conrad): Arkansas (Vidrine 1989a).  
*Disconaias fimbriata* (Frierson): Panuco River system, Mexico (Vidrine 1980a).  
*Disconaias purpuratus* (Say): Mexico.  
*Elliptio dilatata* Rafinesque: Arkansas (Vidrine 1980a).  
*Friersonia iridella* (Pilsbry and Frierson): Panuco River system, Mexico (Vidrine 1980a).  
*Friersonia moctezumensis* (Pilsbry): Mexico.  
*Friersonia semirasa* (Pilsbry): Panuco River system, Mexico (Vidrine 1980a).  
*Fusconaia askewi* (Marsh): *Fusconaia lananensis* (Frierson), Louisiana and Texas (Vidrine 1978a and 1980a).  
*Fusconaia cerina* (Conrad): *Fusconaia flava* (Rafinesque), Mississippi (Vidrine 1980a).  
*Fusconaia flava* (Rafinesque): *Unio coccineus* Hild., Michigan (Wolcott 1899 and in Viets and Plate 1954); *Fusconaia undata* (Barnes), Louisiana (Vidrine 1978a); Louisiana, Oklahoma, and Arkansas (Vidrine 1980a).  
*Lampsilis cardium* Rafinesque: *Unio occidens* Lea, New York (Wolcott 1899); *Lampsilis ovata cardium* Rafinesque in Viets and Plate 1954; Arkansas (Vidrine 1980a).  
*Lampsilis hydiana* (Lea): *Lampsilis radiata* (Barnes), Louisiana (Vidrine 1974a); Louisiana, Texas, and Oklahoma (Vidrine 1978a and 1980a).  
*Lampsilis ornata* (Conrad): *Lampsilis excavata* Lea, Mississippi (Vidrine 1980a).  
*Lampsilis rovirosai* (Pilsbry): Mexico.  
*Lampsilis satur* (Lea): *Lampsilis ovata*, Louisiana (Vidrine 1974a); Louisiana (Vidrine 1978a).  
*Lampsilis radiata radiata* (Gmelin): *Unio luteolus* Lamarck, Michigan (Wolcott, 1899); *Ligumia fasciata* Rafinesque in Viets and Plate 1954.  
*Lampsilis siliquoidea* (Barnes): Michigan (Mitchell 1955 and 1965); *Lampsilis radiata siliquoidea* in Vidrine 1980a.  
*Lampsilis straminea claibornensis* (Lea): Mississippi and Louisiana (Vidrine 1980a).  
*Lampsilis streckeri* Frierson: Arkansas (Vidrine 1980a).  
*Lampsilis teres* (Rafinesque): Texas, Louisiana, and Oklahoma (Vidrine 1980a).  
*Leptodea ochracea* (Say): *Lampsilis ochracea* (Say), North Carolina (Vidrine 1978a and 1980a).  
*Lampsilis ovata/cardium*: Stones and Duck Rivers, Tennessee (Vidrine and Wilson 1991).  
*Leptodea fragilis* (Rafinesque): Texas, Oklahoma, and Louisiana (Vidrine 1980a).  
*Ligumia recta* (Lamarck): Tennessee (Vidrine and Wilson 1991).  
*Ligumia subrostrata* (Say): Louisiana (Vidrine 1989a).  
*Obovaria jacksoniana* (Frierson): *Obovaria castenea* (Lea), Louisiana and Oklahoma (Vidrine 1980); Mississippi (Vidrine 1980a).

*Obovaria unicolor* (Lea): Mississippi (Vidrine 1980a).  
*Popenaias popei* (Lea): Texas (Vidrine 1978a and 1980a).  
*Popenaias* sp.: Mexico.  
*Potamilus alatus* (Say): *Unio alatus* Say, Michigan (Wolcott 1899); *Proptera alata* in Viets and Plate 1954.  
*Potamilus purpuratus* (Lamarck): *Proptera purpurata* (Lamarck), Louisiana, Texas, Oklahoma, and Arkansas (Vidrine 1978a and 1980a).  
*Ptychobranchnus occidentalis* (Conrad): *Ptychobranchnus fasciolare* (Rafinesque), Arkansas (Vidrine 1980a).  
*Pyganodon gibbosa* (Say): *Anodonta gibbosa* Say, Apalachicola (Dobson 1966).  
*Pyganodon grandis* (Say): *Anodonta grandis* Say, Arkansas (Vidrine 1980a).  
*Quadrula pustulosa mortoni* (Conrad): *Quadrula nodulata* (Rafinesque) and *Quadrula pustulosa* group variable, Louisiana (Vidrine 1974a and 1980a).  
*Quadrula pustulosa pustulosa* (Lea): Oklahoma (Vidrine 1980a).  
*Quadrula refulgens* (Lea): Mississippi (Vidrine 1980a).  
*Strophitus subvexus* (Conrad): Louisiana.  
*Toxolasma parvus* (Barnes): *Carunculina parva* (Barnes), Louisiana and Oklahoma (Vidrine 1978a and 1980a).  
*Tritogonia verrucosa* (Rafinesque): Louisiana, Mississippi, and Oklahoma (Vidrine 1978a and 1980a).  
*Truncilla truncata* Rafinesque: Texas (Vidrine 1980a).  
*Uniomerus tetralasmus* (Say): Louisiana.  
*Utterbackia peggyae* (Johnson): *Anodonta peggyae* Johnson, Apalachicola (Dobson 1966).  
*Villosa arkansasensis* (Lea): *Obovaria castenea* (Lea), Arkansas (Vidrine 1980a).  
*Villosa iris* (Lea): Arkansas (Vidrine 1980a).  
*Villosa lienosa* (Conrad): Apalachicola (Dobson 1966); Louisiana, Mississippi, Oklahoma and Florida (Vidrine 1978a and 1980a).  
*Villosa vibex* (Conrad): Apalachicola (Dobson 1966); Louisiana and Florida (Vidrine 1980a).  
*Villosa villosa* (Wright): Alabama (Vidrine 1980a).

Subgenus *Parasitatax* Viets 1949

TYPE SPECIES--*U. ypsilophora* (Bonz 1783)

ETYMOLOGY-- Named to reflect its parasitic behavior.

DIAGNOSIS--Body dark in color; genital acetabula many pairs; female genital field with a single pair of acetabular plates with a medial, anterior flap on each; male genital field with a single pair of acetabular plates; pedipalps large, but not elongate; pedipalpal tarsus with 2-3 clawlets; male pedipalp thicker at base than female pedipalp; male and female first walking legs with similar chaetotaxy; male and female legs densely setose and bearing large, deeply bifid tarsal claws with dorsal prong longer than ventral prong; tarsi of walking legs straight; coxal plates, especially fourth, elongated posteriorly.

HABITAT--Parasites of Unionidae.

DISTRIBUTION--Europe, Asia and North America.

DISCUSSION-- This subgenus has been studied rather extensively compared to the other subgenera (Dimock 1985 and 1988, Hevers 1978c, 1979, and 1980, Joy and Hively 1990 and Vidrine 1992b). Claw shape of this subgenus is similar to that of mites in the subgenus *Anodontinatax* Vidrine. Larvae of this group are described by Hevers (1980) and Prasad and Cook (1972). Illustrations of representative species can be found in Hevers (1978c), Imamura (1953b), Mitchell (1957b), Vidrine (1986c), and Viets (1957).

ADDITIONAL SPECIES INCLUDED-- *U. dimocki* Vidrine 1986c, *U. foili* Edwards and Vidrine 1994, *U. formosa* (Dana and Whelpley 1836), *U. thienemanni* Viets 1957, and *U. uchidai* Imamura 1953b.

*Unionicola (Parasitatax) dimocki* Vidrine 1986c  
Plates 179-181 in Vidrine (1996a)

Synonymy--

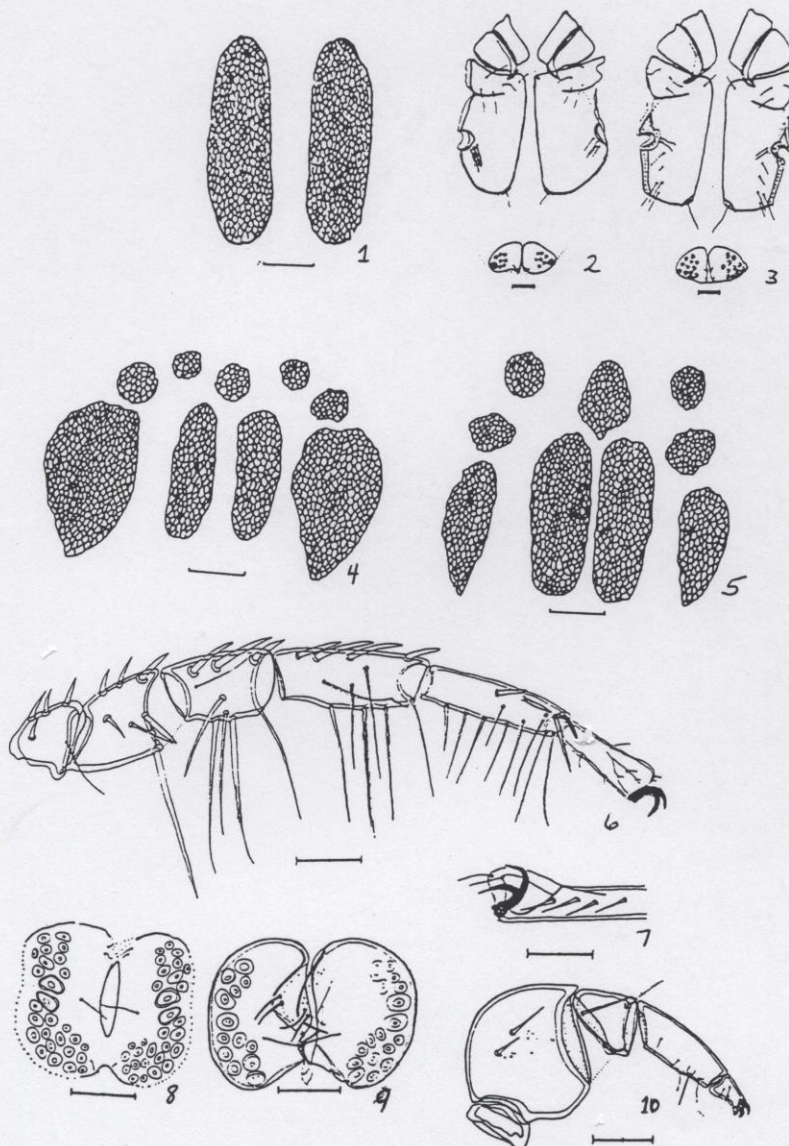
*Unionicola (Parasitatax) dimocki* Vidrine 1986c in Vidrine 1986e and 1992b

Museum type number(s) and location-- CNC 19113, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (female) found in *Lasmigona costata* (Rafinesque) from Rideau River near Billings Bridge, Ottawa, Ontario, Canada, collected on 5 July 1933 by A. LaRocque.

Etymology-- Named to honor Ronald V. Dimock Jr.

Diagnosis-- Character states of the subgenus; male dorsum with an elongate plate that is fused by secondary sclerotization to the body surfaces along the edge of the plate; female dorsum with 2-9, large plates that are not widely separated, and the 2, more central plates are somewhat elongate; female posterior coxal group elongate and extending well posterior of the junction with the fourth walking leg; male posterior coxal group either with or without distinct posterior borders and extensively fused with abdomen and genital field; pedipalp and leg morphology similar to *U. ypsilophora* and *U. formosa*; genital fields posterior.



Figures 1-10. *Unionicola dimocki* Vidrine 1986. 1. Female dorsal plates. 2. Female venter. 3. Male venter. 4-5. Female dorsal plates. 6. First walking leg. 7. Distal end of tarsus of fourth walking leg. 8. Male genital field. 9. Female genital field. 10. Male pedipalp. (Reprinted with permission from the International Journal of Acarology: Vidrine 1986c). Scale equals 100 micrometers.





Map 63. Known distribution of *Unionicola dimocki* Vidrine 1986 in North America.

Male (13 specimens)-- Length including capitulum 1220 (1000-1800); length of posterior coxal group 648 (540-700); dorsal lengths of pedipalp segments: Ti 215 (190-240); Ta 93 (70-110); dorsal lengths of leg segments: leg I: TFe 222 (190-250); Ge 292 (260-330); Ti 282 (240-320); Ta 187 (170-220); leg IV: TFe 288 (270-320); Ge 505 (440-580); Ti 713 (580-800); Ta 590 (470-640).

Female (17 specimens)-- Length including capitulum 1300 (1100-1700); length of posterior coxal group 657 (590-740); central dorsal plate 388 (350-450) long, 119 (100-150) wide; dorsal lengths of pedipalp segments: Ti 201 (160-270); Ta 88 (70-110); dorsal lengths of leg segments: leg I: TFe 222 (190-270); Ge 296 (250-350); Ti 283 (240-330); Ta 189 (160-240); leg IV: TFe 310 (260-350); Ge 545 (470-640); Ti 762 (670-870); Ta 635 (580-710).

Notes-- *Unionicola dimocki* is generally a parasite of members of the mussel subfamily Anodontinae. It commonly occurs in several genera of mussels. It is generally absent, however, in the genera *Anodonta*, *Pyganodon*, and *Utterbackia* in North America. There may indeed be two distinctive species within the currently accepted definition of this species. Specimens from *Lasmigona costata* are typical, while specimens from *Strophitus subvexus* from western Louisiana are somewhat distinctive in morphology and behavior. The question remains unresolved.

#### Hosts:

*Alasmidonta marginata* Say: *Margaritana marginata* Say, Michigan (Wolcott, 1899); *Decurambis marginata* Say in Viets and Plate 1954.

*Alasmidonta viridis* (Rafinesque): *Unio viridis* Rafinesque, Pennsylvania (Haldeman, 1842); *Platynaias viridis* Rafinesque in Viets and Plate 1954.

*Anodontoides ferussacianus* (Lea): *Anodonta subcylindracea* Lea, Michigan (Wolcott, 1899 and in Viets and Plate 1954); Ohio (Vidrine, 1980a); Canada (Vidrine 1986c).

*Arcidens confragosus* (Say): Kentucky (Vidrine, 1980a).

*Arkansia wheeleri* Ortmann and Walker: Oklahoma (Vidrine, 1980a).

*Lasmigona complanata* (Barnes): *Margaritana complanata* Barnes, Michigan and Nebraska (Wolcott, 1899); *Pterosyna complanata* Barnes in Viets and Plate 1954.

*Lasmigona compressa* (Lea): Canada (Vidrine 1986c).

*Lasmigona costata* (Rafinesque): *Margaritana rugosa* Barnes, Michigan and Iowa (Wolcott, 1899 and in Viets and Plate, 1954); *Alasmidonta rugosa*, Iowa and Pennsylvania (Kelly, 1899); Arkansas and Tennessee (Vidrine 1980a); Canada (Vidrine 1986c); Tennessee (Vidrine and Wilson 1991).

*Lasmigona* sp. (possibly *subviridis* Ortmann and Walker): *Unio pressus* Adams and Adams, Michigan (Wolcott, 1899).

*Strophitus subvexus* (Conrad): Louisiana (Vidrine, 1980a).

*Strophitus undulatus* (Say): *Alasmodon rugosus*, Pennsylvania (Haldeman, 1842); *Anodonta edentula* Say, Michigan and New York (Wolcott, 1899); *Strophitus undulatus* and *Strophitus rugosus* Lea in Viets and Plate 1954; Oklahoma, Arkansas, Ohio, Pennsylvania, and Missouri (Vidrine, 1980a); Canada (Vidrine 1986c).

*Villosa iris* (Lea): Arkansas (Vidrine 1989a).

*Unionicola (Parasitatax) foili* Edwards and Vidrine 1994  
Plates 182-183 in Vidrine (1996a)

Synonymy--

*Unionicola (Parasitatax) formosa* (Dana and Whelpley) (in part) Vidrine 1992b, Del Portillo and Dimock 1982, Dimock 1981, 1983, 1985, and 1988, LaRochelle and Dimock 1981, Dimock and Davids 1985, Edwards and Dimock 1988 and 1991, Edwards 1993, LaRochelle 1979, Roberts 1977, Roberts and Dimock 1977 and 1978, and Roberts *et al.* 1978

*Unionicola (Parasitatax) foili* Edwards and Vidrine 1994

Museum type number(s) and location-- The Field Museum of Natural History, Chicago.

Type locality and host-- From *Utterbackia imbecillis* from Fisher's Pond, Mt. Pleasant, Cabarrus Co., North Carolina.

Etymology-- Named to honor Mr. John Foil.

Diagnosis-- Character states of the subgenus; male dorsum with an elongate plate; female dorsum with 2, small, widely separated plates, sometimes divided into 3 or 4 smaller plates with varied degrees of fusion between them; female posterior coxal group usually not elongated nor extending much posterior of the junction with the fourth walking leg; male posterior coxal group with poorly sclerotized and indistinct posterior borders and with extensive secondary sclerotization fusing coxal plates to one another along midline and to the genital field.

Male (topotype) -- Length including capitulum 1200; dorsal lengths of pedipalp segments: Ge 100; Ti 185; Ta 80; dorsal lengths of leg segments: leg I: Ge 255; Ti 255; Ta 160; leg IV: Ge 410; Ti 630; Ta 525.

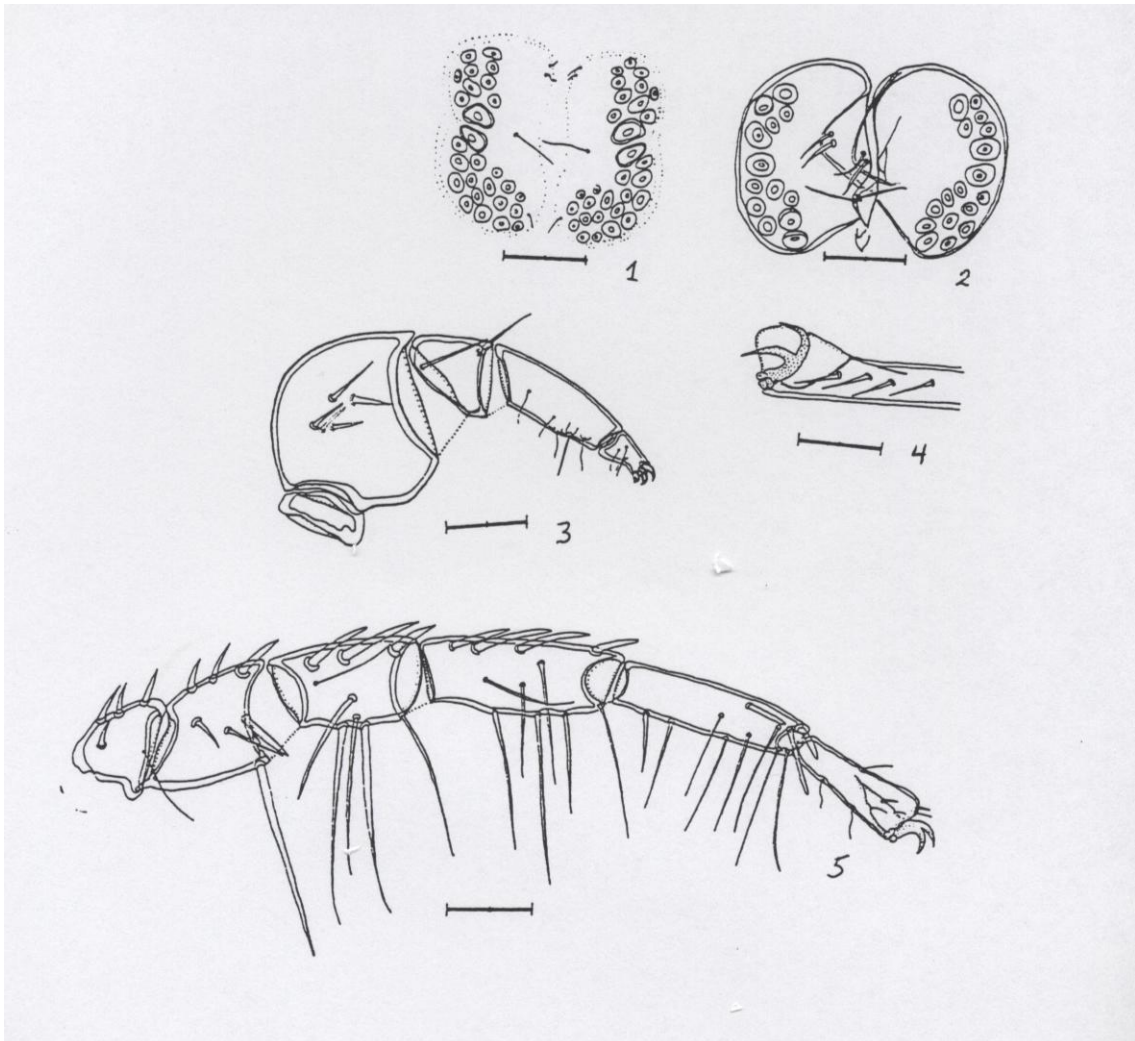
Female (topotype) -- Length including capitulum 1200; dorsal lengths of pedipalp segments: Ge 80; Ti 125; Ta 55; dorsal lengths of leg segments: leg I: Ge 200; Ti 190; Ta 135; leg IV: Ge 410; Ti 540; Ta 440.

Notes-- Edwards (1993) originally contended that this species was morphologically different from *U. formosa sensu stricto*. Consistent morphological differences are not obvious, but behavioral and allozyme differences are obvious. The most striking difference in the field is the apparent host-specificity. The Louisiana population of *Utterbackia imbecillis* reported as hosting this mite in Edwards and Vidrine (1994) had been recently examined and determined to be more closely related to *U. peggyae* (Randy Hoeh, personal communication, 1994). This mite is a parasite of mussels belonging to the genus *Utterbackia*.

Hosts:

*Utterbackia imbecillis* (Say): *Anodonta imbecillus* Say, Illinois (Wolcott, 1899); *Lastena ohioensis*

Rafinesque in Viets and Plate 1954; *Anodonta imbecillus*, Apalachicola (Dobson, 1966), Texas (Calnan 1976), Iowa (Kelly, 1899), Louisiana (Vidrine 1973, 1974a, 1977b), North Carolina (Del Portillo and Dimock 1982, Dimock 1981, 1983, 1985, and 1988, LaRochelle and Dimock 1981, Dimock and Davids 1985, Edwards and Dimock 1988 and 1991, Edwards 1993, LaRochelle 1979, Roberts 1977, Roberts and Dimock 1977 and 1978, and Roberts *et al.* 1978), Louisiana, Arkansas, North Carolina, Pennsylvania, Texas, Mississippi, South Carolina, Alabama, and Florida (Vidrine, 1980a); Tennessee (Edwards and Vidrine, 1994).  
*Utterbackia peggyae* (Johnson): Florida and ?Louisiana.



Figures 1-5. *Unionicola foili* Edwards and Vidrine 1994. 1. Male genital field. 2. Female genital field. 3. Male pedipalp. 4. Distal end of tarsus of fourth walking leg. 5. First walking leg. Scale equals 100 micrometers.





Map 64. Known distribution of *Unionicola foili* Edwards and Vidrine 1994 in North America.

*Unionicola (Parasitatax) formosa* (Dana and Whelpley 1836)  
Plates 184-187 in Vidrine (1996a)

Synonymy--

*Hydrachna formosa* Dana and Whelpley 1836

*Atax ypsilophorus* in Leidy (1883), Girod (1893), Koenike (1895), and Wolcott (1899).

*Atax adensameri* Thon 1901

*Unionicola ypsilophora* (Bonz 1783) in Wolcott (1905 and 1918), Welsh (1930, 1931, and 1932), Waterford (1937), Mitchell and Pitchford (1953), Mitchell (1955), Conroy (1968), and Goldenstein and Boles (1970).

*Unionicola ypsilophora haldemani* (Piersig 1900), in Marshall (1926, 1927, and 1929), and Mitchell (1954).

*Unionicola (Unionicola) ypsilophora* in Viets (1936)

*Unionicola ypsilophora formosa* in Mitchell (1954)

*Unionicola (Parasitatax) ypsilophora* in Viets and Plate (1954)

*Unionicola (Parasitatax) formosa* (Dana and Whelpley, 1836) in Mitchell 1957b and 1965, Crowell 1961, Murray 1965, Dobson 1966, Habeeb 1967, Del Portillo and Dimock 1982, Dimock 1981, 1983, 1985, and 1988, LaRochelle and Dimock 1981, Dimock and Davids 1985, Edwards and Dimock 1988 and 1991, Edwards 1993, LaRochelle 1979, Roberts 1977, Roberts and Dimock 1977 and 1978, and Roberts *et al.* 1978, Vidrine 1973, 1974a, 1977b, 1980a, 1986c, 1986e, and 1992b, Calnan 1976, and Vidrine and Bereza 1978b.

Museum type number(s) and location-- unknown.

Type locality and host-- *Anodonta fluviatilis* Dillw. (= *Pyganodon cataracta* (Say)), Connecticut.

Etymology-- *Formos* means "graceful and beautiful".

Diagnosis-- Character states of the subgenus; male dorsum with an elongate plate; female dorsum with 2, small, widely separated plates, sometimes divided into 3 or 4 smaller plates with varied degrees of fusion between them; female posterior coxal group usually not elongated nor extending much posterior of the junction with the fourth walking leg; male posterior coxal group with poorly sclerotized and indistinct posterior borders and with extensive secondary sclerotization fusing coxal plates to one another along midline and to the genital field.

Male -- Length including capitulum 1300; dorsal lengths of pedipalp segments: Ge 110; Ti 210; Ta 70; dorsal lengths of leg segments: leg I: Ge 295; Ti 275; Ta 190; leg IV: Ge 460; Ti 590; Ta 500.

Female -- Length including capitulum 1650; dorsal lengths of pedipalp segments: Ge 100; Ti 160; Ta 75; dorsal lengths of leg segments: leg I: Ge 250; Ti 230; Ta 165; leg IV: Ge 470; Ti 580; Ta 470.

Notes-- *Unionicola formosa* is generally a parasite of members of the mussel genera *Pyganodon* and *Anodonta* in North America. Specimens measured are from *Pyganodon cataracta* from Fisher's Pond, the type locality of *U. foili*. Edwards and Dimock (1988) began a re-evaluation of the mite species and populations in this group and suggest a larger number of species are involved. Hoeh (1990) has re-evaluated the host genera. This mite has been reported from Sacramento, California (Marshall, 1943), western Canada (Conroy, 1968), and Wisconsin (Marshall, 1933b). This mite is part of an American-Eurasian complex (*U. ypsilophora-formosa-foili* complex), and the complex requires more detailed study. These mites are not only commonly encountered, but they are among the most intensely studied mites of the genus. Ron Dimock and colleagues have conducted numerous studies on varied members of this complex, and in the process, behavior and physiology of these mites is far better understood for the group.

#### Hosts:

*Alasmidonta undulata* (Say): *Alasmidonta triangulata* (Lea), North Carolina (Vidrine 1980a).

*Anodonta couperiana* (Lea): Florida (Vidrine, 1980a).

*Anodonta implicata* Say: North Carolina, Pennsylvania, and Delaware (Vidrine 1980a).

*Anodonta suborbiculata* Say: Illinois (Wolcott, 1899); *Lastena (Utterbackiana) suborbiculata* Say in Viets and Plate 1954; Iowa (Kelly, 1899); *Lastena suborbiculata* Say, Missouri (Utterback, 1916); Louisiana and Texas (Vidrine 1974a, 1977b, and 1980a).

*Anodonta* sp.: Kankakee River, Ohio (Wilson and Clark, 1912) and Ontario, Canada (Marshall, 1929).

*Anodonta* sp: Lake Monroe, Florida.

*Anodontoides radiatus* (Conrad): *Strophitus radiatus* (Conrad), Louisiana (Vidrine 1989a).

*Lampsilis australis* Simpson: Apalachicola (Alabama)(Dobson, 1966).

*Lampsilis cariosa* (Say): *Unio cariosus* Say, Pennsylvania (Haldeman 1842 and Say 1821);

*Lampsilis ovata cariosa* Say in Viets and Plate 1954 (identification of mussels and mites uncertain).

*Lampsilis radiata radiata* (Gmelin): *Unio radiatus* Gmelin, Pennsylvania (Haldeman, 1842);

*Ligumia fasciata* Rafinesque and *L. radiata* in Viets and Plate 1954 (identification of mussels and mites uncertain).

*Lampsilis straminea claibornensis* (Lea): Apalachicola (Dobson, 1966).

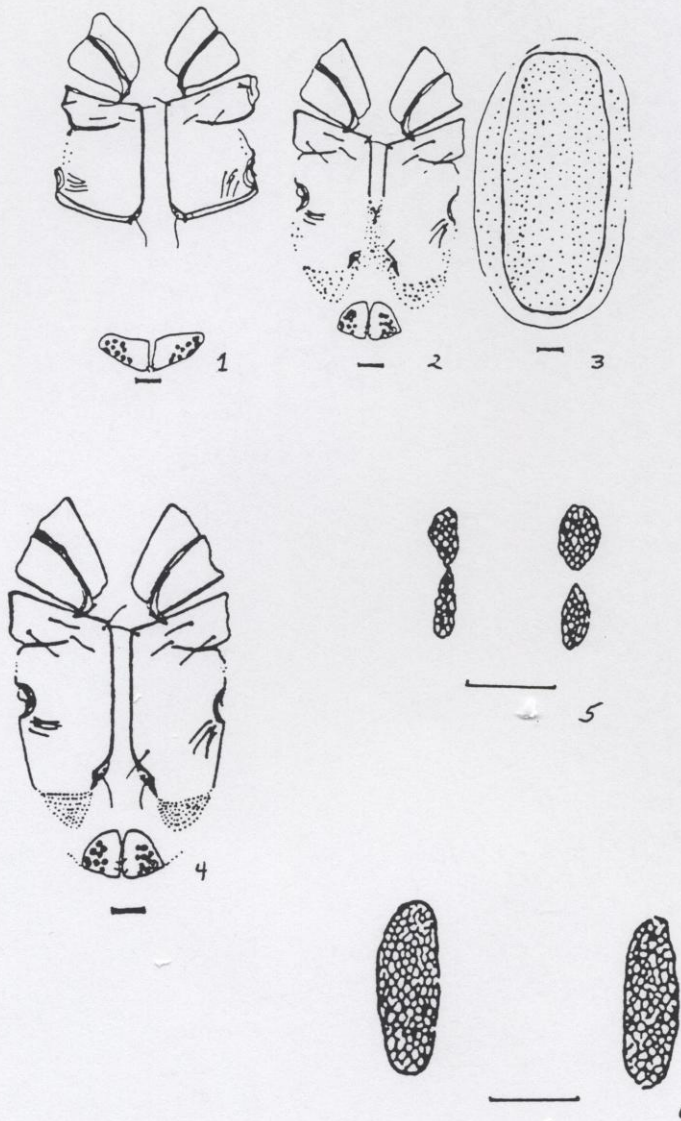
*Lampsilis teres* (Rafinesque): Louisiana (Vidrine, 1980a).

*Ligumia nasuta* (Say): Rhode Island (Vidrine, 1980a).

*Ligumia subrostrata* (Say): *Unio subrostratus* Say, Nebraska (Wolcott, 1899, and in Viets and Plate, 1954); Tennessee (Najarian, 1955).

*Potamilus purpuratus* (Lamarck): *Unio purpuratus* Lamarck, Connecticut (Dana and Whelpley, 1836); *Proptera purpurata* (Lamarck) (Wolcott (1899) considered this mussel to have been misidentified).

*Ptychobranhus subtentum* (Say): *Unio subtentus* Say, Pennsylvania? (Haldeman, 1842, and in Viets and Plate, 1954).



Figures 1-6. *Unionicola formosa* (Dana and Whelpley 1836). 1. Female venter. 2. Male venter. 3. Male dorsum with dorsal plate. 4. Male venter. 5-6. Female dorsal plates. (Reprinted with permission from the International Journal of Acarology: Vidrine 1986c). Scale equals 100 micrometers.





Map 65. Known distribution of *Unionicola formosa* (Dana and Whelpley 1836) in North America.

*Pyganodon cataracta* (Say): *Anodonta fluviatilis* Dillw., Connecticut (Dana and Whelpley 1836), Pennsylvania (Haldeman 1842), New Jersey (Leidy 1883), Ottawa, Canada (Koenike 1895 and Leidy 1883); *Pyganodon cataractus* and *Anodonta marginata* Say in Viets and Plate 1954; New Brunswick, Canada (Paterson and MacLoed 1979, and Gordon, Swan, and Paterson 1979); New Jersey, Delaware, and Pennsylvania (Vidrine 1980a); New York (Baker 1982), North Carolina (Del Portillo and Dimock 1982, Dimock 1981, 1983, 1985, and 1988, LaRoche and Dimock 1981, Dimock and Davids 1985, Edwards and Dimock 1988 and 1991, Edwards 1993, LaRoche 1979, Roberts 1977, Roberts and Dimock 1977 and 1978, and Roberts *et al.* 1978).  
*Pyganodon fragilis* (Lamarck): *Anodonta fragilis* Lamarck, Michigan (Wolcott, 1899) (also in Viets and Plate 1954).

*Pyganodon gibbosa* (Say): Apalachicola (Dobson, 1966).

*Pyganodon grandis* (Say): *Anodonta ovata*? Lea, *Anodonta footiana* Lea, *Anodonta plana* Lea, and *Anodonta decora* Lea, Michigan, New York, and Nebraska (Wolcott, 1899); *Pyganodon grandis footiana* Lea, *Pyganodon grandis lugubris* Say, and *Pyganodon grandis* Say in Viets and Plate 1954; *Anodonta grandis* Say, Kansas (Murray, 1965, and Goldenstein and Boles, 1970), Iowa (Marshall, 1926); *Anodonta corpulenta* Cooper, Iowa (Kelly, 1899) and Illinois (Wolcott, 1899); *Anodonta grandis*, Tennessee (Najarian, 1955), Maumee River, Ohio (Clark and Wilson, 1912), Louisiana (Vidrine 1974a, and 1977b), Texas (Calnan, 1976), Louisiana, Texas, Wisconsin, Iowa, Ohio, Missouri, Minnesota, and Illinois (Vidrine, 1980a); *Anodonta hallenbecki* Lea, Alabama (mussel species uncertain, in Vidrine (1980a).

*Quadrula cylindrica* Say: *Unio cylindricus* Say, Pennsylvania? (Haldeman, 1842 and in Viets and Plate, 1954); *Orthonymus cylindrica* in Vidrine (1980a).

*Strophitus undulatus* (Say): Louisiana (Vidrine 1989a).

*Toxolasma paulus* (Lea): *Carunculina paula* Lea, Apalachicola (Dobson, 1966); *Carunculina parva* (Barnes) in Vidrine (1980a).

*Tritogonia verrucosa* (Rafinesque): *Unio verrucosus* Rafinesque, Pennsylvania? (Haldeman, 1842, and in Viets and Plate, 1954).

*Uniomerus tetralasmus* (Say): Louisiana (Vidrine, 1974a).

*Unionicola (Parasitatax) ypsilophora* (Bonz 1783)  
Plates 188-190 in Vidrine (1996a)

Synonymy--

*Unionicola (Parasitatax) ypsilophora* (Bonz 1783), Vidrine 1986c, 1992b

*Unionicola formosa-ypsilophora* complex, Baker 1982

Museum type number(s) and location-- unknown.

Type locality and host-- Europe.

Etymology-- *Ypsil* means "Y-shaped," and *ophora* means "to bear," thus *ypsilophora* reflects the obvious Y-shaped, white, excretory "bladder" borne on the black dorsum of these mites.

Diagnosis-- Character states of the subgenus; male dorsum with an elongate plate; female dorsum with 2, small, widely separated plates; male posterior coxal group with well sclerotized and distinct posterior borders and with only moderate secondary sclerotization fusing coxal plates to one another and to the genital field.

Male (5 specimens)-- Length including capitulum 1150 (1000-1250); length of posterior coxal group 500 (480-540); dorsal lengths of pedipalp segments: Ti 185 (170-200); Ta 65 (60-70); dorsal lengths of leg segments: leg I: TFe 188 (170-200); Ge 255 (230-290); Ti 240 (210-270); Ta 178 (160-200); leg IV: TFe 263 (230-300); Ge 418 (360-480); Ti 553 (500-640); Ta 448 (410-500).

Notes-- Specimens were measured from: *Anodonta cataracta* Say from Sydney River southwest of junction of Highways 4 and 5, Cape Breton county, Nova Scotia, Canada, collected 4 May 1962 by A. M. Rick; *A. cataracta* from Lake George at southwest end, New Brunswick, Canada, collected on 30 June 1962 by A. M. Rick; *A. implicata* Say from 100 acre pond, Rhode Island, collected on 10 September 1978; *Obovaria olivaria* (Rafinesque) from Mississippi River ca. 8 km southeast of Guttenberg, Clayton County, Iowa, collected 1977 by S. L. H. Fuller; and *Anodonta grandis* Say (= *Pyganodon grandis* (Say)) from Mississippi River at Lansing, Allamakee County, Iowa, collected 1977 by S. L. H. Fuller. I have a fairly long series of these specimens from *Pyganodon cataracta* from Swartzwood Lake, New Jersey. This is typically a Eurasian species, which may be easily confused morphologically with *U. formosa* and *U. foili*. The distinctive posterior border of the fourth coxal plate of the male permits separation of this species from *U. formosa* and *U. foili*; however, there is variation in the extent of sclerotization of these posterior borders. The females are not distinguishable.

Hosts:

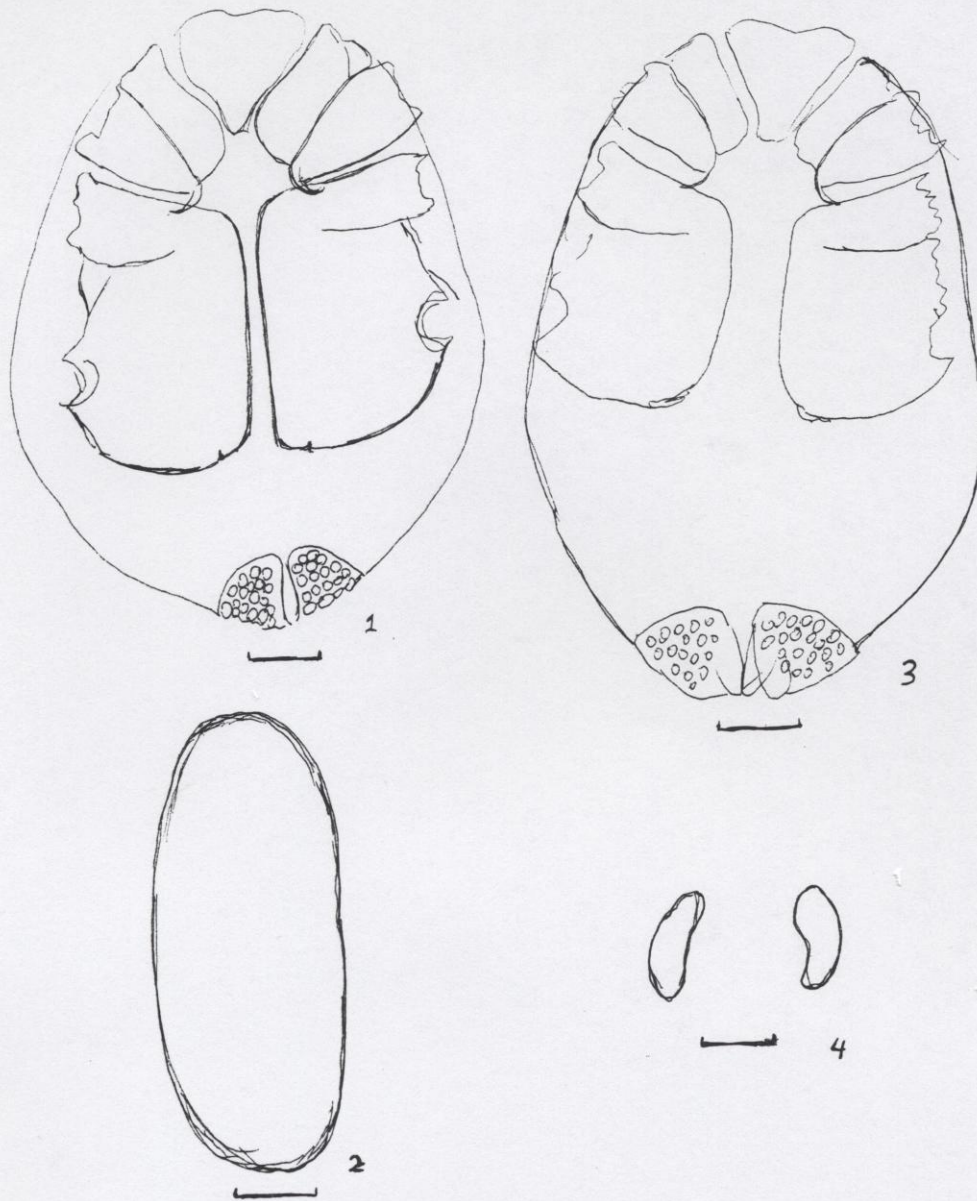
*Anodonta implicata* Say: Rhode Island (Vidrine 1986c)

*Obovaria olivaria* (Rafinesque): Iowa (Vidrine 1980a and 1986c).

*Pyganodon cataracta* (Say): New York (Baker 1982); New Jersey and Canada (Vidrine 1986c).

*Pyganodon fragilis* (Lamarck): Nova Scotia, Canada.

*Pyganodon grandis* (Say): *Anodonta grandis*, Iowa (Vidrine 1986c).



Figures 1-4. *Unionicola ypsilophora* (Bonz 1783). 1. Male venter. 2. Male dorsal plate. 3. Female venter. 4. Female dorsal plates. (Reticulations not drawn on coxal and dorsal plates). Scales equal 100 micrometers.





Map 66. Known distribution of *Unionicola ypsilophora* (Bonz 1783) in North America.

Subgenus *Wolcottatax* 1992b

TYPE SPECIES--*U. arcuata* (Wolcott 1898)

ETYMOLOGY-- Named to honor Robert Wolcott.

DIAGNOSIS--Body dark in color; genital acetabula many pairs; female genital field with a single pair of genital (acetabular) plates similar to *Parasitatax*; male genital field with a single pair of genital plates; coxal plates, especially the third and fourth, rectangular; pedipalps more slender than *Parasitatax* with tarsus moderately elongate; male and female pedipalps similar in size and shape; pedipalpal tarsus with 2 small but obvious clawlets; male and female first walking legs apparently similar and densely setose, with tarsi arcuate in posterior legs and all tarsal claws moderately bifid; third and fourth coxal plates together forming an almost perfect square in outline.

HABITAT--Parasites of Unionidae.

DISTRIBUTION-- Asia and North America.

DISCUSSION--This relatively common subgenus has never been studied in detail. Illustrations of representative species can be found in Imamura (1953b) and Vidrine (1986c).

ADDITIONAL SPECIES INCLUDED-- *U. arcuatoides* Vidrine 1986c.

*Unionicola (Wolcottatax) arcuata* (Wolcott 1898)

Plates 191-193 in Vidrine (1996a)

Synonymy--

*Atax arcuata* Wolcott 1898, Wolcott 1899

*Atax arcuatus* Wolcott 1898 in Piersig 1901

*Unionicola arcuata* (Wolcott 1898) in Marshall 1927 and 1933b, Mitchell 1954, Crowell 1961, and Habeeb 1967

*Unionicola (Parasitatax) arcuata* (Wolcott 1898) in Viets and Plate 1954, Vidrine 1980a, 1986c, and 1986e

*Unionicola (Wolcottatax) arcuata* (Wolcott 1898) in Vidrine 1992b

Museum type number(s) and location-- Marshall Collection, Field Museum of Natural History, Chicago, Illinois.

Type locality and host-- ? *Pyganodon grandis* in Michigan.

Etymology-- Named for its arcuate tarsi on posterior walking legs.

Diagnosis-- Character states of the subgenus; dorsum apparently lacking a dorsal plate; coxal plates abbreviate and with distinct borders; pedipalp Ta with 2, distinct clawlets; genital fields with numerous acetabula; all legs with small, bifid tarsal claws with the dorsal prong shorter than the ventral prong; fourth walking leg with Ta distinctly arcuate.

Male (22 specimens)-- Length including capitulum 1200 (1000-1400); length of posterior coxal group 333 (270-400); dorsal lengths of pedipalp segments: Ti 144 (120-180); Ta 75 (60-90); dorsal lengths of leg segments: leg I: TFe 177 (140-220); Ge 229 (160-300); Ti 214 (160-280); Ta 137 (110-170); leg IV: TFe 321 (240-430); Ge 424 (310-580); Ti 578 (440-780); Ta 379 (320-470).

Female (19 specimens)-- Length including capitulum 1600 (1300-1900); length of posterior coxal group 320 (260-400); dorsal lengths of pedipalp segments: Ti 143 (120-170); Ta 73 (65-90); dorsal lengths of leg segments: leg I: TFe 180 (150-240); Ge 235 (180-310); Ti 226 (170-290); Ta 138 (110-170); leg IV: TFe 326 (260-420); Ge 429 (320-570); Ti 574 (450-780); Ta 391 (320-480).

Notes-- *Unionicola arcuata* is generally a parasite of members of the mussel subfamily Anodontinae. The specimens vary greatly in size, but relative leg segment ratios are consistent enough to prevent ready separation into subgroups based solely upon size. Apparently *U. arcuata* in North America forms a *Rassenkreis*, since varied size morphs are found in specific taxa of hosts. It is probable that a thorough study of this taxon would unveil several species at minimum.

Adults, sometimes as many as 100 mites per host, oviposit in the demibranch blades (gills) of freshwater mussels (Vidrine 1980a). This species is commonly found in lotic waters, and this species apparently does not co-occur with *Parasitatax*; however, it does commonly co-occur with members of the subgenus *Dimockatax*.

Hosts:

*Alasmidonta heterodon* (Lea): *Prolasmidonta heterodon* (Lea), Ashuelot River, New Hampshire (Vidrine, 1980a); Massachusetts.

*Alasmidonta marginata* Say: *Margaritana marginata* Say, Michigan and Pennsylvania (Wolcott, 1899); *Decurambis marginata* Say in Viets and Plate 1954; Michigan (Kelly, 1899); and Arkansas (Vidrine, 1980a).

*Alasmidonta undulata* (Say): Rhode Island (Vidrine, 1980a); Canada (Vidrine 1986c).

*Alasmidonta viridis* (Rafinesque): *Margaritana deltoides* Lea, Michigan ? (Wolcott, 1899); *Pressodonta calceola* Lea in Viets and Plate 1954; *Alasmidonta calceola* (Lea), Douglass Lake, Wisconsin (Marshall 1927 and 1933b); Michigan (Vidrine, 1980a); Canada (Vidrine 1986c).

*Alasmidonta varicosa* (Lamarck): Canada (Vidrine 1986c).

*Anodontoides ferussacianus* (Lea): *Anodonta subcylindracea* Lea, Michigan (Wolcott, 1899) (and in Viets and Plate 1954); Douglas Lake, Wisconsin (Marshall, 1927); Canada (Vidrine 1986c).

*Anodontoides radiatus* (Conrad): Alabama (Vidrine 1980a); *Strophitus subvexus* (= *S. radiatus*), Louisiana and Mississippi, (Vidrine, 1980a).

*Lampsilis radiata* (Gmelin): *Unio luteolus* Lamarck, Michigan (Wolcott, 1899) (= *Ligumia fasciata* Rafinesque in Viets and Plate 1954); Vidrine 1980a.

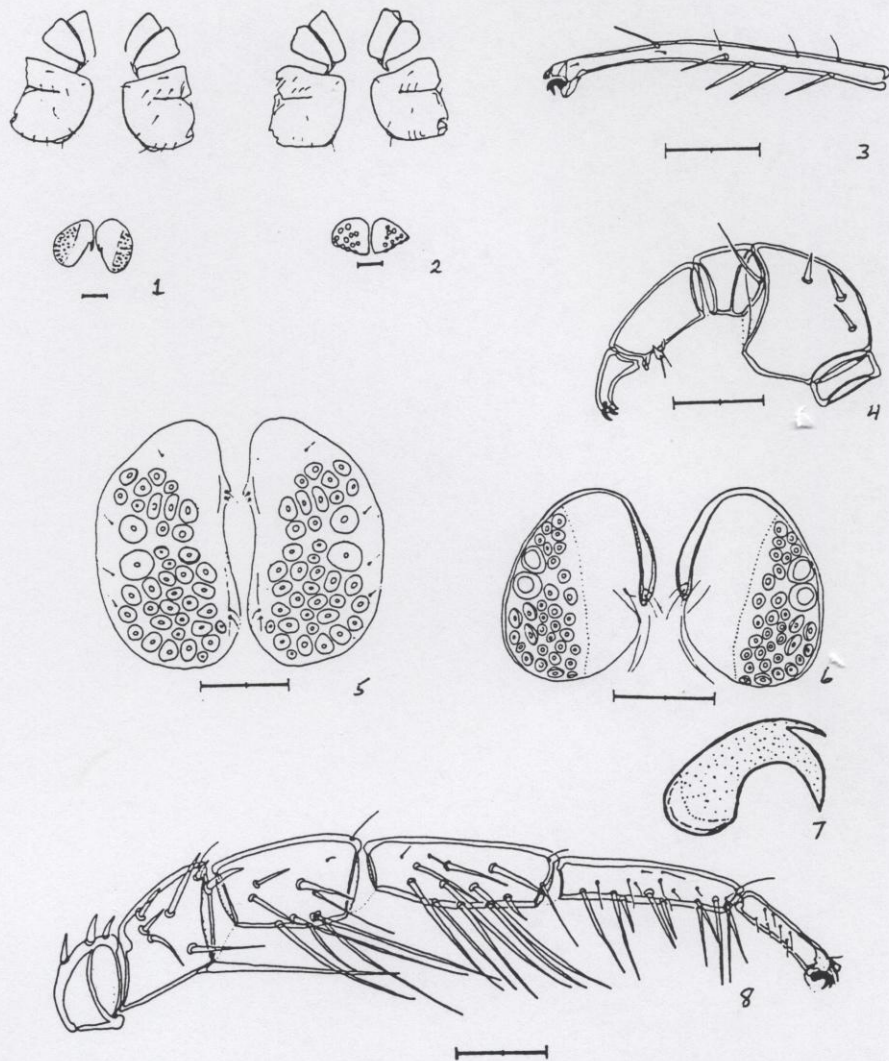
*Lasmigona compressa* (Lea): Canada (Vidrine 1986c).

*Lasmigona costata* (Rafinesque): *Margaritana rugosa* Barnes, Michigan (Wolcott, 1899) (and in Viets and Plate 1954); Vidrine 1980a.

*Pyganodon fragilis* (Lamarck): *Anodonta fragilis*, Michigan (Wolcott, 1899) *Anodonta marginata* Say in Viets and Plate 1954; *Anodonta cataracta* (Say) Vidrine, 1980a.

*Pyganodon grandis* (Say): *Anodonta footiana* Lea, Michigan (Wolcott, 1899) (= *Pyganodon grandis footiana* Lea in Viets and Plate 1954); *Anodonta grandis* Say in Vidrine 1980a, 1989a.

*Strophitus undulatus* (Say): *Anodonta edentula* Say, Michigan (Wolcott 1899) (and in Viets and Plate 1954); Canada (Vidrine 1986c).



Figures 1-8. *Unionicola arcuata* (Wolcott 1898). 1. Female venter. 2. Male venter. 3. Tarsus of fourth walking leg. 4. Male pedipalp. 5. Male genital field. 6. Female genital field. 7. Tarsal claw of fourth walking leg. 8. Male first walking leg. (Reprinted with permission from the International Journal of Acarology: Vidrine 1986c). Scale equals 100 micrometers.





Map 67. Known distribution of *Unionicola arcuata* (Wolcott 1898) in North America.

Subgenus *Dimockatax* 1992b

TYPE SPECIES-- *U. tumida* (Wolcott 1898)

ETYMOLOGY-- Named to honor Ronald V. Dimock Jr.

DIAGNOSIS--Body light in color; genital acetabula many pairs; female genital field with a single pair of acetabular plates, with medial, inner margins developed into spinous flap; male genital field with a single pair of acetabular plates; male and female pedipalps similar in size and shape; pedipalps large with elongate tarsus; pedipalpal tarsus with 1-2 obvious clawlets; male and female first walking legs similar and sparsely setose with tarsal claws short and thick and moderately bifid; body swells to nearly 5 mm in ovigerous females; coxal plates especially third and fourth nearly rectangular; third and fourth coxal plates together forming almost a perfect square in outline.

HABITAT--Parasites of Unionidae.

DISTRIBUTION-- Asia and North America.

DISCUSSION-- With the white, swollen bodies, this divergent subgenus grossly resembles *Najadicola ingens* (Koenike 1895) (Pionidae: Najadicolinae), which is another mite that inhabits mussels in the Northern Hemisphere (Simmons and Smith, 1984). The four species in *Dimockatax* are essentially unstudied; however, they comprise a uniquely divergent group. Apparently this subgenus in North America forms a *Artenkreis*, since three very similar species are found in different geographic areas and hosts. Illustrations of representative species can be found in Vidrine (1986c) and Wolcott (1998 and 1899). A fourth species is known from southeastern Asia. A unique faunal assemblage of mites parasitize the Anodontinae and are distributed both in Eurasia and North America. The subgenera include *Anodontinatax*, *Parasitatax*, *Wolcottatax*, and *Dimockatax*. The absence of the latter two subgenera in Europe is difficult to explain, except it is apparent that these subgenera are more commonly found in genera other than *Anodonta*--the common genus in Europe.

ADDITIONAL SPECIES INCLUDED-- *U. bishopi* Vidrine 1986c, *U. neocooki* Vidrine 1987a, and *U. tumidoides* Vidrine 1986c.

*Unionicola (Dimockatax) bishopi* Vidrine 1986c  
Plates 194-196 in Vidrine (1996a)

Synonymy--

*Unionicola (Dimockatax) bishopi* Vidrine 1986a in Vidrine 1992b

*Unionicola (Parasitatax) bishopi* Vidrine 1986c in Vidrine 1986e

Museum type number(s) and location-- CNC 19114, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Alasmidonta marginata* Say 1818 from Ouachita River at Rte. U. S. 270, Rocky Shoals Park, Montgomery County, Arkansas, collected on 12 August 1978 by D. R. Clark, W. Bell, and M. F. Vidrine.

Etymology-- Named to honor Thomas D. Bishop.

Diagnosis-- Character states of the subgenus; dorsum apparently lacking a dorsal plate; posterior coxal plates with distinct borders; female acetabular plates with an elongate, bird-bill-like spinous process; male acetabular plates with more than 20 acetabula each; pedipalps thick; pedipalp Ta with 2, moderately large and distinct clawlets; all tarsal claws of walking legs bifid with the dorsal prong shorter than the ventral prong; first walking leg with short setae; fourth walking leg Ta nearly straight; body light in color.

Male (4 specimens)-- Length including capitulum 1250 (1000-1500); length of posterior coxal group 370 (340-400); dorsal lengths of pedipalp segments: Ti 136 (120-145); Ta 84 (80-90); dorsal lengths of leg segments: leg I: TFe 168 (160-170); Ge 200 (190-210); Ti 220 (210-230); Ta 169 (160-175); leg IV: TFe 275 (270-280); Ge 373 (360-380); Ti 500 (490-510); Ta 343 (340-350).

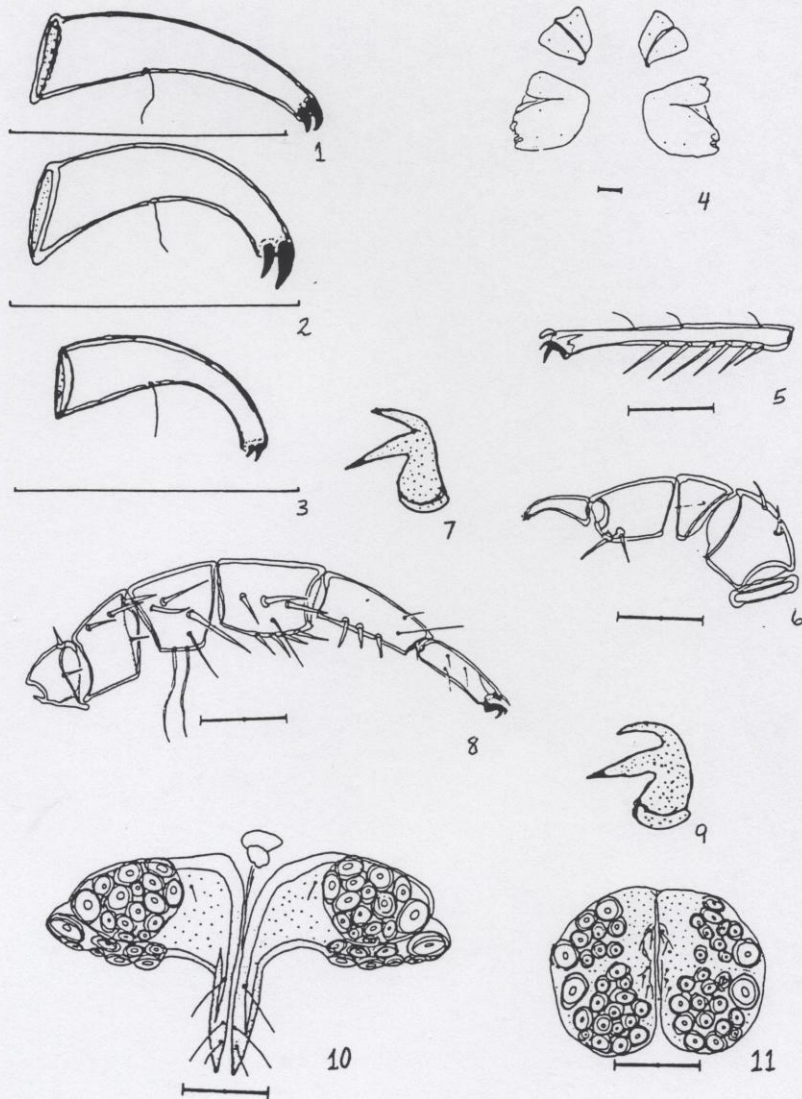
Female (3 specimens)-- Length including capitulum 1833 (1500-2000); length of posterior coxal group 400; dorsal lengths of pedipalp segments: Ti 133 (120-150); Ta 87 (80-90); dorsal lengths of leg segments: leg I: TFe 186 (180-200); Ge 253 (250-260); Ti 260 (250-280); Ta 185 (170-210); leg IV: TFe 387 (370-410); Ge 540 (520-570); Ti 650 (620-690); Ta 417 (400-430).

Notes-- *Unionicola bishopi* is only known from its type locality. Usually a single male and one or two females occur in each infested host. It is nearly identical to *U. tumida*, but it is larger and has distinctive clawlets on the pedipalp tarsus.

Hosts:

*Alasmidonta marginata* Say: Arkansas (Vidrine, 1986c).

*Strophitus undulatus* (Say): Arkansas (Vidrine, 1986c).



Figures 1-11. *Unionicola neocooki* Vidrine 1987. 1. Tarsus of pedipalp. *Unionicola bishopi* Vidrine 1986. 2. Tarsus of pedipalp. *Unionicola tumida* (Wolcott 1898). 3. Tarsus of pedipalp. 4. Female coxal plates. 5. Tarsus of fourth walking leg. 6. Female pedipalp. 7. Tarsal claw of fourth walking leg. 8. Male first walking leg. 9. Tarsal claw of first walking leg. 10. Female genital field. 11. Male genital field. (Reprinted with permission from the International Journal of Acarology: Vidrine 1986c). Scale equals 100 micrometers.





Map 68. Known distribution of *Unionicola bishopi* Vidrine 1986 in North America.

*Unionicola (Dimockatax) neocooki* Vidrine 1987a  
Plate 197 in Vidrine (1996a)

Synonymy--

*Unionicola (Dimockatax) neocooki* Vidrine 1987a in Vidrine 1992b

*Unionicola (Parasitatax) neocooki* Vidrine 1987a

*Unionicola (Parasitatax) cooki* Vidrine 1986c and in Vidrine 1986e

Museum type number(s) and location-- CNC 19115, Canadian National Collections, Biosystematics Research Institute, Ottawa, Canada.

Type locality and host-- Holotype (male) found in *Lasmigona compressa* from Willow Brook ca. 3.0 km east northeast of Grand Valley, Dufferin County, Ontario, Canada, collected on 5 August 1970 by B. T. Kidd.

Etymology-- Named to honor David Cook.

Diagnosis-- Character states of the subgenus; dorsum apparently lacking a dorsal plate; posterior coxal plates with distinct borders; female acetabular plates with an elongate, bird-bill-like spinous process; male acetabular plates with more than 20 acetabula each; pedipalps thick; pedipalp Ta with 2, small but distinct clawlets; all tarsal claws of walking legs bifid with the dorsal prong shorter than the ventral prong; first walking leg with short setae; fourth walking leg Ta nearly straight; body light in color.

Male (5 specimens)-- Length including capitulum 1800 (1750-2000); length of posterior coxal group 488 (400-540); dorsal lengths of pedipalp segments: Ti 143 (140-150); Ta 90; dorsal lengths of leg segments: leg I: TFe 215 (200-220); Ge 282 (250-320); Ti 296 (270-320); Ta 174 (150-190); leg IV: TFe 436 (410-460); Ge 582 (570-600); Ti 758 (710-780); Ta 466 (450-480).

Female (5 specimens)-- Length including capitulum 2250 (2000-2600); length of posterior coxal group 512 (500-520); dorsal lengths of pedipalp segments: Ti 168 (160-170); Ta 92 (90-100); dorsal lengths of leg segments: leg I: TFe 226 (220-240); Ge 322 (320-330); Ti 338 (300-370); Ta 194 (180-210); leg IV: TFe 530 (510-540); Ge 748 (720-780); Ti 868 (830-940); Ta 538 (520-570).

Notes-- *Unionicola neocooki* is only known from several Canadian (Ontario) localities from this same host. Usually a single male and one or two females occur in each infested host. It is nearly identical to *U. tumida* and *U. bishopi*, but it is larger and has distinctive clawlets on the pedipalp tarsus.

Hosts:

*Lasmigona compressa* (Lea): Canada (Vidrine, 1986c).



Map 69. Known distribution of *Unionicola neocooki* Vidrine 1987 in North America.

*Unionicola (Dimockatax) tumida* (Wolcott 1898)  
Plates 198-200 in Vidrine (1996a)

Synonymy--

*Atax tumidus* Wolcott 1898 in Wolcott 1898 and 1899, Piersig 1901

*Unionicola (Parasitatax) tumida* (Wolcott 1898) in Mitchell 1954, Viets and Plate 1954, Viets 1956 and 1957, Crowell 1961, Habeeb 1967, Vidrine 1977b, 1980a, and 1986e, and Vidrine and Bereza 1978b.

*Unionicola (Dimockatax) tumida* (Wolcott 1898) in Vidrine 1992b.

Museum type number(s) and location-- Marshall Collection, Field Museum of Natural History, Chicago, Illinois.

Type locality and host-- From *Anodontoides ferussacianus* (Lea) from Michigan.

Etymology-- Named for its tumescent (swollen) body.

Diagnosis-- Character states of the subgenus; dorsum apparently lacking a dorsal plate; coxal plates abbreviate and with distinct borders; female acetabular plates with an elongate, bird-bill-like spinous process; male acetabular plates with more than 20 acetabula each; pedipalps thick; pedipalp Ta with 2, very small clawlets that are almost indistinct; all tarsal claws of walking legs bifid with the dorsal prong shorter than the ventral prong; first walking leg with short setae; fourth walking leg Ta nearly straight; body light in color.

Male (7 specimens)-- Length including capitulum 1150 (1000-1200); length of posterior coxal group 298 (250-340); dorsal lengths of pedipalp segments: Ti 102 (80-110); Ta 75 (68-80); dorsal lengths of leg segments: leg I: TFe 137 (115-150); Ge 167 (140-180); Ti 173 (150-180); Ta 125 (110-130); leg IV: TFe 221 (200-230); Ge 303 (260-320); Ti 393 (350-420); Ta 286 (250-310).

Female (7 specimens)-- Length including capitulum 1800 (1600-1900); length of posterior coxal group 342 (300-400); dorsal lengths of pedipalp segments: Ti 116 (110-120); Ta 79 (75-80); dorsal lengths of leg segments: leg I: TFe 167 (140-180); Ge 217 (190-230); Ti 224 (200-240); Ta 143 (140-150); leg IV: TFe 324 (280-360); Ge 466 (390-500); Ti 544 (490-570); Ta 349 (320-370).

Notes-- *Unionicola tumida* is generally a parasite of members of the mussel subfamily Anodontinae. It is not commonly found in the genera *Anodonta* and *Pyganodon* in North America. A single population of *Utterbackia imbecillis* from upper Bayou Cocodrie in Louisiana is unusually parasitized by this mite. More detailed study may recognize this latter population as distinctive. There is a high probability that local populations currently assigned to this species are indeed distinctive.





Map 70. Known distribution of *Unionicola tumida* (Wolcott 1898) in North America.

Hosts:

*Alasmidonta viridis* (Rafinesque): *Margaritana deltoides* Lea, Michigan ? (Wolcott, 1899); *Pressodonta calceola* Lea in Viets and Plate 1954; *Alasmidonta calceola* (Lea) (Vidrine, 1980a).

*Amblema plicata* Say (?): *Anodonta ovata* Lea, Michigan (Wolcott, 1899, and in Viets and Plate 1954) (mussel identification uncertain) (Vidrine, 1980a).

*Anodontoides ferussacianus* (Lea): *Anodonta subcylindracea* Lea, Michigan (Wolcott, 1899) (and in Viets and Plate 1954).

*Anodontoides radiatus* (Conrad): *Strophitus subvexus* (= *S. radiatus*), Louisiana (Vidrine, 1980a).

*Lasmigona costata* (Rafinesque): Missouri (Utterback 1916); Vidrine 1980a.

*Pyganodon cataracta* (Say): New York (Baker 1982).

*Pyganodon fragilis* (Lamarck): *Anodonta fragilis*, Michigan (Wolcott, 1899), *Anodonta marginata* Say in Viets and Plate 1954; *Anodonta cataracta* (Say) Vidrine, 1980a.

*Strophitus undulatus* (Say): *Anodonta edentula* Say, Michigan (Wolcott, 1899 and in Viets and Plate 1954; Arkansas?, Pennsylvania, and Ohio (Vidrine 1980a); *Strophitus subvexus* (Conrad), San Jacinto River, Texas (Vidrine 1980a).

*Utterbackia imbecillis* (Say): *Anodonta imbecillus* Say, Louisiana (Vidrine 1977b and 1980a).

## SUMMARY AND CONCLUSIONS

This volume taxonomically treats 70 species of mites belonging to either of two genera, *Najadicola* and *Unionicola*. Diagnoses, figures, host lists, and notes are provided, and distributions of these mites in North America are depicted on maps. Many of the species are routinely found as parasites in freshwater mollusks and sponges, and these hosts are listed and annotated. They demonstrate a variety of morphological and behavioral adaptations, which are useful in identification. The purpose of this volume is to introduce the reader to these mites and to provide a general reference to the species.

This volume is part of a set of four books dealing with North American *Najadicola* and *Unionicola* (Vidrine 1996a, 1996b, and 1996c). Other volumes contain: photomicrographs of 62 of the species; collection data and community descriptions; and a discussion of systematics and coevolution. Physiology, behavior, and molecular biology of these mites are areas where research is rapidly growing. My colleagues are making good strides in these areas. The volumes do not deal with these topics. Neither was I skilled in these areas of research nor was I convinced that these books were the proper place for an extended accumulation and discussion of the many ideas and hypotheses. The attached "Working Bibliography" contains references to most of these works.

Another work has been prepared for simultaneous release (Vidrine 1996e). This book compiles worldwide data from many sources. Contents include diagnoses of genera and subgenera of the world. Also, a key to the species of the world and lists of reported hosts for these mites are compiled. Collectively, these North American and world treatments provide an introduction to these diverse and remarkable mites and their intricate life histories and involvements with their hosts.

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## BIOGRAPHICAL SKETCH

Malcolm F. Vidrine received his Ph.D. in Biology at the University of Southwestern Louisiana in 1980. His thesis was centered upon the water mites parasitizing freshwater mussels in eastern North America. In 1978, he was awarded a Jessup Fellowship by the Academy of Natural Sciences of Philadelphia, where he studied the Academy's mussel collections. He is currently a Professor of Biology in the Division of Sciences at Louisiana State University at Eunice. He is the author and/or coauthor of 7 books and more than 70 scientific and popular articles on a wide variety of topics including leprosy in armadillos, trematodes, leeches, mosquitoes, rotifers, butterflies, dragonflies, plants/wildflowers, prairie restoration, mussels, and mites. He serves as Vice-President of the Cajun Prairie Habitat Preservation Society, through which he has been actively restoring a prairie in a 10 acre city park in Eunice. He has been married to Gail Jeanne Quillman for 12 years, and they have two children, Daniel and Caroline. His older son, Macky, is a musician in Atlanta, Georgia.

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