Hildebrand, H.H. and D. King. 1974. A preliminary biological study of the Cayo del Oso and the Pita Island Area of the Laguna Madre. Annual Report to Central Power and Light Co. 333 pp.

1975. A biological study of the Cayo del Oso and the Pita Island Area of the Laguna Madre. Annual Report to Central Power and Light Co. 290 pp.

1976. A biological study of the Cayo del Oso and the Pita Island Area of the Laguna Madre. Annual Report to Central Power and Light Co. 257 pp.

1979. A biological study of the Cayo del Oso and the Pita Island Area of the Laguna Madre. Annual Report to Central Power and Light Co. 257 pp.

Livingston R.J. 1976. Diurnal and seasonal fluctuations of or ganisms in a north Florida estuary. Estuarine and Coastal Mar Sci. 4: 373-400.

Parker, R.H. 1955. Changes in the invertebrate fauna, appa rently attributable to salinity changes in the bays of Centra Texas. J. Paleon. 29(2): 193-211.

Simmons, E.G. 1957. An ecological survey of the upper Laguna Madre of Texas. Publ. Inst. Mar. Sci. 4(2): 156-200.

Zimmerman, F.J. and A.H. Chaney. 1969. Salinity decrease as an affector of molluscan density levels in a turtle grass (*Thalas sia testudinum* Konig) bed in Redfish Bay, Texas. TAIUS 2(1): 5-10.

SOUTH AMERICAN PARASITIC MITE GENUS *ATACELLA* (ARTHROPODA: ACARI: UNIONICOLIDAE) IN NORTH AMERICAN FRESH-WATER MUSSELS (BIVALVIA: UNIONOIDA: UNIONACEA AND MUTELACEA)

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Most species-group taxa of unionicolid mites that infest specific sites within the branchial chambers of fresh-water mussels have been placed in the cosmopolitan genus *Unionicola*. The large, intrabranchial unionicolid mussel parasites that are placed in the possibly monotypic genus *Najadicola*, are now known to be found in North America (including Mexico) and Southeast Asia (M.F. Vidrine, unpublished). *Atacella*, the only other unionicolid genus known to infest unionoid mussels, has been reported only from mycetopodid mutelacean and hyriid unionacean mussels in a small portion of southeastern South America (Fig. 1). Our data indicate that mites that are consistent with Cook's (1974) concept of the genus *Atacella* also occur in southern United States and northern Mexico (Fig. 1), in mycetopodid and unionid mussels, and that the range of *Atacella* possibly extends continuously in the Americas.

The reported differences between nominal *Atacella* and *Unionicola* lie primarily in the shape and degree of sclerotization of the palpi, and in the degree of separation between the third and fourth coxal plates (epimera): *Atacella* has flat palpi whose venters are weakly sclerotized, and its third and fourth coxal plates are completely separated by a suture; *Unionicola* has subcylindrical palpi whose venters are strongly sclerotized, and its third and fourth coxal plates are incompletely separated by a suture (Cook 1974). However, an ongoing, comprehensive study of the unionicolid mite parasites of North American unionacean mussels (M.F. Vidrine, unpublished) has revealed that *U. stricta* (Wolcott 1898) [known only from the mussel *Uniomerus tetralasmus* (Say 1831), concept of Johnson, 1970)] (Vidrine 1973, 1974) and those mites in the complex *U. tupara* Mitchell and Wilson 1965 [known only from the unionid genera *Amblema*, *Megalonaias*, *Plectomerus*, and *Elliptoideus* (Vidrine 1979)] are intermediate in terms of the features that are presently published (Cook, 1974) as the differences between *Unionicola* and *Atacella*. Therefore, even though *Atacella* probably represents a distinct clade within the Unionicolidae, the morphological differences between *Atacella* and *Unionicola* are not trenchantly defined.

Table 1 summarizes the previously reported incidence o *Atacella* in unionoid mussels. All these records are from Paraguay, Uruguay, southeastern Brazil, and northeastern Argentin from hosts in the mycetopodid genus *Anodontites* and the hyriid genera *Castalina* and *Diplodon*. At least two species of *Atacella*, *A. perforata* (Koenike 1890) and *A. clathrata* Lundblad 1937 infest both mutelacean and unionacean mussels in South America.

Table 2 summarizes our new locality and incidence records o *Atacella*, from the southeastern United States and northern Mex ico. These records are from hosts in the mycetopodid genus

Fig. 1. Known geographic distribution of *Atacella*, s.l. in th Americas. Closed circles (●) represent locality records.

Anodontites (in Mexico) and a series of unionid taxa (*Popenaias*, *"Nephronaias"*, *"Disconaias"*, and *Carunculina*) in the United States and Mexico. The *Atacella* taxa found by us in the Mexican *Anodontites* appear to be conspecific with those reported to infest *Anodontites* in South America; this supports the hypothesis of a range of *Atacella* that is continuous from the United States to Argentina. *Atacella* infesting unionid taxa, however, are different from those reported from South American unionoids. Two of these mite entites are undescribed and appear to be closely related to each other: *Atacella* (A.) sp. nov. Type I (found in the Rio Grande and Panuco River systems) and *Atacella* (A.) sp. nov. Type II (found in the Panuco River system). *Atacella* (A.) sp. nov. Type I infests unionid genera that are referrable (by inference) to the Davis, et. al. (1978) tribes Lampsilini (*"Disconaias"*) and Elliptionini (*Popenaias* and *"Nephronaias"*); *Atacella* (A.) sp. nov. Type II was found only in nominal *Popenaias* in the Panuco River system. A third entity, *Atacella* (A.) sp. nov. Type III, referred to as *Unionicola latipalpa*, a manuscript name, has been described in an unpublished thesis (Dobson, 1966) from *Carunculina parva* (Barnes 1823) in the Apalachicolan province (Suwannee River to the Escambia River drainages) of Alabama and Florida. This entity was also found in the same host in the Navasota River (Brazos River system) (Calnan, 1976, referred to as *Unionicola* sp. "III") and other eastern and central Texas locations (M.F. Vidrine, unpublished). Despite the examination of a large number (60 lots) of *Carunculina* from the area between eastern Texas and Alabama, no *Atacella* (A.) sp. nov. Type III were found. In our opinion, the data do not support any explanation of the apparent interruption in the range of the latter.

In about 175 species (and about 15,000 specimens) of mussels examined thus far in North America from about 475 stations, *Atacella* has not been found in any mussel species or locality other than those mentioned above. Although data are too scanty to permit discussion of the specificities of other *Atacella* for their

Table 1. Previous records of co-occurrence of *Atacella* with mussel hosts. Mussel taxa are indented to the right, under the mite taxa. All names are literary; they were not verified by the authors.

Atacella (A.) fissipes (Koenike 1891)
- *Anodontites patagonicus* (Lamarck 1819)
  - Brazil – Koenike, 1891
  - Paraguay – Lundblad, 1937, 1938 and 1941
- *Anodontites trapesialis susannae* (Gray 1834)
  - Argentina – Rosso de Ferrades, 1976

Atacella (A.) perforata (Koenike 1890)
- *Anodontites patagonicus* (Lamarck 1819)
  - Brazil – Koenike, 1890
  - Uruguay – Caches and Mane-Garzon, 1973
- *Diplodon delodontus pilbsryi* Marshall 1928
  - Uruguay – Caches and Mane-Garzon, 1973
- *Anodontites trapesialis spixii* (D'Orbigny 1835)
  - Argentina – Rosso de Ferradas, 1976

Atacella (A.) clathrata Lundblad 1937
- *Anodontites* sp.
  - Brazil – Lundblad, 1937, 1941 and 1942
- *Anodontites obtusus lucidus* (D'Orbigny 1835)
- *Anodontites trapesialis spixii* (D'Orbigny 1835)
- *Diplodon rhuacoicus* (D'Orbigny 1835)
- *Diplodon charruanus* (D'Orbigny 1835)
  - Argentina – Rosso de Ferradas, 1976

Atacella (A.) entrerrianensis Rosso de Ferradas 1976
- *Anodontites trapesialis spixii* (D'Orbigny 1835)
  - Argentina – Rosso de Ferradas, 1976

Atacella (Atacellides) rugosus (Koenike 1890)
- *Anodontites p. patagonicus* (Lamarck 1819)
  - Brazil – Koenike, 1890
  - Uruguay – Caches and Mane-Garzon, 1973

Atacella (Atacellides) schubarti Viets 1954
- *Diplodon delodontus expansus* (Kuster 1856)
  - Brazil – Viets, 1954

Atacella (A.) subrecta Caches and Mane-Garzon 1973
- *Anodontites p. patagonicus* (Lamarck 1819)
  - Uruguay – Caches and Mane-Garzon, 1973

Atacella (A.) gigantea Caches and Mane-Garzon 1973
- *Anodontites p. patagonicus* (Lamarck 1819)
  - Uruguay – Caches and Mane-Garzon, 1973

Atacella (Polyatacides) prominens (Koenike 1914)
- *Catalina nehringi* von Ihering 1891
  - Brazil – Koenike, 1914

Table 2. New records of co-occurrence of *Atacella* with mussel hosts. Mite taxa are indented to the right, under the mussel taxa. All mite taxa are concepts of M.F. Vidrine. All mussel taxa are the concepts of D.J. Bereza.

Mutelacea
- Mycetopodidae
  - Anodontitinae (*sensu* Parodiz and Bonetto, 1963)
    - *Anodontites trapesialis glaucus* (Valenciennes 1833)
      - *Atacella (A.) fissipes* (Koenike 1891)
        - Northwestern Mexico
      - *Atacella (A.) perforata* (Koenike 1890)
        - Panuco River system, Mexico
      - *Atacella (A.) entrerrianensis* Rosso de Ferradas 1976
        - Panuco River system, Mexico

Unionacea
- Unionidae
  - Lampsilinae (*sensu* Davis, et al., 1978)
    - *Popenaias popei* (Lea 1857)
      - *Atacella (A.)* sp. nov. Type I
        - Rio Grande system, Mexico and USA
    - *Popenaias* ?sp. nov. (= *P. popei* of authors)
      - *Atacella (A.)* sp. nov. Type II
        - Panuco River system, Mexico
    - *Popenaias metallica ganina* (Pilsbry 1909)
      - *Atacella (A.)* sp. nov. Type II
    - *"Nephronaias"* sp.
      - *Atacella (A.)* sp. nov. Type I
        - Rio Huichihuayan, Panuco River system, Mexico
    - *"Disconaias" purpurata* (Say 1831)
      - *Atacella (A.)* sp. nov. Type I
        - Panuco River system, Mexico
    - *Carunculina parva* (Barnes 1823)
      - *Atacella (A.)* sp. nov. Type III
        - Texas, Alabama, and Florida, USA

mussel hosts, our rather intensive sampling of the United States Gulf drainage facilities the assumption that *Atacella* (A.) sp. nov. Type III is specific for *Carunculina*.

This apparent host-parasite specificity suggests that *Atacella* (A.) sp. nov. Type III or its progenitors are not recent immigrants to the northern Gulf drainage area, because *Carunculina* has not been found south of the United States and appears to have no close relatives south of the United States.

At present, however, all speculations about the biogeography and host-parasite co-evolution of *Atacella* and mussels are limited by the current taxonomic discrimination between *Atacella* and *Unionicola*. If the current published concepts of the two genera are accurate, it is safe to assume that the known distribution of *Atacella* is warm-temperate to tropical and that it is not possible to say in which part of the New World *Atacella* originated.

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LITERATURE CITED

Caches, M.A. and F. Mane-Garzon. 1973. Sobre cuatro especies del genero *Atacella* Lundblad, 1937 (Acarina, Unionicolidae) en el Uruguay. *Trabajos V Congresso Latino-americano Zoologia*, 1: 49-57.

Calnan, T.R. 1976. The systematics and distribution of metazoan parasites in the Unionidae from Navasota River, Texas. M.S. thesis, Texas A. and M. University, College Station, Texas. Pp. i-viii & 1-112.

Cook, D. 1974. Water mite genera and subgenera. *Memoirs of the American Entomological Institute*, Number 21, pp. i-vii & 1-860.

Davis, G.M., S.L.H. Fuller and C. Hesterman. 1978. Toward a definitive higher classification of North American Unionacea. *Bulletin of the American Malacological Union, Inc.*, 1977: 85.

Dobson, R. 1966. A survey of the parasitic Unionicolidae (Arachnida: Acarina) of the Apalachicolan faunal region of the southern United States. M.S. thesis, Florida State University, Tallahassee. Pp. i-vii & 1-99.

Johnson, R.I. 1970. The systematics and zoogeography of the Unionidae (Mollusca: Bivalvia) of the Southern Atlantic Slope region. Harvard University (Cambridge, Massachusetts), Museum of Comparative Zoology, *Bulletin* 140(6): 263-450.

Koenike, F. 1890. Sudamericanische auf Muschelthieren Schmarotzende *Atax*-species, Zoologischer Anzeiger, 13 (325-352): 424-427.

Koenike, F. 1891. Noch ein Sudamericanische Muschel *Atax*. *Zoologischer Anzeiger*, 13 (353-380): 15-16.

Koenike, F. 1914. Neue und neubennannte Wassermilben. *Abhandlungen Naturwissenschaftlichen Verein zu Bremen*, 22 398-400.

Lundblad, O. 1937. Funfte Mitteilung uber neue Wassermilben aus Santa Catharina in Sudbrasilien. *Zoologischer Anzeiger*, 120: 280-293.

Lundblad, O. 1938. Neue Wassermilben aus Paraguay. *Zoologischer Anzeiger*, 122: 7-19.

Lundblad, O. 1941-1942. Die Hydracarinenfauna Sudbrasiliens und Paraguay. *Kunglica Svenska Vetensakademiens handlingar. Tredje Serien*. 1941. Erster Teil, 19(7): 1-183. 1942. Zweiter Teil, 20(2): 3-175.

Mitchell, R. and J.L. Wilson. 1965. New species of water mites from Tennessee unionid mussels. *Journal of the Tennessee Academy of Sciences*, 40(3): 104-106.

Parodiz, J.J. and A.A. Bonetto. 1963. Taxonomy and zoogeographic relationships of the South American naiades (Pelecypoda: Unionacea and Mutelacea). *Malacologia*, 1(2): 179-213.

Rosso de Ferradas, B. 1976. The genus *Atacella* Lundblad, (Unionicolidae, Prostigmata, Acari) in clams from the Ayui Grande stream, Entre Rios Province, Argentina. *Physis, Section B, Buenos Aires*, 35 (90): 39-50.

Vidrine, M.F. 1973. Fresh-water mussels (Bivalvia: Unionidae) from Evangeline Parish, Louisiana, parasitized by water mites (Acarina: Unionicolidae) and Aspidogastrid trematodes (Trematoda: Aspidogastridae). *Proceedings of the Louisiana Academy of Sciences*, 36: 53.

Vidrine, M.F. 1974. Aspidogastrid trematode and acarine parasites of fresh-water clams in south central and southwestern Louisiana. M.S. thesis, Louisiana State University, Baton Rouge, pp. i-viii & 1-125.

Vidrine, M.F. 1979. Water mite (Arthropoda: Unionicolidae) parasites of ambleminine fresh-water mussels (Mollusca: Unionacea) in North America. *ASB* [Association of Southeastern Biologists] *Bulletin*, 26(2): 82.

Viets, K. 1954. Suswassermilben aus Sudamerika. *Archiv fur Hydrobiologie*, 49(1-2): 1-224.

Wolcott, R. 1898. New American species of the genus *Atax* (Fabr.) Bruz. *Zoological Bulletin*, 1: 279-285.