

**FLORIDA  
MUSEUM**  
OF NATURAL HISTORY®

---

# BULLETIN

---

## UROCOPTID LANDSNAILS OF THE GENUS *HOLOSPIRA* FROM SOUTHERN MEXICO

Fred G. Thompson and Elizabeth L. Mihalcik

Vol. 45, No. 3, pp. 63-124

2005

The **FLORIDA MUSEUM OF NATURAL HISTORY** is Florida's state museum of natural history, dedicated to understanding, preserving, and interpreting biological diversity and cultural heritage.

The **BULLETIN OF THE FLORIDA MUSEUM OF NATURAL HISTORY** is a peer-reviewed publication that publishes the results of original research in zoology, botany, paleontology, and archaeology. Address all inquiries to the Managing Editor of the Bulletin. Numbers of the Bulletin are published at irregular intervals. Specific volumes are not necessarily completed in any one year. The end of a volume will be noted at the foot of the first page of the last issue in that volume.

Richard Franz, *Managing Editor*  
Erika H. Simons, *Production*

Bulletin Committee  
Richard Franz, *Chairperson*  
Ann Cordell  
Sarah Fazenbaker  
Richard Hulbert  
William Marquardt  
Susan Milbrath  
Irvy R. Quitmyer  
Scott Robinson, *Ex officio Member*

ISSN: 0071-6154

Publication Date: December 15, 2005

**Send communications concerning purchase or exchange  
of the publication and manuscript queries to:**

Managing Editor of the BULLETIN  
Florida Museum of Natural History  
University of Florida  
PO Box 117800  
Gainesville, FL 32611-7800 U.S.A.  
Phone: 352-392-1721  
Fax: 352-846-0287  
e-mail: [dfranz@flmnh.ufl.edu](mailto:dfranz@flmnh.ufl.edu)

# UROCOPTID LANDSNAILS OF THE GENUS *HOLOSPIRA* FROM SOUTHERN MEXICO

Fred G. Thompson<sup>1</sup> and Elizabeth L. Mihalcik<sup>2</sup>

## ABSTRACT

The taxonomy of the landsnail genus *Holospira* s.s. and subgenus *Stalactella* from southern Mexico is reviewed. The area of study includes the state of Puebla and adjacent regions of Morelos, Oaxaca and Veracruz. *Stalactella* Bartsch, 1906 is redefined and is recognized as distinct from *Propilsbrya* Bartsch, 1906 with which it had previously been associated. Twenty-nine species are recognized. The primary types of all species are illustrated, except for *Holospira tetralasma* Pilsbry, 1902. New species of *Holospira* s.s. include *Holospira acanthidia* n. sp., *H. denserpens* n. sp., *H. eburnea* n. sp., *H. zygoptyx* n. sp., *H. rhinion* n. sp., *H. aurantiaca* n. sp., *H. scololaema* n. sp., *H. colymis* n. sp., *H. fortisculpta* n. sp., *H. haploplax* n. sp. New species of *Salactella* include *H. cremnobates* n. sp., *H. psectra* n. sp., *H. marmorata* n. sp., and *H. chazumbae* n. sp. *Holospira goniostoma* (Pfeiffer, 1856), *H. teres* (Menke, 1847), *H. hogeana* Martens, 1897, *H. pfeifferi* (Menke, 1847), *H. (S.) rosei* Bartsch, 1906 and *Coelostemma microstoma* (Pfeiffer, 1861) are redescribed, and lectotypes are designated. Since its original description the latter species was referred questionably to *Holospira*.

**Key Words:** Urocoptid snails, *Holospira*, new species, southern Mexico

## TABLE OF CONTENTS

Introduction .....	64
Material and Methods .....	65
Subfamily Holospirinae .....	66
Genus <i>Holospira</i> Martens, 1860 .....	66
Subgenus <i>Holospira</i> Martens, 1860 .....	67
The <i>Holospira goniostoma</i> species-group .....	67
<i>Holospira goniostoma</i> (Pfeiffer 1856) .....	67
<i>Holospira maxwelli</i> Pilsbry 1953 .....	68
The <i>Holospira acanthidia</i> species-group .....	68
<i>Holospira acanthidia</i> new species .....	68
The <i>Holospira rehderi</i> species-group .....	69
<i>Holospira rehderi</i> Bartsch 1947 .....	69
<i>Holospira albertoi</i> Bartsch 1947 .....	70
The <i>Holospira zygoptyx</i> species-group .....	71
<i>Holospira zygoptyx</i> new species .....	71
The <i>Holospira melea</i> species-group .....	72
<i>Holospira melea</i> Bartsch 1926 .....	72
<i>Holospira hyperia</i> Bartsch 1926 .....	73
<i>Holospira eburnea</i> new species .....	73

<sup>1</sup> P.O. Box 117800, Florida Museum of Natural History, University of Florida, Gainesville, FL 32611-7800 USA fgt@flmnh.ufl.edu

<sup>2</sup> 2500 Shotwell St., Bainbridge College, Bainbridge, GA 39817, USA emihalcik@bainbridge.edu

The <i>Holospira teres</i> species-group .....	75
<i>Holospira teres</i> (Menke 1847) .....	75
<i>Holospira hogeana</i> Martens 1897 .....	76
<i>Holospira teotitlana</i> Bartsch 1945 .....	78
The <i>Holospira pfeifferi</i> species-group .....	79
<i>Holospira tetralasma</i> Pilsbry 1902 .....	79
<i>Holospira pfeifferi</i> (Menke, 1847) .....	79
<i>Holospira oaxacana</i> Bartsch, 1906 .....	80
<i>Holospira rhinion</i> new species .....	81
The <i>Holospira painteri</i> species-group .....	82
<i>Holospira painteri</i> Bartsch 1906 .....	82
<i>Holospira denserpens</i> new species .....	82
The <i>Holospira aurantiaca</i> species-group .....	83
<i>Holospira aurantiaca</i> new species .....	83
The <i>Holospira scololaema</i> species-group .....	85
<i>Holospira scololaema</i> new species .....	85
<i>Holospira colymis</i> new species .....	86
The <i>Holospira fortisculpta</i> species group .....	87
<i>Holospira fortisculpta</i> new species .....	87
The <i>Holospira haploplax</i> species-group .....	88
<i>Holospira haploplax</i> new species .....	88
Subgenus <i>Stalactella</i> Bartsch 1906 .....	89
<i>Holospira</i> (S.) <i>rosei</i> Bartsch 1906 .....	90
<i>Holospira</i> (S.) <i>cremnobates</i> new species .....	91
<i>Holospira</i> (S.) <i>psectra</i> new species .....	92
<i>Holospira</i> (S.) <i>marmorata</i> new species .....	93
<i>Holospira</i> (S.) <i>chazumbae</i> new species .....	94
Genus <i>Coelostemma</i> Dall 1895 .....	95
<i>Coelostemma microstoma</i> (Pfeiffer 1861) .....	95
Acknowledgments .....	96
Literature Cited .....	96

## INTRODUCTION

Holospirinae are an ancient and fascinating group of organisms found in submesic and xeric habitats from northern Oaxaca north to southern Texas, New Mexico and Arizona. Species clearly identifiable as Holospirinae are recorded from the Paleocene of New Mexico (Cockerell 1914) and from the Upper Cretaceous of Alberta (Tozer 1956). Currently 127 species are known from Mexico, and 26 have been recorded from the United States. Only a single species, *Metastoma roemeri* (Pfeiffer, 1848), occurs in both countries (Florida Museum of Natural History collection). Holospirids are confined to calcareous terranes. Most species are obligate inhabitants of limestone or dolomite exposures. Most have very localized geographic distributions. Some are confined to areas of a few square meters. Most others are restricted to areas of a few square kilometers. Usually, specimens are numerous and readily collected when a colony is found. However, populations may be overlooked easily because very precise ecological parameters limit the immediate deployment of colonies. We have found as many as four species occurring in immediately proximal colonies deployed in different

microhabitats that were separated only by a few meters. At a locality 1 km east of Azumbilla, Puebla we collected *Holospira hogeana* Martens, *Holospira* (s. s.) sp., *Holospira* (*Stalactella*) sp. and *Bostrichocentrum* sp. Fifteen genera and subgenera currently are recognized in the Holospirinae. In most cases their distinctions are based on shell morphology. Within this subfamily convergence in shell characters appears to have occurred many times (Thompson 1971, 1988). Distinctions between subgenera and interpretations of phylogenetic relationships are rather arbitrary because too little remains known about many of the species comprising the Holospirinae.

The purpose of the paper is to review two subgenera of the landsnail genus *Holospira* Martens, 1860 from southern México, *Holospira* s. s. and *Stalactella* Bartsch, 1906. The subgenus *Holospira* is widely distributed from Arizona, New Mexico and Texas south to Oaxaca. *Stalactella* is restricted to a limited area centered in Puebla and immediately adjacent Oaxaca. The geographic scope of this study includes species from Puebla and the immediate vicinities of Veracruz, Oaxaca



and Morelos. Twenty eight species are recognized in this area, of which fourteen are new. The fauna of Guerrero does not include any of the species groups we recognize here, and it will be discussed elsewhere. This study excludes *Bostrichocentrum* Strebel, 1880 and most *Coelostemma* Dall, 1895 which various authors have recognized as separate genera or as subgenera of *Holospira*.

The needs for this study are two fold. The taxonomy of the southern Mexican *Holospira s.l.* was in a state of chaos, and a comprehensive review was required before further progress on the genus can be made in that part of the country or elsewhere. Many species from southern Mexico were poorly described, including some of the earliest names applied to the Holospirinae. This made it nearly impossible to identify newly collected material from there. Both *Holospira s. s.* and *Stalactella* had not been defined adequately, and their relationships to other generic-group taxa remained unresolved. We continue to recognize *Stalactella* as a subgenus of *Holospira*. The relationship of *Stalactella* to *Propilsbrya* is less clear. Pilsbry (1953) treats *Stalactella* as a section of *Propilsbrya*. We find that the similarities of lamellar structure between the two are overshadowed by numerous other differences in the shell.

Very few naturalists have collected specimens of holospirids from the area comprising this study. In general this reflects the scant attention that has been given Mexican landsnails. The names of collectors are unreported for many species described prior to 1900. The earliest collector recorded to have found holospirids from southern Mexico was the Prussian naturalist F. Liebmann, 1840-1843. Joseph N. Rose and Joseph H. Painter collected snails during botanical explorations for the United States National Museum between 1903-1905. Charles R. Orcutt, a botanist from the same institution collected some mollusks at the same time and later in 1925. Marie E. Bourgeois, a Mexican naturalist collected mollusks in the state of Morelos and Puebla between 1939 - 1947. Maxwell Smith, a private collector from the United States collected some mollusks in western Veracruz in 1948.

#### MATERIAL AND METHODS

This study is based on specimens collected by the authors between 1966 and 2004. Most specimens are deposited in the Florida Museum of Natural History. Duplicate specimens are deposited in the Instituto Tecnologia de Ciudad Victoria, Tamaulipas. We have examined the primary types of all species reported from southern Mexico, except for *Holospira tetralasma* Pilsbry, 1902, the province of which is unknown. All primary types

are illustrated by means of digital photographs reproduced at 600 ppi, as are other specimens. Species described in the 19<sup>th</sup> Century and early 20<sup>th</sup> Century are redescribed in cases where earlier descriptions are inadequate for identification. Other species described adequately in the literature are illustrated, and notations are added where appropriate.

Geographic coordinates. For specimens collected subsequent to 1990 latitude and longitude were determined by GPS instrumentation and are given in parentheses (). Latitude and longitude for earlier locality records were taken from gazeteers and are given in brackets [].

Shell measurements are given in mm and are standard for elongate-cylindrical shells. The length of the shell is measured from the tip of the apex to the base of the peristome. Width is the width of the spire perpendicular to the shell length, but does not include the peristome. The measurements we provide are based on specimens selected to show maximum variation. The following abbreviations are used for measurements. L = length of shell, W = width of shell, AH = aperture height, AW = aperture width, Wh = number of whorls, RP = ribs on

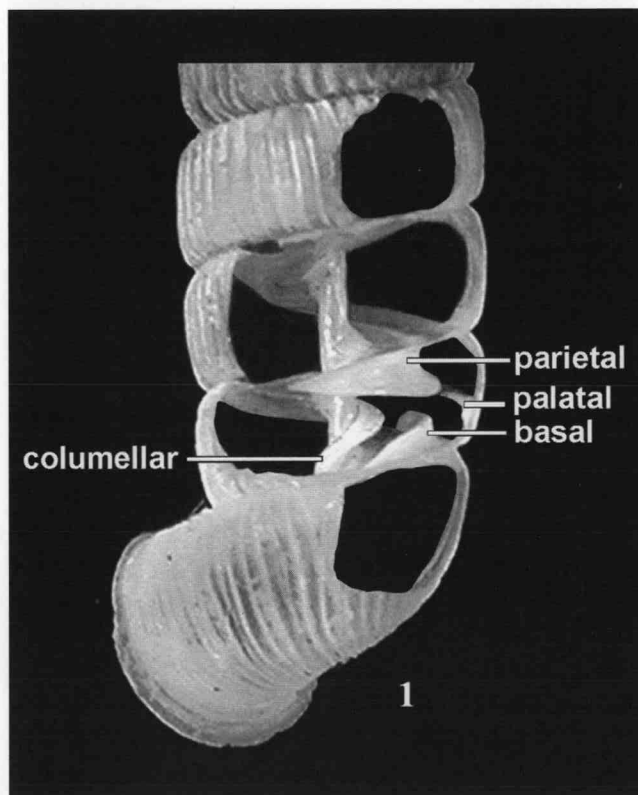


Figure 1. *Holospira rehderi* Bartsch, 1947. An opened shell showing the positions of the columellar lamella, parietal lamella, palatal lamella and basal lamella which comprise the internal barrier.

the penultimate whorl, X = mean, SD = standard deviation, Min = minimum, Max = maximum.

The internal barrier of the shell is viewed by filing open the lower whorls and selectively chipping away the shell wall to expose internal structures. In the case of unique types of species described by 19<sup>th</sup> Century authors the barrier was examined by use of radiographs.

#### Subfamily HOLOSPIRINAE Pilsbry, 1953

Holospirinae are characterized as a group by a combination of traits including the shell, jaw, radula, retractor muscle system and reproductive anatomy. Holospirid shells are characterized by having a complete apex at maturity. The apex remains a functional house for the digestive gland and gonad. The axis is hollow, although in some species it may be very narrow and solid in appearance. The adult shell has an internal barrier, which usually is confined to the last 1-4 whorls. Basically the barrier consisting of four lamella: the *columellar*, the *parietal*, the *basal* and the *palatal* (Fig. 1). We have examined numerous species from throughout Mexico. Modifications through reduction in the number of lamella occur in the various genera and subgenera. When four lamellae are present they occur in the combination listed above. When three only are present the combination consists of the columellar, parietal and basal lamellae. When two are present the combination includes the columellar and parietal lamellae. When only a single lamella is present it is always the columellar lamella. Several generic groups of Holospirinae lack lamellae. The lamellae develop only at definitive growth of the shell. The sequence of ontogenetic development precedes first with (1) the columellar, then (2) the parietal, then (3) the basal, and last, (4) the palatal. Specimens may have an externally complete but atypically thin adult shell-form that has not yet completed development of the internal barrier. Such specimens may lack one or more of the lamella characteristic of adult shells. The lamellae that are lacking occur in the reverse sequence of their development. Thus, if one lamella is lacking in a normally 4-lamellate species, it will be a palatal lamella; if two lamella are lacking these will be the palatal and the basal, etc. However, we find that specimens which attain definitive growth appear to be constant in the number, development and location of lamellae characteristic for that taxon. This is very different from the condition that occurs in some United States species now placed in the subgenus *Eudistemma* Dall, 1895 (see Bequaert & Miller 1973) in which populations vary in the number of lamella that may be present (Pilsbry, 1946).

Anatomical information on the Holospirinae is limited and equivocal. At present it is not possible to re-

solve phylogeny and delineate genera on the basis of available data, and the soft anatomy shows little differentiation among closely related species. This could reflect the fact that the species distributions are very restricted because of their obligate confinement to calcareous terrain. Reproductive specialization is not necessary for genetic isolation, nor are other ecological isolating mechanisms. Table 1 lists the species have been studied anatomically. We have examined the anatomy of several of the species discussed below. The results will be published elsewhere following further study of Holospirinae from other areas of Mexico.

The Holospirinae may be characterized anatomically as follow. The jaw is solid and striate. The radula is generalized in structure and dentition; the transverse rows of teeth are nearly straight, and the central and lateral teeth have a single large cusp, the mesocone. The columellar retractor muscle gives rise lower down (within two whorls of the mantle collar) to the pharyngeal retractor and the right and left ocular retractors. The ocular retractors each subdivide to form the respective ocular retractor and the pedal retractors; the right ocular retractor passes through the genital atrium. The penis retractor muscle originates on the floor of lung and inserts on the apex of the penis. The penis is short and bulbous, and it may or may not have a terminal caecum. A well-developed epiphallus enters the end of the penis eccentrically. The spermatheca is elliptical and has a long duct. It is appressed against the uterus at the base of the albumen gland. The spermatheca duct is with or without with a caecum.

#### Genus *Holospira* Martens, 1860

*Holospira* Martens; in Albers, 1860: 209. Thompson, 1998: 87-89. International Commission on Zoological Nomenclature, Opinion 1932: 206-207. (Type species: *Cylindrella golfussi* Menke, 1847, not *Cylindrella piloceri* Pfeiffer, 1841).

Four species of Holospirinae have been described from the region near Tehuacán, Puebla. These are *Holospira tetralasma* Pilsbry, 1902, *H. pfeifferi* (Menke, 1847), *H. painteri* Bartsch, 1906 and *H. (Stalactella) rosei* Bartsch, 1906. The exact province of each remains unknown. *Holospira tetralasma* was described without locality. The other three species were described as from Tehuacán. These records can be interpreted only as approximations, as was frequent with locality information provided in earlier literature.

Another species, *Holospira torrei* Pilsbry, 1935, was described from an unspecified locality in Mexico. The holotype was collected by a Señor Botteri, who gave it to Carlos de La Torre, who in turn gave the specimen

Table 1. Species of Holospirinae that have been studied anatomically.

SPECIES	STUDY
<i>Bostrichocentrum centicostata</i> (Thompson, 1964)	Thompson, 1964
<i>Bostrichocentrum goldmani</i> (Bartsch, 1906)	Thompson, 1906
<i>Bostrichocentrum perplexa</i> (Thompson, 1964)	Thompson, 1964
<i>Bostrichocentrum pupa</i> (Thompson, 1964)	Thompson, 1964
<i>Coelostemma elizabethae</i> (Pilsbry, 1889)	Pilsbry, 1902
<i>Hendersoniella christmani</i> Thompson & Correa-Sandoval, 1994	Thompson & Correa-Sandoval, 1994
<i>Hendersoniella lux lux</i> Thompson & Correa-Sandoval, 1994	Thompson & Correa-Sandoval, 1994
<i>Hendersoniella palmeri</i> (Dall, 1905)	Thompson & Correa-Sandoval, 1994
<i>Holospira (Allocoraphe) minima</i> Martens, 1893	Gilbertson 1989a
<i>Holospira (Eudistemma) arizonensis</i> Stearns, 1890	Gilbertson, 1989b
<i>Holospira (Eudistemma) chiricahuana</i> Pilsbry, 1905	Gilbertson, 1989b
<i>Holospira (Eudistemma) danielsi</i> Pilsbry & Ferriss, 1915	Gilbertson, 1993
<i>Holospira (Eudistemma) ferrissi</i> Pilsbry, 1905	Gilbertson, 1993
<i>Holospira (Eudistemma) nelsoni</i> Pilsbry, 1902	Pilsbry, 1902
<i>Holospira (Eudistemma) sherbrookei</i> Gilbertson, 1989	Gilbertson, 1989b
<i>Holospira (Eudistemma) tantalus campestris</i> Pilsbry & Ferriss, 1915	Gilbertson, 1993
<i>Holospira (Holospira) goldfussi</i> (Menke, 1847)	Pilsbry, 1946
<i>Holospira (Millerspira) milleri</i> Gilbertson & Naranjo-Garcia, 1998	Gilbertson & Naranjo-Garcia, 1998
<i>Holospira (Millerspira) hoffmani</i> Gilbertson & Naranjo-Garcia, 1998	Gilbertson & Naranjo-Garcia, 1998
<i>Holospira (Sonoraloa) remondi laevior</i> Pilsbry, 1953	Gilbertson, 1993
<i>Holospira (Sonoraloa) dentaxis alamellata</i> Gilbertson, 1993	Gilbertson, 1993

to Pilsbry. Pilsbry (1935: 2) comments "Señor Botteri collected mainly in the state of Vera Cruz, but the locality of this form was not recorded". We have examined the holotype (ANSP 162325). It belongs to a species-group found in western Coahuila and eastern Chihuahua. The species is excluded from this study.

#### Subgenus *Holospira* Martens, 1860

The following species from Puebla, Veracruz, Morelos and Oaxaca are assigned to the subgenus *Holospira*. They form twelve or more natural species-groups. The differences between the groups suggest the need for further taxonomic division of the genus. This must wait until the *Holospira* in other regions of Mexico are better known.

#### The *Holospira goniostoma* species-group

The shell is medium sized and tan or light brown in color. The apex as well as the spire have distinct axial ribs that are closely spaced. The spire is slender and has a moderately elevated, rounded apex. The whorls are separated by a shallow suture. The internal barrier consists of four relatively well-developed lamellae located in the anti-penultimate and penultimate whorls.

The geographic range and species composition of this group is not clear. Two species are included. Several species from northern Mexico and the southwestern United States have shell features similar to *Holospira goniostoma*. Their relationships to this group remain uncertain.

#### *Holospira goniostoma* (Pfeiffer, 1856)

Figs. 2-7

*Cylindrella goniostoma* Pfeiffer, 1856: 47; Pfeiffer, 1859: 710; Pfeiffer, 1862b: 63; pl. 7, figs. 7-9.

*Holospira goniostoma* (Pfeiffer). Fischer and Crosse, 1873: 328; pl. 17, fig. 4. Strebel, 1880: 84; pl. 14, figs. 6-6c. Pilsbry, 1902: 77-79; pl. 21, figs. 36-41.

Description.— Shell shiny; color of apex and spire light tan, crossed by lighter tan or white oblique ribs; peristome and interior of aperture glossy white. Shell medium sized, 14.1-16.7 mm in length; slender, 0.22-0.26 times as wide as high. Whorls, 14.5-17.1. Apex moderately long and convex with about 9-10 convex or scalariform whorls. Spire cylindrical with moderately arched whorls. Embryonic shell smooth, consisting of 2.1-2.3 protruding whorls, the first of which is enlarged and is followed by the wider but shorter second whorl.

Following whorls of apex crossed by oblique, low, narrow ribs that are about a third the width of their interspaces; ribs with white knobs at their lower ends; ribs on spire becoming more widely spaced, arched and less oblique; 39-48 ribs on the penultimate whorl. Umbilicus narrowly rimate and partially obscured by the rounded last quarter of a whorl. Aperture on a short neck that is about a fifth as long as the width of the last whorl. Aperture sub-ovate in shape with a weak impression along the parietal wall. Peristome thin but slightly thickened along its edge, and moderately reflected along lower palatal, basal and columellar margins. Columella straight, about a tenth the diameter of the whorls. Internal barrier consisting of four lamellae, and confined to the penultimate and anti-penultimate whorls (Figs. 2-5, radiographs). Columellar lamella one whorl long; low and rounded; located on the middle of the columella and confined to the penultimate whorl. Parietal lamella 1.5 whorls long; originating in the lower half of the penultimate whorl, pendant from the middle of the dorsal wall; strongly reflected toward the middle of the outer wall along its middle. Basal lamella about as thick as the columellar lamella; occupying the length of the penultimate whorl; arising vertically from the middle of the floor; highest near its middle and tapering gradually at both ends. Palatal lamella consisting of a low ridge located below the middle of the last half of the penultimate whorl.

Measurements in mm of the lectotype and the two paralectotypes are given in Table 2.

Table 2.— *Holospira goniostoma* (Pfeiffer, 1861) Measurements of the lectotype and two paralectotypes. Wh = whorls; Ewh = embryonic whorls; RPW = ribs on penultimate whorl.

	L	W	AH	AW	Wh	RPW
Lectotype	16.7	3.8	2.3	2.5	17.1	45
Paralectotype	15.8	3.5	2.7	2.7	16.2	39
Paralectotype	14.1	3.7	-	-	14.5	48

Type Locality.— "Mexico". Lectotype by present designation: British Museum (Natural History) 1996153. There are three syntypes in the British Museum. The largest specimen is designated here in as the Lectotype. The other two specimens are designated as Paralectotypes. The province of *H. goniostoma* remains unknown. We assume the species came from southern Mexico, but that is not certain.

Remarks.— This species is distinguished by its medium sized, slender, cylindrical shell with a moderately long and gently convex apex. The whorls are sculptured with crowded narrow low ribs that are about 1/4-1/3 as wide as their interspaces. The internal barrier consisting of four lamella that are confined to penultimate and anti-penultimate whorls.

*Holospira goniostoma* is not particularly similar to other southern Mexican species, although it seems to be closest to the following species. In size and shape it resembles the *Holospira hogeana* species-group (see below), but those *Holospira* lack ribs on the spire. Other species known from southern Mexico are shorter, they have fewer whorls, and they differ in other particular characteristics.

*Holospira maxwelli* Pilsbry, 1953

Figs. 8-10.

*Holospira maxwelli* Pilsbry, 1953: 143; pl. 9, fig. 4

Type Locality.— Veracruz, Beyond Terote [Perote], near Cordova [Cordoba]. Holotype: ANSP 191105; collected by Maxwell Smith. Two specimens from the Maxwell Smith Collection are in the Florida Museum of Natural History (UF 50207) and bear the datum "beyond Perote".

Distribution.— Known only from the type locality.

Remarks.— *Holospira maxwelli* tentatively is placed near *H. goniostoma* because of the strong similarity in shape and sculpture. Apparently *H. maxwelli* is tri-lamellate (Fig. 10). Pilsbry (1953) did not observe a palatal lamella in the holotype of *H. maxwelli*, nor did we find one in the single specimen we opened. Only three specimens are known for the species, all of which appear to be mature. It is not certain that the lamella was very weak and overlooked or inadvertently destroyed in the two specimens that have been opened.

The *Holospira acanthidia* species-group

This group consists of a single species. It is characterized by its elongate shape with thin, widely spaced ribs on the apex and spire. The internal barrier consists of three lamella. The parietal lamella bears a single row of very short denticles.

*Holospira acanthidia* n. sp.

Figs. 11-16

Description.— Light tan in color with lighter colored ribs which tend to be white on last whorl or two. Peristome and the interior of aperture white. Shell slender, 11.7-14.1 mm long and 0.22-0.25 times as wide as high. Whorls 16.1-19.1. Embryonic whorls 2.3-2.5, not

offset from subsequent whorls. Apex long attenuated, consisting of about 10 whorls. Spire with 8-9 whorls, slightly tapered below. Last whorl only slightly enlarged with a short descending neck which is about 1/3 - 1/4 as long as diameter of preceding whorl (Fig. 16). Neck with a weak longitudinal impression below periphery. Umbilicus rimate with a narrow elliptical perforation. Suture deeply impressed, particularly on the apex. Whorls of spire weakly arched. Embryonic whorls smooth. Following whorls have strong ribs that are about 1/3-1/4 width of their interspaces. Ribs becoming weaker and more widely spaced on middle of the spire, but increasing in size on lower two whorls. Penultimate whorl has 20-31 ribs. On neck of last whorl ribs become narrower and poorly defined on the dorsal and mesad surfaces. Dorsal side of neck with a weak nearly straight longitudinal impression, causing a weak indentation on parietal margin within aperture. Aperture broadly auriculate in shape; about 0.95-1.11 times as wide as high, and about 0.14-0.17 times height of shell. Peristome slightly thickened, narrowly and nearly uniformly reflected around aperture. Plane of aperture in lateral profile lying at about 40° to the axis of shell. Columella hollow, 0.12-0.14 times width of whorls. Internal barrier tri-lamellar, consisting of the columella lamella, a short basal lamella and the parietal lamella (Fig. 16). Columella lamella about 2.0 whorls long; with a thickened periphery, beginning 3/4 of a whorl above aperture and ending in anti-penultimate whorl where it is most strongly developed. It extends about 1/4 of distance across the cavity. Occasional small, sharp denticles are present on its surface. Its outer edge deflected upward so that it forms a shallow gutter along columella. Parietal lamella about 2.5 whorls long beginning in anti-penultimate whorl and ending at about 3/4 whorl behind aperture; originating above upper end of columellar lamella by about 1/2 a whorl. Parietal lamella large, projecting downward about a third of distance across cavity and then curves abruptly outward towards palatal wall; bearing a single row of irregularly spaced, very short, thorn-like denticles on its crest in posterior half of penultimate whorl. Columellar lamella about 2.5 whorls long, extending from lower half of anti-penultimate whorl to upper half of body whorl. Basal lamella low and thick, about one whorl long; beginning 1.5 whorls above aperture and

Measurements of the holotype and 13 paratypes (UF 80952) are given in Table 3.

Type Locality.— Puebla, limestone bluff 6.3 km northwest of Tehuacán; 1750 m altitude. Holotype: UF 34377; collected 9 August, 1965 by Fred G. Thompson; Paratypes: UF 80952 (17); same data as the holotype.

Snails were collected at the edge of a limestone

bluff on the south side of the road from Tehuacán to Puebla. The bluff was covered with sparse, bleak, xeric vegetation. Live specimens were found under flat slabs of limestone.

Remarks.— Like *Holospira maxwelli*, this species differs from *H. goniostoma* by lacking a palatal lamella. *Holospira acanthidia* differs from *H. goniostoma* and *H. maxwelli* by its slender shape and rugose sculpture. There are about 15-19 whorls. The apex consisting of about 10 whorls and is slightly convex in outline. The long, slender spire is nearly cylindrical and tends to be constricted below the penultimate whorl. The sculpture consists of strong, widely spaced ribs. The tri-lamellate internal barrier also is distinctive. The long parietal lamella extends through the anti-penultimate and penultimate whorls. In the anti-penultimate whorl it projects downward about half way across cavity and then flares outward toward palatal wall. It bears a single row of minute spines. The parietal and columellar lamellae are offset at their upper ends by about half a whorl. The columella lamella is short, and the low basal lamella is even shorter.

Etymology.— The species name *ακανθα* is from the Classical Greek *ιδιον*, a thorn, and the diminutive suffix *idion*. The name alludes to the short thorn-like denticles on the parietal lamella.

#### The *Holospira rehderi* species-group

This group of medium-sized species is characterized by having thin, translucent shells that are uniform gray or grayish-brown in color. The apex is attenuated, and the whorls are sculptured with strong ribs separated by interspaces that are about 3-4 times as wide as the ribs. The internal barrier is tetra-lamellate with four well-developed lamellae that are visible through the shell wall in fresh specimens. The group is found in extreme western Puebla, adjacent Morelos and northwestern Oaxaca.

#### *Holospira rehderi* Bartsch, 1947

Figs. 17-39

*Holospira rehderi* Bartsch, 1947b: 287-288; fig. 2.

*Holospira morelosensis* Bartsch, 1947b: 288; fig. 4.

Description.— Small to medium in size, 9-15 mm in length. Shell light brownish-gray in color, thin and semi-translucent. Typically consisting of 11.5-13.0 whorls separated by a distinctly impressed suture. Sculptured with well-developed slightly oblique ribs throughout length of apex and spire; ribs vary from crowded with interspaces scarcely wider than ribs, to having interspaces 4-5 times width of ribs. Shell shape highly variable within and between colonies, varying from squat

Table 3. *Holospira acanthidia* n. sp. Shell parameters in mm for the holotype (UF 34377) and 13 paratypes (UF 80952). L = length, W = width, AH = aperture height, AW = aperture width, Wh = whorls, RP = ribs on penultimate whorl, X = mean, SD = standard deviation.

	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
Holotype	12.8	2.9	2.0	2.0	18.6	29	0.23	0.16	1.00
Paratypes									
X	12.6	3.0	2.0	2.0	17.7	24.1	0.24	0.16	1.01
SD	0.6	0.1	0.1	0.1	0.8	2.7	0.01	0.01	0.05
Min.	11.7	2.7	1.8	2.1	16.1	20	0.22	0.14	0.90
Max.	14.1	3.1	2.1	1.9	19.1	31	0.25	0.17	1.11

and barrel-shaped to elongate-cylindrical. Umbilicus openly rimate. Aperture broadly pyriform-shaped with a slight node along parietal margin near posterior corner; aperture projecting forward beyond previous whorl for about a tenth the diameter of the whorl. Internal barrier consisting of four lamellae (Figs. 31, 39). Columellar lamella well-developed in penultimate whorl and extends to first half of last whorl. Parietal lamella begins as a low crest at lower part of anti-penultimate whorl; in penultimate whorl the lamella extends about half way across cavity and curves outward toward outer wall, and then again it is reduced to a low crest in last half of penultimate whorl. Basal lamella well developed on middle of floor of last half of penultimate whorl. Palatal lamella a low, narrow ridge on lower third of outer wall in last half of penultimate whorl, and lies opposite gap between parietal lamella and basal lamella.

Measurements based on the holotypes and three population sample are given in Table 4.

Type Localities.— *Holospira rehderi*. Puebla, Chietla [18° 31'N, 98° 34' W]. Holotype: USNM 543589; collected by Marie E. Bourgeois. USNM 543590 includes 25 specimens labeled as paratypes.

*Holospira morelosensis*. Morelos, Tlaquiltenango [18° 37'N, 99° 10' W]. Holotype: USNM 543591; collected by Marie E. Bourgeois. USNM 543592 includes 10 specimens labeled as paratypes.

Distribution.— *Holospira rehderi* is widespread in Morelos, western Puebla and northwestern Oaxaca from 1000-2100 m altitude. Morelos: 7.2 km SSW of Ticumán, 1033 m alt. (UF34285); limestone ridge 2 km NW of Nopalera (18°48'35"N, 99°03'55"W), 1200 m alt. (UF 200399); 7 km W of Jojutla, 1033 m alt. (UF 34287). PUEBLA: 5 km SSE of Izucar de Matamoros, (18°32'34"N, 98° 25'40"W); 1340 m alt. (UF 200408, UF 233192); microwave tower hill 12.5 km SE of Izucar de Matamoros (18°31'16"N, 98°24'59"W), 1450 m alt.

(UF 200081); 12.6 km SSE of Izucar de Matamoros, 1700 m alt. (UF 34382); 13 km. SE of Izucar de Matamoros, 1475 m alt. (UF 34373). Oaxaca: 2.7 km W of Teposcolula (17°30'22"N, 97°29'50"W), 2100 m. alt. (UF 211612); limestone hill 7 km E of Teposcolula, km Post 7, 2160 m alt. (UF 211630); 2 km NE of Tonalá, 1540 m alt. (UF 34361); 13.4 km NE of Tonalá, 2060 m alt. (UF 34380); 13.5 km N of Tonalá; 2090 m alt. (UF 34284).

Remarks.— This species occurs in numerous isolated colonies over a relatively large geographic area in southern Mexico. Such colonies have independent evolutionary histories, and rather distinct morphologically appearing populations occur throughout this area. Some populations differ quite strikingly, and the initial impression is that they represent different species. However, their morphological characteristics overlap those of other populations so that no consistent distinctions can be made. Bartsch (1947b) had before him eleven specimens of *Holospira rehderi* and twenty-six specimens of *H. morelosensis*. The holotypes are dissimilar in appearance to the extent that Bartsch did not compare the two, though they were described in the same publication. The holotype of *H. rehderi* is elongate and cylindrical in shape (Figs. 17-20). It has widely spaced ribs with interspaces that are 4-5 times as wide as the ribs, and the ribs tend to be discontinuous across the whorl. The holotype of *H. morelosensis* is smaller and is tapered-elongate in shape (Figs. 21-24). It has closely spaced ribs that are about as wide as their interspaces.

Distinctions between *Holospira rehderi* and *H. morelosensis* are inconsistent within large specimen samples. The samples presented in Table 3 were selected to show extreme variations between populations. Other samples bridge the apparent differences between these. Specimens from 2 km NW of Nopalera, Morelos (UF 200399, Figs. 25-31) encompass typical variation

Table 4. *Holospira rehderi* Bartsch, 1947. Shell measurements of the holotypes of *H. rehderi* (USNM 543590) and *H. morelosensis* (USNM 543591), and parameters of three population samples

	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
Holotypes									
<i>rehderi</i>	13.6	3.7	2.4	2.5	13.2	29	0.27	0.18	1.06
<i>morelosensis</i>	12.1	3.7	2.4	2.5	12.3	54	0.31	0.20	1.06
UF 34373 (n = 25). Puebla, 13 km SE of Izucar de Matamoros									
	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
X	11.62	3.34	2.08	2.13	14.46	37.2	0.32	0.19	1.03
SD	0.79	0.15	0.29	0.27	0.83	5.18	0.03	0.04	0.13
Min.	9.3	3.1	1.6	1.8	12.8	24	0.29	0.17	0.80
Max.	12.2	3.7	3.2	2.7	16.1	44	0.36	0.25	1.23
UF 34287 (n = 12). Morelos, 7 km W of Jojutla									
	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
X	13.1	3.5	2.7	2.8	12.4	45.6	0.27	0.21	1.02
STD	0.89	0.32	0.09	0.11	0.41	3.50	0.03	0.01	0.05
Min.	12.0	2.5	2.7	2.5	11.5	38	0.19	0.19	0.95
Max.	14.7	3.8	2.9	3.0	13.1	50	0.29	0.23	1.12
UF 200399 (n = 25). Morelos, 2 km NW of Nopalera									
	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
X	11.9	3.5	2.4	2.5	12.12	42.6	0.29	0.21	1.05
SD	0.39	0.12	0.12	0.11	0.33	3.04	0.01	0.01	0.06
Min.	11.3	3.3	2.3	2.4	11.9	36	0.28	0.20	1.00
Max.	12.5	3.6	2.7	2.7	12.8	47	0.31	0.22	1.18

for the species. Specimens from 7 km W of Jojutla, Morelos (UF 34287, Figs. 32-35) have an unusually large aperture, but a few specimens from the same sample are typical with regard to this character. Specimens from 13 km SE of Izucar de Matamoros, Puebla (UF 34373, Figs. 36-39) tend to be short, squat and barrel-shaped with a larger number of whorls, and have widely spaced ribs. But variation in this sample includes some specimens that closely approach in shape and sculpture the holotype of *H. rehderi*. We conclude that the material we have examined represents a single variable species, *H. rehderi*. *Holospira morelosensis* is a subjective junior synonym.

*Holospira albertoi* Bartsch, 1947

Figs. 40-44

*Holospira albertoi* Bartsch, 1947a: 141-142; fig. 1.

Description.— Shell light grayish-brown; translucent with the parietal, palatal and basal lamellae visible through shell in fresh specimens. Medium sized, 12.1-

15.4 mm long; moderately slender, 0.22-0.27 times as wide as long. Apex attenuated and slightly concave in outline. Spire cylindrical. Sculpture on post-embryonic whorls consisting of about 30-76 distinct thin, lamellar axial ribs. Peristome moderately reflected. Aperture oblique in lateral profile and extending beyond previous whorl (Figs. 41, 44). Internal barrier tetra-lamellate.

Measurements of the holotype and 25 specimens (UF 34383) are given in Table 5.

Type Locality.— Puebla, the steep west bank of a gully on the SE lower flank of Cerro Chimeco, near Petlalcingo, very close to the Oaxaca border at km 309 along the Pan-American Highway; 1400-1500 m alt. [18° 04' N, 97° 54' W]. Holotype: USNM 543495; collected by Ing. Alberto R. V. Arellano.

Distribution.— Puebla. Known only from the immediate vicinity of the type locality. Bartsch reports it from Cerro Sangre de Grado, on the SW side of Km 304 on the Pan-American Hwy. (USNM 543497). We collected it from a bluff along the Rio Petlalcingo, 1 km



Table 5. *Holospira albertoi* Bartsch, 1947. Shell parameters of the holotype and of 25 specimens selected to show variation (UF 34383).

	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
Holotypes UF 34383	15.3	3.7	2.62	2.56	15.4	-	0.24	0.17	0.98
X	14.06	3.38	2.63	2.47	15.21	48.72	0.24	0.19	0.94
SD	0.74	0.13	0.23	0.15	0.62	9.66	0.01	0.02	0.08
Min	12.1	3.2	2.3	2.1	13.4	30	0.22	0.16	0.76
Max	15.4	3.7	3.3	2.8	16.3	76	0.27	0.22	1.13

SW of Petlalcingo, 1350 m alt. (UF 211644, UF 211645), and at 5 km NW of Petlalcingo, 1500 m. alt. (UF 34383).

Remarks.— The translucent shell and the attenuate weakly concave apex are distinctive. This species is similar to *Holospira rehderi* because of its thin shell, its medium size, its color and its distinct costate sculpture.

#### The *Holospira zygoptyx* species-group

The internal barrier is tetra-lamellate. The basal lamella unique among holospirids in that it is stout and flat-topped and has a flange along its outer edge. The flange projects up and then curves outward to mirror the curvature of the parietal lamella. The group includes a single species found near Tehuacán, Puebla.

#### *Holospira zygoptyx* n. sp.

Figs. 45-52

Description.— Shell opaque white with a rust colored apex and a white aperture. Medium sized, about 11-14 mm long; relatively slender, 0.24-0.28 times as wide as long; cylindrical or slightly claviform with a tapered apex that is about a third of the length of the shell. Whorls 12.9-14.4. Suture moderately impressed. Umbilicus rimate or imperforate. Embryonic shell rust colored, smooth consisting of 2.0-2.4 whorls that are narrower but higher the succeeding whorl; not noticeably offset from following whorls. Apex and spire sculptured with low slightly oblique ribs that are about as wide as their interspaces; 52-78 ribs on penultimate whorl. Ribs becoming slightly stronger and more widely spaced on last whorl. Aperture oblique, lying at an angle of about 20-25° in lateral profile (Figs. 45, 52); extending forward slightly beyond body whorl on a short neck. Dorsal side of neck impressed and nearly smooth. Aperture opening broadly auriculate with a wide embayment at posterior corner. Peristome moderately expanded around aperture; narrowest at posterior corner and wid-

est along columellar margin. Columella narrow, straight, about 1/10 width of shell. Internal barrier long; consisting of four lamellae confined mostly to anti-penultimate and penultimate whorls (Figs. 50, 51). Columellar lamella stout; located on center of columella; extending about ¼ of distance across cavity; confined to penultimate whorl (Fig 50, the parietal lamella is broken away to show the columellar lamella). Parietal lamella pendant from middle of roof; two whorls long, originating at beginning of anti-penultimate whorl and extending to end of penultimate whorl, hanging half-way across cavity and then flaring out toward outer wall along its edge, occluding from view the columellar lamella (Fig. 51). Basal lamella lying along middle of floor, confined to lower half of penultimate whorl; stout, low and flattened with its outer edge raised as a narrow shelf and curved outward parallel to edge of the parietal lamella (Figs. 50, 51) Palatal lamella lying along lower third of middle quarter of penultimate whorl opposite the gap between the parietal and basal lamellae.

Measurements of the holotype and 25 paratypes (UF 337051) are given in Table 6.

Type Locality.— Puebla, 1.0 km by road south of San Antonia Texcala (18°22'42"N, 97°27'16"W), 2000 m alt. Holotype: UF 190771; collected 10 April, 1991 by Fred G. Thompson. Paratype: UF 337051 (56), ITCV (25); same data as the holotype.

The type locality lies in an arid scrub-cactus community on a short and narrow limestone reef with a NE-SW axis where it is crossed by Highway 125, 15 km south of Tehuacán on Highway 125 to Huahuapam de Leon. The limestone reef is bounded on either side by shales and clays. Snails were found under limestone boulders at the top of the knoll on the west side of the road.

Distribution.— Known only from the type locality  
Remarks.— This is a tetra-lamellate species with



a white opaque shell that is sculptured with slightly oblique axial ribs that are about as wide as their interspaces. The shell is moderately long and slender with an extended apex. The aperture is broadly auriculate, and projects beyond the body whorl for a short distance at about 25° to the shell axis. The internal barrier is confined to the anti-penultimate and penultimate whorls. This species is unusual within *Holospira* by having the parietal lamella pendent downward beyond the columellar lamella, occluding it from view when the shell is opened. It is unique within the Holospirinae by having a broad, flat-topped basal lamella with the outer edge flaring outward upward and toward the outer wall to mirror the curvature of the parietal lamella.

Superficially *Holospira zygoptyx* is similar to *H. melea* Bartsch, 1926 (see below). The latter is a shorter and squatter species with poorly defined ribs, the shell is broadly terete, and it has a tri-lamellate barrier with the short basal lamella developed as a simple ridge on the floor of the penultimate whorl.

Etymology.— The species name *zygoptyx* from the Classical Greek ζῦγος, a team or pair, and πτύξ, a fold or leaf, and alludes to the mirrored development of the parietal and basal lamellae.

#### The *Holospira melea* species-group

We group the following three species together in the *Holospira melea* species-group because they have relatively small, opaque, glossy white shells that lack distinct ribs on the spire. Instead, the sculpture on the spire consists of low, rounded folds or incremental striations. The two smooth embryonic whorls are not offset in their development from the subsequent apical whorls. The species are tri-lamellate; they lack a palatal lamella. The parietal lamella is very large, and along its highest section its edge curves outward toward the outer wall. The basal lamella is low and rounded.

Tri-lamellate holospirids occur in scattered regions of southern Mexico (Puebla, Oaxaca and Veracruz), in Querétaro and in Arizona. They have in common the

presence of a columellar, a parietal and a basal lamella, but lack a palatal lamella. They have little else in common. The tri-lamellate stage appears to have been derived independently in the three geographic regions, and also it appears to have been independently derived among some of the species from southern Mexico, such as *Holospira acanthidea* and *H. maxwelli* which are discussed above. On the basis of the tri-lamellate condition all of these species could be placed in *Malinchea* Bartsch, 1945 (= *Tristemma* Bartsch, 1906), which Bequaert and Miller (1973: 141) consider a synonym of *Holospira* subgenus *Eudistemma* Dall, 1895. *Eudistemma* is a group of species found in Arizona and New Mexico. Species from Puebla appear not to be closely related to *Holospira* s. s., and we also doubt that they are closely related to the subgenus *Eudistemma*.

#### *Holospira melea* Bartsch, 1926

Figs. 53-56

*Holospira (Tristemma) melea* Bartsch, 1926: 5; pl. 1, fig. 11. Pilsbry, 1953: 141.

Type Locality.— Puebla, Ixcaquixtla. Holotype: USNM 363145. Collected by C. R. Orcutt during botanical explorations in southern Mexico.

Distribution.— Known only from the type locality. The holotype is the only known specimen.

Remarks.— We provide figures of the holotype of *Holospira melea* and the following species, *Holospira hyperia* Bartsch, 1926. *Holospira melea* and *H. hyperia* are known only from single specimens each. The holotype of *H. melea* is an adult shell in which the internal barrier appears to have reached definitive development. The holotype of *H. hyperia* may not be mature, as is suggested by the adnate aperture. Both species are poorly known. They are readily recognized by their shell shapes. Measurements for the two holotypes are as follow.

	Length	width	ApH	ApW	whorls
<i>Holospira melea</i>	13.9	4.3	2.5	2.7	12.6
<i>Holospira hyperia</i>	13.0	4.6	3.1	2.9	14.0

Table 6. *Holospira zygoptyx* n. sp. Shell parameters of the holotype (UF 34373) and 25 paratypes (UF 337051).

	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
Holotype	14.7	3.6	2.8	2.9	14.5	63	0.24	0.19	1.04
Paratypes									
X	12.44	3.26	2.27	2.35	13.44	66.04	0.26	0.18	1.05
SD	0.83	0.11	0.29	0.15	0.52	6.52	0.02	0.02	0.13
Min.	11.2	3.0	2.2	2.1	19.9	52	0.24	0.17	0.98
Max.	14.1	3.4	3.3	2.6	14.4	78	0/28	0.20	1.14

*Holospira hyperia* Bartsch, 1926

Figs. 57-59

*Holospira (Tristemma) hyperia* Bartsch, 1926: 6; pl. 1, fig. 15. Pilsbry, 1953: 141.

Type Locality.— Puebla, Esperanza. Holotype: USNM 363146. Collected by C. R. Orcutt, while conducting botanical explorations in southern Mexico.

Distribution.— Known only from the type locality.

*Holospira eburnea* n. sp.

Figs. 60-66

Description.— Shell pupiform; cylindrical in shape with a gently rounded conical apex. Spire glossy white with a dark-tinged apex in which the embryonic whorls are reddish-black in live specimens; peristome white; interior of aperture tinged with orange or light brown. Shell small-medium in size for a *Holospira*; up to about 13 mm in length, and 0.28-0.39 times as wide as long with 10.6-13.5 whorls; spire with 4-6 whorls. Suture shallow but distinctly impressed; whorls weakly arched between suture. Embryonic whorls smooth and protruding. Subsequent whorls of apex with oblique, low, smooth, rounded ribs that are about as wide as their interspaces. Usually ribs are vague or obsolete on spire, but in some specimens they may be nearly continuous to the base. Umbilicus usually imperforate; occasional specimens rimate. Aperture broadly auriculate in shape with a weak indentation behind parietal margin near posterior corner; plane of aperture parallel to shell axis; extending forward slightly beyond previous whorl (Fig. 66). Aperture slightly wider than high and about 0.21-0.25 times length of shell. Peristome conspicuously reflected along outer, basal and columellar margins, narrower along parietal margin. Shell wall thin but strong. Axis straight-sided and nearly uniformly wide in lower whorls; 0.12-0.14 times shell width. Internal barrier confined to penultimate whorl, not visible from within aperture (Figs. 64, 65). Tri-lamellate; palatal lamella absent. (One specimen of 14 opened had a very weak

elongate deposit where the palatal lamella would be). Columellar lamella one whorl long; located on center of axis; thin, blade-like; extending about 1/5 of distance across cavity. Parietal lamella one whorl long; along its middle it is pendent from the center of the roof to center of cavity and then is reflected toward outer wall. Basal lamella about a half whorl long, located in middle of penultimate whorl; low and rounded.

Measurements of the holotype and 25 paratypes (UF 341576) are given in Table 7.

Type Locality.— Puebla, limestone hill-top 7.6 km south-southwest of Molcaxac (18°40.1'N, 97°54.2'W); 2040 m alt. Holotype: UF 34294; collected 23 October, 1970 by Fred G. Thompson. Paratypes: UF 341576 (345), ITCV (200); same data as the holotype. UF 200092 (278); same locality, collected 22 February, 1992 by Fred G. Thompson. UF 200589 (70); same locality, collected 28 October, 1992 by Fred G. Thompson and Elizabeth L. Raiser.

The type locality is in submesic scrub vegetation with sparsely scattered small deciduous trees and shrubs. *Holospira eburnea* was collected on a limestone hill-top from under limestone blocks and caliche. Specimens tended to cluster under stones that lay against small clumps of vegetation. Snails predominantly were under stone that lay on limestone bedrock. Less frequently they were under stone that lay on the lateritic soil. *Holospira eburnea* was very abundant on the three occasions of our visits to the type locality. It is the only species of snail we found there.

Distribution.— Known only from the type locality.

Remarks.— This is a tri-lamellate species with the internal barrier confined to the penultimate whorl, and consists of a low columellar lamella, an enlarged parietal lamella and a low short basal lamella. It is recognized by its small pupiform shell that is glossy white with a dark apex. The apical sculpture consisting of low, close oblique ribs that become nearly obsolete on the spire. The shallow suture separates about 10.5-13.5

Table 7. *Holospira eburnea* n. sp. Shell parameters of the holotype (UF 34294) and 25 paratypes (UF 341576).

	L	W	AH	AW	Wh	W/L	AH/L	AW/AH
Holotype	12.2	3.9	2.8	2.8	12.0	0.32	0.23	1.00
Paratypes								
X	10.80	3.55	2.36	2.38	11.84	0.33	0.22	1.01
SD	1.10	0.18	0.19	0.19	0.80	0.03	0.08	0.06
Min.	9.4	3.3	2.1	2.1	10.6	0.28	0.21	0.96
Max.	13.2	3.9	2.9	2.9	13.5	0.39	0.25	1.07

whorls. The aperture is broadly auriculate, extending slightly forward beyond the previous whorl. The peristome is strongly reflected and is separated from the previous whorl.

*Holospira eburnea* is similar to *H. melea*. The latter is terete in shape with a more elongate apex, and a deeper suture (Figs. 53-55). The sculpture on the apex consists of fewer and more widely spaced ribs. The aperture projects farther forward, and the peristome is narrower. The internal barrier extends through the antepenultimate and penultimate whorls. The parietal lamella is nearly two whorls in length. On its crest is a single row of very small thorn-like denticles.

*Holospira eburnea* is similar to *H. hyperia*, which has a stockier shell with an abbreviate apex, the suture is shallower (Figs. 57, 58) and the peristome is adnate to the previous whorl. As in *H. eburnea*, the internal barrier is confined to the penultimate whorl, but the parietal lamella is much weaker.

Etymology.— The species name *eburnea* is from the Latin *eburneus*, of ivory, alluding to the color of the shell.

#### The *Holospira teres* species-group

This is a group of three large species found in extreme eastern Puebla and the immediate vicinity of Veracruz. This heterogeneous group is difficult to define. The species have in common large opaque white shells with a white apex. The embryonic whorls are relatively large, and grade evenly into the following whorls without being noticeable offset or protruding. The suture is shallow. The spire is smooth or weakly striate, although some species may be weakly costate near the base of the spire. The internal barrier consists of four lamella in most species. However, the palatal lamella is highly variable in the degree of its development. In some forms it is present as a low white callus, and in others it is obsolete or absent. The parietal lamella is long and it projects downward half-way across the whorl. Its edge is reflected outward toward the palatal wall along its highest section.

#### *Holospira teres* (Menke, 1847)

Figs. 67-75

*Cylindrella teres* Menke, 1847: 1. Philippi, 1847: 5; pl. 3, figs. 5-6. Pfeiffer, 1848: 381-382.

*Holospira teres* (Menke). Fischer and Crosse, 1873: 327-328. Martens, 1897: 279; pl. 17, fig. 3. Pilsbry, 1902: 104-105; pl. 15, figs. 18-20. Haas, 1933: 271. Bartsch, 1943: 58.

*Holospira teres minor* Martens, 1897: 278.

Description.— Shell large and stocky, over 17 mm

long, 0.30 times as wide as high; aperture about 0.20 times height of shell. Lectotype with 13.2 whorls. Apex rather extended with 2.2 smooth protruding embryonic whorls, which sit at a slightly oblique angle to shell axis. Embryonic whorls nearly flattened peripherally with a weak shoulder; stacked and button-like. Following five apical whorls have numerous close weakly sigmoid axial ribs. Whorls of spire smooth and weakly striate with irregularly spaced incremental striation. Last 1.5 whorls with numerous close ribs that are higher than wide. Penultimate whorl with 76 ribs. Umbilicus imperforate. Aperture free from previous whorl and advanced slightly on a short neck; slightly wider than high; slightly oblique to shell axis in lateral profile (Fig. 68). Peristome of lectotype very thin, and weakly reflected only along parietal and columellar margins; basal and palatal margins are thin and chipped to a degree that suggests shell is not quite mature. Internal barrier consists of three lamella. Columellar lamella inclined vertically outward from the center of the columella; low and rounded along its periphery; 1.5 whorls long with its lower end visible from within aperture. Parietal lamella thin and pendent from the center of the parietal wall. Its upper half extends about half-way across whorl and curves outward toward palatal wall (Figs. 68, 70). It begins at the same level as columellar lamella and is one whorl long. Lower half slightly more than half as high as upper half and it is vertical to roof of whorl. Basal lamella compressed; about a half whorl long; slanted slightly toward columella. It originates forward of origin of parietal lamella and lies at about a third of the distance from the palatal wall to the columella. Basal lamella highest opposite high point of parietal lamella and then becoming a rounded ridge forward of that point. There is no indication of a palatal lamella (but see Remarks below).

Measurements in mm of the lectotype (SMF 7023) and two paralectotypes (BMNH 1996135) are as follows.

	length	width	ApH	ApW	whorls
Lectotype	17.6	5.2	3.4	3.6	13.2
Paralectotype	20.1	5.7	4.5	4.4	12.6
Paralectotype	22.0	7.8	—	—	13.2

Type Locality.— “State of Puebla”. Lectotype by present designation: SMF 7023; collected by F. Liebmann, 1840-1843. This specimen was cited by Haas (1933, *Archiv Molluskenkunde*, 65: 271) as “der Typ”. Some or all of Menke’s collection was purchased by A Gysser, which was subsequently acquired by the Senckenberg-Museum (R. Janssen, personal communication).

The lectotype is the only specimen in the Senckenberg-Museum (Figs. 67-70). The Senckenberg-Museum specimen is selected as the lectotype because

of Haas's notation. Three syntypes in the British Museum (Natural History), 1996135, are here in designated paralectotypes. One is illustrated (Figs. 71-75). They bear no additional information concerning their provenance. We refer them to *Holospira teres*, but with some doubt because of their larger size and more attenuate apex. Radiographs comprising Figs. 72-75 of the paralectotype illustrated in Fig. 71 show that the internal barrier is very similar to that of the lectotype.

Distribution.—Unknown.

Remarks.—This species is recognized by its opaque glossy white color with a white apex. It is large, stout and cylindrical-conical in shape. The apex is sculptured with numerous close, fine tread-riblets. The spire is smooth but marked with incremental striation. The last whorl has coarse axial ribs. The internal barrier is tri-lamellate and is confined to the penultimate whorl and the upper half of the body whorl. The columellar lamella is relatively weak and narrow. The parietal lamella extends half way across the cavity and then curving toward the outer wall. The basal lamella is low and is about half a whorl long.

This is a large species compared to most other *Holospira* known from Puebla. Three aspects of its shell relate it with other species from the region about Tecamachalco, Puebla. The shell is glossy white, the apex is attenuated with protruding embryonic whorls and the last whorl is sculpture with numerous close, sharp ribs. The high, outwardly flaring parietal lamella, and the short but high, thin, basal lamella are similar to *Holospira hogeana* Martens, 1897 from near Tecamachalco. There is no indication of a palatal lamella in the lectotype, but this may be due to either of two causes. The shell had been opened previous to when we examined it, and the palatal lamella may have been on the portion of the wall that was removed. In this species-group the palatal lamella is very weakly developed, and it could easily have been unnoticed. Another possibility is that the palatal lamella may not yet have developed in the growth of the shell. The thin lamella of the lectotype appear to be under-developed. The weak development of the peristome also indicates that the lectotype is slightly immature.

*Holospira hogeana* Martens, from north of Tehuacán, near Chapulco and Azumbilla, is a large species that is similar in shell-size to *H. teres*, but the apex is shorter, the shell is dull white, not glossy as in *H. teres*, the palatal lamella is very weak or obsolete, and the basal lamella when present is a short, low, broadly rounded ridge. The lectotype of *H. teres* lacks a palatal lamella, but this may be an artifact of various causes. The specimens figured as *Cylindrella teres* by Pfeiffer (1862a:

pl. 6, figs. 28-29) and copied by Pilsbry (1902: pl. 15; figs. 18-19) appear to be *H. hogeana*.

*Holospira hogeana* Martens, 1897

Figs. 76-85

*Holospira teres hogeana* Martens, 1897: 280; pl. 16, fig. 17. Pilsbry, 1902: 104; pl. 23, fig. 71.

Description of the lectotype (Figs. 76, 81).—This is an old, weathered, lusterless shell, which in other respects is in good condition. Color uniform white. Moderately large, about 17 mm long; about 0.28 time is wide as high. Containing about 15 whorls: Spire cylindrical with a convex apex. Umbilicus narrowly perforate. Embryonic shell not conspicuously set off from following whorls of spire; consisting of 2.5 smooth whorls that gradually increase in width; first embryonic whorl inflated; second whorl shorter but wider than the first. Apex below embryonic whorls consisting of five whorls that form an evenly arched dome above spire; apical whorls strongly arched between deeply impressed suture; sculptured with numerous closely spaced oblique thread-ribs that are about as wide as their interspaces; upper ends of ribs recurved posteriorly. Whorls of spire nearly flat-sided and separated by a weakly impressed suture. Sculptured as on the apex, except that the ribs are weaker developed and are more widely spaced until the last whorl where they become stronger and more crowded toward the aperture. Aperture extended forward on a very short neck, the length of which is about 0.07 diameter of last whorl. Columella straight, 0.17 times width of shell and concave in outline within each whorl. Internal barrier consisting of four lamellae. The following description is based on radiographs of the lectotype (Figs. 77-80). Columellar lamella low, rounded, located on middle of columella; 1.5 whorls long confined to penultimate whorl and upper half of last whorl. Parietal lamella pendent from middle of the roof in the penultimate and anti-penultimate whorls; reaching its greatest height in the upper half of penultimate whorl; it gradually tapers below, and more abruptly above; along its highest point it curves outward toward palatal wall. Basal lamella a low semi-lunar ridge near the periphery of last half of penultimate whorl. Palatal lamella a low callused ridge located just below middle of outer wall in first quarter of penultimate whorl opposite and just below outward curvature of parietal lamella.

Measurements of the lectotype are as follow. Length, 17.2 mm; width, 4.9 mm.; length of aperture, 3.4 mm; width of aperture, 3.1 mm.; whorls, 15.3; embryonic whorls, 2.5. The fifth whorl is perforated by an insect hole.

Measurements based on 25 specimens from a lime-

Table 8. *Holospira hogeana* Martens, 1897. Measurement based on 25 specimens (UF 190779)..

	L	W	AH	AW	Wh	W/L	AH/L	AW/AH
X	16.2	4.9	3.3	3.3	17.3	0.30	0.20	1.20
SD	1.3	0.38	0.17	0.39	0.78	0.04	0.02	0.09
Min.	11.9	4.0	3.0	3.0	15.5	0.25	0.18	0.91
Max.	18.0	5.8	3.7	4.9	18.2	0.34	0.26	1.12

stone hill 1 km east of Azumbilla, Puebla (UF 190779) are given in Table 8.

Live-collected specimens from 1 km northeast of Azumbilla, Puebla (UF 190779) are described as follow. Specimens from a near by locality, 1 km NE of Chapulco are illustrated (Figs. 82-85). Shell uniform white, except that the embryonic whorls and the earliest whorls of spire are light tan. Peristome white. Throat behind aperture light tan. Large, stocky, about 12-18 mm long; 0.25-0.34 times as wide as high. Cylindrical in shape with a relatively short convex apex. Embryonic whorls protruding. Last whorl enlarged with a short neck extending 1/5 the diameter of shell beyond periphery of last whorl; rounded below periphery, not pinched inward. Umbilicus narrowly rimate. Suture shallow. Shell consisting of about 15.5-18.2 whorls. Whorls of spire nearly flat-sided. Apex consisting of about 8-9 whorls that are slightly rounded peripherally. Embryonic shell consisting of about 2.5-2.6 smooth whorls. First two embryonic whorls strongly protruding. Apical whorls with numerous, fine ribs that are as wide as their interspaces. These become diminished on first whorl of spire and are absent or are reduced to weak striations or segments on middle whorls of spire. Ribs again becoming well defined and stronger on last two whorls, and are distinct but compressed near peristome. Aperture obovate in shape with a slight longitudinal indentation in parietal wall behind posterior corner; parietal lip convex in outline between columella and posterior corner; aperture 0.28-0.34 times as wide as high; height of aperture about 0.19-0.23 times length of shell. Peristome narrowly reflected around aperture, but not noticeably thickened; narrowest at posterior corner; widest along basal lip; plane of aperture in lateral profile parallel vertical. Axis straight and hollow about 0.18-0.23 times width of whorl, bearing a low, spiral swelling in its middle. Internal barrier usually tri-lamellate. Columella lamella about 1.5-2.0 whorls long beginning about 0.6 whorls posterior to aperture; increasing in size to a low, rounded cord in the penultimate whorl and gradually diminishing into the anti-penultimate whorl. Parietal lamella about two whorls long, beginning one-half whorl behind aperture as a low

ridge on roof of the anti-penultimate whorl and then rapidly increasing in height and reflected outward towards shell wall as a high narrow blade in penultimate whorl. Parietal lamella frequently bearing numerous, very short thorn-like denticles along its crest; denticles not arranged in any definite pattern. Basal lamella may bear similar denticles. Basal lamellae very weak and confined to penultimate whorl where it is usually developed as a low callus ridge or may be absent. Palatal lamella almost always absent. When present it consists of a weak peripheral crest below the middle of the outer wall of the penultimate whorl.

Type Locality.— Veracruz, Maltrate [18° 48' N, 97° 16' W; Alt. 2299 m], on the railway between Veracruz [City] and the City of Mexico, a little west of Orizaba, eastern slope of the plateau. Lectotype by present designation: British Museum (Natural History) 1901.6.22.1903; collector unknown

This lot contains a single specimen. The label with the specimen states "syntype?". There is no evidence that Martens had more than a single specimen before him. In the event that other specimens labeled as syntypes are discovered the specimen cited above is herein designated as the lectotype. It conforms very closely to the figure in von Martens, except that it has an insect hole in the 5th whorl, which is not indicated in Martens' figure. His figure has a width/height ratio of 0.284. This is slightly wider than his measurements would indicate, which give a ratio of 0.25. My measurements give a ratio of 0.285.

Distribution.— This species occurs in eastern Puebla from the Sierra de Tecamachalco, near Tecamachalco, east to the Puebla-Veracruz Escarpment near Ciudad Mendoza, Veracruz, and is found from 1750-2430 m altitude. Puebla: 1 km NE of Chapulco, 1940 m alt. (UF 34376, UF 330927) 1.5 km NNE Chapulco, 1900 m alt. (UF 34292); 3 km NNE Chapulco, 1940 m alt. (UF 34290); 4 km NNE Chapulco, 1940 m alt. (UF 34291); 5 km NE of San Martin Esperillo (18°45'11"N, 97°31'36"W), 2430 m alt (UF 200585); limestone hill 1 km E of Azumbilla, 23 km N of Tehuacán (18°37'23" N, 97°23'35" W), 2150 m alt. (UF 190779); 1.5 km WNW

Azumbilla 2400 m alt. (UF 34288); 3 km NW Azumbilla (18°39'21"N, 97°24'37"W), 2100 m alt. (UF 200561); Cerro San Juanico, 4 km E of Azumbilla (18°39'49"N, 97°28'19"W), 1800 m alt. (UF 233194); 2 km N of Tecamachalco, 2300 m alt. (UF 34295); 2 km SE of Tecamachalco, 2140 m alt. (UF 190764, UF 190753); 3.7 km SE of Tecamachalco, 2300 m alt. (UF 34287); limestone escarpment 23 km W of the Puebla-Veracruz state line, 10 km E of Esperanza (ca. 18°50'N97°25'W), 2350 m alt. (UF 81774). Veracruz: 20 km WSW of Ciudad Mendoza, 1750 m alt. (UF 34372).

**Habitat.**— This species occurs in xeric areas with shrubs, *Agave* and cactuses, where it is found on soil at or near the base of limestone slopes. We have collected it at a number of stations, but we never encountered it on exposed limestone slopes or ledges. Near Chapulco it was associated on the soil with *Bostrichocentrum* sp.

**Remarks.**— The species is recognized by the following combination of characters. The shell is opaque white, up to 18 mm long; stocky and bullet shaped with a relatively short rounded apex. The apex is sculptured with close distinct rib-threads which become obsolete on the nearly smooth spire. The internal barrier is trilamellate, and is confined to the anti-penultimate and penultimate whorls. The parietal and columellar lamellae are well developed. The basal lamella is low or absent and is confined to penultimate whorl. Generally the palatal lamella is absent. In occasional specimens it is indicated by a low callused ridge.

*Holospira hogeana* is distinguished from *H. teres* by its nearly lusterless shell with an abbreviated rounded apex, and its internal barrier. Generally the basal lamella is weak, and it is located along the outer periphery of the floor, not in the center as it is in *H. teres*.

*Holospira hogeana* shows considerable variation

in shell size from one population to the next. Most specimens closely approximate the measurements given above. Some population samples lack a basal lamella, or it is reduced in size to a simple rise on the basal wall.

*Holospira teotitlana* Bartsch, 1945

Figs. 86-100

*Holospira teotitlana teotitlana* Bartsch, 1945: 92-93; fig. 2.

*Holospira teotitlana filia* Bartsch, 1945: 93-95; fig. 1.

**Diagnosis.**— Large, up to 17-23 mm in length and 0.24-0.29 times as wide as long. Whorls 12.3-14.1, weakly arched between suture. Shell solid, opaque; uniform white or light tan in color; cylindrical in shape with a moderately short rounded apex. Apex sculptured with very fine oblique incremental threads or smooth. Spire generally smooth, but usually bearing distinct oblique axial ribs on last whorl or two. Embryonic whorls not conspicuously set off from following whorls. Aperture is broad and subcircular with a weakly differentiated posterior corner. Peristome moderately reflected and projects beyond periphery of last whorl (Figs. 89, 95, 100). Internal barrier tetra-lamellate; confined to penultimate whorl and first half of body whorl (Fig. 90).

Measurements based on the two holotypes and 25 specimens from UF 34283 are given in Table 9.

**Type Localities.**— *Holospira teotitlana teotitlana*: Oaxaca, foothills of Cerro Blanco (Cerro de Tizatepec) at Teotitlán del Camino. Holotype: USNM 431954; collected by Maria E. Bourgeois.

*Holospira teotitlana filia*: Oaxaca, Cerro Tizatepec, near Ignacio Mejia. Holotype: USNM 431957; collected by Maria E. Bourgeois. Ignacio Mejia (18° 06' 02N, 97° 07' 41W) is a railroad station ca 5 km SW of Teotitlán del Camino at 788 m.

Table 9. *Holospira teotitlana* Bartsch, 1945. Shell parameters of the holotypes of *Holospira teotitlana teotitlana* Bartsch, 1945 (USNM 431954), *Holospira teotitlana filia* Bartsch 1945 (USNM 431957) and of 25 specimens selected to show variation (UF 34283).

	L	W	AH	AW	Wh	W/L	AH/L	AW/AH
Holotypes								
<i>teotitlana</i>	17.0	5.5	3.6	3.7	12.5	0.32	0.21	1.03
<i>filia</i>	19.4	6.0	4.0	4.1	13.2	0.31	0.21	1.03
UF 34283								
X	20.81	5.61	4.17	4.17	13.14	0.27	0.20	1.00
SD	0.84	0.20	0.33	0.36	0.45	0.01	0.02	0.06
Min.	19.0	5.1	3.5	3.0	12.3	0.24	0.16	0.84
Max.	22.6	6.0	4.6	4.7	14.1	0.29	0.23	1.08

Distribution.— This species is found in extreme eastern Puebla and adjacent Oaxaca in the Tehuacán - Tomellín Valley, at 790-950 meters altitude. Puebla: 10.7 km N of Teotitlán del Camino; 950 m alt (UF 34383); 2.5 km N of Teotitlán del Camino (UF 200775); 10 km NW of Coxcatlán, 880 m alt (UF 337311); 11.5 km SSE of Coxcatlán (UF 337317). Oaxaca: 2.7 km S, 1.5 km W of Teotitlán del Camino (18°06.3'N, 97°05.2'W), 810 m alt (UF 337299); 8 km S of Teotitlán del Camino (18°05.2' N, 97°04.6'W), 910 alt. ((UF 200425); 2.5 km N of San Juan de Los Cues (18°03.9'N, 97°04.1'W), 850 m alt. (UF 337284); 1.3 km N of San Juan de Los Cues (18°03.3'N, 97°04.4'W) (UF 337305).

Remarks.— *Holospira teotitlana* is similar to *H. hogeana* in the general appearance of the shell. Both are large species with strong, opaque, uniform whitish shell. Both have similarly sculptured shells. Both have non-conspicuously protruding embryonic whorls that are not offset in the angle of growth nor conspicuously differing in size from the following whorls of the apex. This is an unusual condition among southern Mexican *Holospira*. Generally, *H. teotitlana* has a tetra-lamellate internal barrier confined to the penultimate whorl and upper body whorl, whereas *H. hogeana* has a trilamellate internal barrier that occupies the antepenultimate and penultimate whorls.

#### The *Holospira pfeifferi* species-group

A group of medium- to large-sized tetra-lamellate species. The shell is lusterless, light brown or tan and is sculptured with numerous closely spaced axial riblets. The group is known from the Tehuacán-Tomellín Valley in extreme southeastern Puebla and adjacent Oaxaca. The area around Tomellín, Oaxaca has extensive outcrops of calcareous strata, which remain virtually unexplored for mollusks. The valley is known for its endemic Cactacea.

#### *Holospira tetralasma* Pilsbry, 1902

*Cylindrella pilocerei* Pfeiffer. Philippi, 1847: 5; pl. 3, figs. 7, 8. Pfeiffer, 1848: 382. Pfeiffer, 1859: 710. Pfeiffer, 1862b: 61; pl. 6, figs. 32, 33. (Not *Cylindrella pilocerei* Pfeiffer, 1841, a *nomen nudum* (Opinion 1932: International Commission of Zoological Nomenclature, 1999).

*Holospira pilocerei* (Pfeiffer). Fischer and Crosse, 1873: 329; pl. 17, fig. 5. Strebel, 1880: 82; pl. 5, fig. 1. Martens, 1897: 278. (Not *Cylindrella pilocerei* Pfeiffer, 1841).

*Holospira tetralasma* Pilsbry, 1902: 73-75; pl. 21, figs. 23-27.

Type Locality.— Unknown. Location of type unknown.

Distribution.— Unknown.

Remarks.— Pilsbry named this species on the basis of the description and figure given in Strebel. The location of the specimen upon which the description and illustration are based is unknown. The characteristics of size, shape and sculpture as depicted by Strebel suggest that this species is most closely related to *Holospira pfeifferi*.

#### *Holospira pfeifferi* (Menke, 1847)

Figs. 101-105

*Cylindrella pfeifferi* Menke, 1847: 1. Philippi, 1851: 6, figs. 4. Pfeiffer, 1848: 382. Pfeiffer, 1862b: 60; pl. 6, figs. 30-31.

*Holospira pfeifferi* (Menke). Martens, 1860: 40.- Tryon, 1868: 313; pl. 15, fig. 34. Fischer and Crosse, 1873: 323-325. (exclusive of var. b). Strebel, 1880: 84-85; pl. 13, fig. 12. Martens, 1897: 280. Pilsbry, 1902: 80-81; pl. 22, figs. 49-51.

Description.— Shell bluish gray in color with a glossy white peristome; interior of aperture faint grayish-brown. Shell terete in shape without marked differentiation between the apex and the spire. Lectotype with an elongate-conical apex of seven whorls and a cylindrical spire of five whorls; sides of spire weakly convex. Moderately large and stocky, about 16.1-17.4 mm long, and about 0.32 times as wide as high. Whorls 12.0-12.7. Suture deeply impressed on apical whorls, shallow on spire. Apical whorls moderately arched; whorls on spire weakly arched. Base of last whorl obtusely angulate. Umbilicus rimate. Embryonic whorls 2.5; large, about 1.5 mm in diameter, almost a third the width of the spire; first embryonic whorl swollen and button-shaped; second whorl shorter but wider; embryonic whorls minutely granular. Postembryonic whorls uniformly sculptured with strong protracted ribs that are about as high as wide and are about a third the width of their interspaces; ribs slightly sigmoid and knobby at their bases; their upper ends weakly crenulate suture; lectotype with 66 ribs on penultimate whorl; paralectotype with 53 ribs. Aperture nearly circular; flattened across parietal margin; plane of aperture prosocline, lying at an angle of 10° to shell axis. Peristome adnate to previous whorl, and slightly crenulate where it crosses over ribs on body whorl; peristome uniformly thickened and moderately reflected along outer, basal and columellar lips. Columella weakly sigmoid, about 0.1 times width of whorl. Internal barrier consisting of four lamellae. The following description is based on radiographs of the lectotype (Figs. 102-105). Columella lamella confined to

penultimate whorl; thick, about 1/5 width of cavity and protruding from columella at about a fourth of the distance above floor; lower end visible from within aperture. Parietal lamella pendent from the middle of roof and confined to penultimate whorl; gradually tapered along its upper half; thickened along outer edge, which is strongly reflected toward the outer wall of the whorl. Basal lamella projecting as a short narrow blade from the middle of the floor in last quarter of penultimate whorl and lying immediately below the parietal lamella. Palatal lamella consisting of a low rounded callus one half a whorl long, and located just above floor of last half of penultimate whorl.

Measurements in mm of the lectotype and paralectotype are as follow.

	length	width	ApH	ApW	whorls
Lectotype	16.1	5.1	4.0	4.0	12.0
Paralectotype	17.4	5.5	3.9	4.0	12.7

Type Locality.— Puebla, Tehuacán. Lectotype by present designation: British Museum (Natural History) 1996134. There are three specimens labeled as syntypes in the British Museum. These are from the Cuming Collection. The specimen selected as the lectotype most closely conforms to the description in Menke and most closely matches the figure in Philippi. The paralectotype is larger, and its shell is more cylindrical in shape than is the lectotype. In all other aspects its shell is similar to the lectotype except that it has a fractured peristome. The third specimen in the British Museum is a different species, *Holospira teres*. Pfeiffer (1862: 60; pl. 6, figs. 30-31) described and figured another specimen which was in his collection, most of which was destroyed during the war of 1939-1944. I have been unable to locate the specimen. His figure is very similar to the lectotype.

Distribution.— *Holospira pfeifferi* is known only from the type specimens. It has not been found since its original discovery. Tehuacán, as cited in early literature, referred to the general region and not just to the city. We have collected at many stations in the area, and we have not found any population that is identifiable with this species. However, the similarities of sculpture and the internal barrier of *H. pfeifferi* to the following species are striking similar.

Remarks.— This species is distinguished by the following combination of characters. The shell is bluish-gray in color. It is moderately large, 16.1-17.4 mm long and terete in shape with a well-differentiated apex and spire. There are 12.0-12.7 whorls sculptured with strongly costulate; ribs that weakly crenulate the suture above and are knobby along the base. The embryonic whorls are large and protruding. The peristome is adnate to the previous whorl. The internal barrier is tetra-

lamellate and confined to the penultimate whorl, except that the columellar lamella extends downward to the point where it is visible from within the aperture.

*Holospira pfeifferi* is similar to *H. oaxacana* because of its sculpture, shape and internal barrier.

*Holospira oaxacana* Bartsch, 1906

Figs. 106-109

*Holospira oaxacana* Bartsch, 1906: 132-133; pl. 4, fig. 5.

Description.— Shell opaque, light tan in color (the three known specimens are dead-collected shells). Length up to 18 mm. long. Stout, 0.30-0.33 times as wide as high. Nearly cylindrical with a moderately extended convex-conical apex. Whorls 11.0-11.5. Sculpture consisting a numerous close sinuous, oblique axial ribs that are about as wide as their interspaces; about 100 on penultimate whorl. Peristome most strongly reflected along columellar margin; narrow and nearly straight across parietal margin. Aperture slightly oblique in lateral profile; not projecting beyond periphery of previous whorl. Columella narrow, nearly straight. Internal barrier tetra-lamellate; confined principally to last half of penultimate whorl. Palatal lamella weakly developed.

Type Locality.— Oaxaca, Tomellín. Tomellín [17°45'N, 96°57'W] is a railroad station near Cuicatlán at the south end of the Tehuacán-Tomellín Valley. Lectotype by present designation: USNM 175085; collected by C. R. Orcutt, Paralectotypes: USNM 1025749 (2).

Bartsch did not designate a holotype among the three specimens he had before him. He figured the largest specimen, which was set aside in a separate vial accompanied by a label stating "TYPE". We select this specimen as the lectotype (Fig. 106). The other two specimens are designated paralectotypes. One paralectotype is worn nearly smooth (Fig. 107). The second specimen has fine oblique axial ribs (Figs. 108).

Distribution.— Known only from the type locality.

Remarks.— Bartsch's photograph of the lectotype is almost featureless. It does not depict the fine, close, ribbed sculpture of the shell, although he describes it clearly. Bartsch opened the posterior side of a paralectotype (Figs. 108, 109) as well as the lectotype to observe the internal barrier. His description of the barrier in the lectotype is very accurate, although he did not illustrate it. The lectotype has four lamellae in the penultimate whorl. The columellar, parietal, and basal lamellae are well developed. The palatal lamella is present as a low ridge. The barrier in the paralectotype is identical in placement and development to the lectotype, except that it lacks a distinct palatal lamella, other than a slight callus on the internal wall. We figure the opened paralectotype to illustrate the internal barrier (Fig.



109). The opening on the posterior side of the shell in the lectotype is too narrow to permit this feature to be photographed.

*Holospira rhinion* n. sp.

Figs. 110-116

Description.— Shell thin but solid, translucent, light tan, lusterless, rough in appearance, peristome and interior of aperture white. Large, 13.3-16.9 mm long; stocky, 0.26-0.33 times as wide as long. Terete in shape with an attenuated apex, widest at top of spire (5-6 whorls above aperture), and diminishing in width below. Whorls 11.5-14.2; nearly flat sided on spire; separated by a shallow suture. About 2.3 embryonic whorls; button-shaped and protruding, smooth, usually same color as following whorls. Apex and spire sculptured with fine, generally oblique riblets that are about as wide as their interspaces; ribs nearly uniform in development through length of shell but becoming more strongly developed on last whorl. Aperture ample and sub-circular with a weak indentation along parietal margin near posterior corner; aperture usually wider than high; height about 0.19-0.26 times length of shell; plane of aperture lying at a slight angle to axis of shell and extending slightly forward beyond periphery of previous whorl (Fig. 112). Peristome thin; reflected most noticeably along columellar and parietal margins; least so along posterior corner and outer lip. Axis narrow, 0.09-0.11 times width of shell at penultimate whorl; slowly increasing in size and noticeably twisted. Internal barrier tetra-lamellate; confined to penultimate whorl (Figs. 114-116). Columellar lamella thin and horizontal, extending about 1/5 of distance across cavity of whorl; located on middle of axis in the last half of penultimate whorl and extended as a weak callus into the first half of body whorl. Parietal lamella large, a little more than half a whorl in length, beginning in second half of penultimate whorl and extending to beginning of body whorl; suspended from center of roof;

reaching nearly half-way across cavity and then flaring toward outer wall. Palatal lamella 1/4 of a whorl long, low but solid; located along the lower suture on the outer wall so that superficially it resembles a secondary basal lamella (Figs. 114, 115). Basal lamella confined to second half of penultimate whorl; situated on center of basal wall; high, initially erect and then flaring outward along its edge.

Measurements based on the holotype and 25 paratypes (UF 342781) are given in Table 10.

Type Locality.— Puebla, a limestone hillside on the west side of Federal Highway 131, 15 km southeast of Tehuacán; 1540 m altitude. Holotype: UF 34375; collected by Fred G. Thompson 8 August, 1965. Paratypes: UF 342781 (171), UF 342782 (6), ITCV (50); same data as the holotype.

The type locality was nearly barren of plants, except for a few cacti, nettles and occasional mesquite. Snails were found under loose rock.

Distribution.— Known only from the type locality and a nearby locality. Puebla: 3 km N of Ajalpan (18°23'05"N, 97°18'53"W), 1260 m alt. (UF 200779).

Remarks.— This is a moderately large species with a rough surface sculptured with numerous fine axial riblets. The color is tan, lusterless and translucent. The shell is terete in shape with an attenuated apex. The aperture is ample and sub-circular in shape. The internal barrier is extra-lamellate and is confined to the penultimate whorl and the upper half of the body whorl. The palatal lamella is short and is located on the outer wall bordering the lower suture in the penultimate whorl. *Holospira rhinion* is unique within the Holospirinae because of the location of the palatal lamella. Usually the palatal lamella is low in profile (Fig. 114). Occasionally the palatal lamella is large to the extent that it nearly occludes from view the basal lamella when the shell is opened (Fig. 116).

Etymology.— The name *rhinion* is from the Clas-

Table 10. *Holospira rhinion* n. sp. Shell parameters of the holotype (UF 34375) and 25 paratypes (UF 342781)

	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
Holotype	16.0	4.4	3.2	3.3	14.2	72	0.28	0.20	1.04
Paratypes									
X	14.98	4.28	3.20	3.20	12.77	82.84	0.29	0.21	1.00
SD	0.86	0.10	0.20	0.23	0.60	9.23	0.02	0.02	0.09
Min.	13.3	4.1	3.0	2.6	11.6	62	0.26	0.19	0.79
Max.	16.9	4.5	3.8	3.9	14.2	103	0.33	0.26	1.26

sical Greek, *ρίπιον*, a small file or rasp, and alludes to the over all rough appearance of the shell.

The *Holospira painteri* species-group

This group is found in eastern Puebla in the area from Tehuacán northwest to Azumbilla, over a distance of about 25 km. The species are alike in having small, terete or cylindrical-terete shells with an attenuate apex. The whorls are separated by a well-impressed suture. The shell is opaque white or livid white with white embryonic and juvenile whorls, and is smooth or is sculptured with fine, close riblets. The internal barrier is tetralamellate, and is confined principally to the penultimate whorl and may extend partially into the body whorl.

*Holospira painteri* Bartsch, 1906

Figs. 117-122

*Holospira painteri* Bartsch, 1906: 130-131; pl. 3, fig. 5.

Description.— The smallest known species of *Holospira*, 7.6-9.3 mm in length; 0.29-0.36 times as wide as high. Whorls 9.7-11.2. First embryonic whorl 0.8 mm wide. Shell terete in shape, tapering toward base. Apex and spire opaque white. Sculptured with fine, closely spaced oblique riblets that are about as wide as their interspaces. Columellar lamella well developed, confined to lower half of penultimate whorl and upper half of body whorl (Figs. 121, 122). Columellar lamella and parietal lamella visible from within aperture. Parietal lamella extending through length of penultimate whorl and upper half of body whorl; large and flaring outward toward outer wall. Parietal lamella separated from palatal lamella by a narrow gap in lower half of penultimate whorl. Palatal lamella is a weak callus on the middle of the lower half of the penultimate whorl; visible on outside of shell as a longitudinal narrow white streak. Basal lamella weak, low and confined to last quarter of penultimate whorl.

Measurements based on 13 paratypes are given in Table 11.

Type Locality.— Puebla, Tehuacán. Holotype: USNM 187675. Paratypes: USNM 1025750 (44), Same data as the holotype. The type series was collected by

Joseph N. Rose and Joseph H. Painter during botanical explorations between 1903-1905.

Distribution.— This species is known only from the type locality of "Tehuacán", Puebla.

Remarks.— *Holospira painteri* has not been found since its original discovery.

*Holospira denserpens* n. sp.

Figs. 123-129

Description.— Shell elongate cylindrical-conical in shape with an abbreviate-attenuated apex. Small, about 9.4-12.5 mm long; 0.26-0.34 times as wide as long. Opaque; glossy white with a livid tinge to spire. Apex and embryonic whorls white. Interior of aperture and interior of whorls light rusty orange in color. Whorls 10.1-12.5; embryonic whorls relatively large and slightly protruding; following apical whorls button-shaped and strongly rounded between sutures; spire consisting of five strongly arched whorls with a noticeably impressed suture; whorls becoming increasingly turgid toward the apex. Shell smooth, sculptured with poorly defined oblique incremental striations that tend to become stronger on the last whorl; apical whorls devoid of ribs. Umbilicus usually imperforate, occasionally rimate. Aperture height 0.20-0.29 times shell length; broadly auriculate in shape with a narrow embayment at posterior corner; noticeably offset laterally at posterior corner; forming a broad shelf above with an indentation behind the peristome. Aperture extended forward for a short distance beyond previous whorl (Fig. 129). Plane of aperture nearly parallel to shell axis. Peristome blunt, weakly reflected along outer and basal margins; hardly at all along columellar and parietal margins. Columellar axis narrow, 0.08-0.10 times width of shell; straight sided. Internal barrier tetra-lamellate; one whorl long, confined to last half of penultimate whorl and first half of body whorl (Figs. 127, 128); not visible from within aperture. Columellar lamella located one whorl behind aperture; less than half a whorl in length, strong with a rounded edge and extending about 1/4 of distance across cavity. Parietal lamella one whorl long; confined to penultimate whorl; suspended from middle of roof; extending to near

Table 11. *Holospira painteri* Bartsch, 1906. Shell parameters in mm for 13 paratypes (USNM 1025759).

	L	W	AH	AW	Wh	W/L	AH/L	AW/AH
X	8.15	2.65	1.71	1.84	10.22	0.33	0.21	1.08
SD	0.48	0.12	0.09	0.05	0.37	0.02	0.02	0.05
Min.	7.60	2.50	1.46	1.73	9.7	0.29	0.19	1.00
Max.	9.30	2.80	1.86	1.86	11.2	0.36	0.23	1.18

middle of cavity and flaring outward slightly along its edge. Palatal lamella very weak, consisting of a low ridge below middle of outer wall; less than half a whorl in length and confined to the middle half of the penultimate whorl. Basal lamella low and rounded; lying directly beneath the parietal lamella; about half a whorl in length between the last quarter of the penultimate whorl and the first quarter of body whorl.

Measurements based on the holotype and 25 paratypes (UF 341543) are given in Table 12.

Type Locality.—Puebla, a limestone hill 1 km east of Azumbilla, 23 km north of Tehuacán (18°37.2'N, 97°23.4"W); 2150 m alt. Holotype: UF 190783; collected 11 April 1991 by Fred G. Thompson. Paratypes: UF 341543 (78), ITCV (30); same data as the holotype. Topotypes: UF 190782; same data as the holotype; specimens preserved in ethanol.

Azumbilla is at the intersection of Hwy. 125 and the road east to Nicolas Bravo. The type locality is an isolated conical peak covered with xeric vegetation consisting of cactus, *Agave*, and shrubs. Snails were collected in the immediate vicinity of a cleft in the west-facing cliff. *Holospira denserpens* was found aestivating in small solution crypts in the limestone and under dried mosses on the limestone cliff. A species of *Bostrichocentrum* was common under *Agave* and terrestrial bromeliads in the tallus slope at the base of the cliff.

Distribution.—Known only from the type locality.

Remarks.—The species is characterized by its small size, being about 9.5–12.5 mm long and relatively slender with an abbreviate-attenuated apex. It is opaque with a apex white and a glossy livid-white spire. The apical whorls are button-shaped and strongly arched between the suture. The whorls are smooth with irregular, fine, oblique striations. The aperture is broadly auriculate in shape, offset laterally and has a narrow posterior corner. The internal barrier is tetra-lamellate and is confined to penultimate whorls and first quarter

of body whorl. The columellar lamella is stout but very short. The parietal lamella large and pendant. The palatal lamella is short and very weak. The basal lamella is strong, low and rounded.

*Holospira denserpens* is distinguished from *H. painteri* by its larger shell, the spire is cylindrical as opposed to being tapered below, the apex is shorter and more rounded and the sculpture is smooth in contrast to the distinct riblets in the latter species. The parietal lamella does not flare toward the outer wall nearly to the extent that it does in *H. painteri*, the columellar lamella is much shorter and the basal lamella is stronger.

Etymology.—The species name *denserpens* is taken from the Latin, *dens*, a tooth, and *serpens*, a serpent, and alludes to the gleaming white, smooth, slender shell.

#### The *Holospira aurantiaca* species-group

A group relationship of the following new species is not apparent. It strongly resembles the next two species by the glossy white, opaque shell with orange or reddish upper-most apical whorls, and obsolescent sculpture on the spire. *Holospira aurantiaca* is smaller than those two species, it is much more slender, and it lacks minute bristles lining the interior of the body whorl and the penultimate whorl.

The relatively small slender size of *Holospira aurantiaca* bears some resemblance to *H. denserpens*. It differs from the latter species by its orange colored embryonic and early juvenile whorls, its less rotund whorls, the presence of narrow but distinct riblets on the apex, the presence of weakly developed sub-obsolete ribs on the spire, and the more extensive development of the internal barrier.

#### *Holospira aurantiaca* n. sp.

Figs. 130–136

Description.—Shell opaque white with an orange or rust-colored apical tip; peristome white; interior of

Table 12. *Holospira denserpens* n. sp. Shell parameters of the holotype (UF 190783) and 25 paratypes (UF 341543).

	L	W	AH	AW	Wh	W/L	AH/L	AW/AH
Holotype	11.8	3.3	2.5	2.4	11.0	0.28	0.21	0.96
Paratypes								
X	10.37	3.12	2.17	2.18	11.33	0.30	0.21	1.01
SD	0.82	0.09	0.14	0.17	0.64	0.02	0.10	0.09
Min.	9.4	3.1	2.0	2.0	10.1	0.26	0.20	0.85
Max.	12.5	3.3	2.4	2.5	12.5	0.34	0.25	1.22

aperture and interior of whorls orange tinted. Moderately small-sized; 10.8-13.4 mm long; slender, 0.24-0.31 times as wide as high. Terete, widest point at top of spire, and gradually tapering toward the base; apex attenuated and slightly convex in outline. Whorls 12.0-14.6; whorls of spire moderately arched between sutures; apical whorls become increasingly turgid toward apex. Embryonic whorls 2.5, protruding; set at a slight angle to succeeding whorls; regularly increasing in size; second embryonic whorl narrower but higher than succeeding whorl; smooth. Postembryonic whorls of spire with fine oblique riblets that are about as wide as their interspaces. Riblets becoming obsolescent on the spire, but when present are larger and more widely spaced. Usually axial sculpture becomes better defined as bolder oblique ribs on penultimate whorl and body whorl. Umbilicus rimate or imperforate. Aperture broadly auriculate; posterior corner forming a small embayment; aperture offset laterally and forming a rather broad horizontal shelf behind parietal lip; shelf with a conspicuous central indentation; aperture projecting forward for about 1/5 diameter of previous whorl (Fig. 133); slightly oblique to axis of shell. Peristome thick, blunt, weakly reflected along the basal, columellar and parietal margin; becoming very narrow along posterior corner. Axis straight, narrow, about 0.06-0.08 times width of shell; expanding noticeably in the anti-penultimate and penultimate whorls. Internal barrier tetra-lamellate (Fig. 136); not visible from within aperture. Columellar lamella lying on middle of columella, moderately thin, extending horizontally for about 1/4 of distance to outer wall; one whorl in length and confined to penultimate whorl. Parietal lamella two whorls in length, beginning in anti-penultimate whorl and extending to upper half of body whorl; suspended vertically from outer third of roof for about half of cavity width. Palatal lamella about 1/2 a turn in length in the first half of penultimate whorl; weak; located along lower third of whorl. Basal lamella one

whorl in length, confined to penultimate whorl, located on center of floor, vertical and about 1/4 height of whorl.

Measurements of the holotype and 26 paratypes are given in Table 13. Specimens from 2 km north of Tecamachalco are slightly smaller than those of the type series, but they are typical in all other aspects of the shell.

**Type Locality.**— Puebla, limestone canyon 2 km southeast of Tecamachalco (18°51.4'N, 97°42.0'W), 2140 m alt. Holotype: UF 190756; collected 9 April, 1991 by Fred G. Thompson. Paratypes: UF 341545 (134) ITCV (50); same data as the holotype.

The type locality is in a small canyon on the northwest end of a limestone mountain that faces southwest. It is reached by driving for about 2 km up a rough graded road from the southeast edge of Tecamachalco to a quarry. The area is arid. It is vegetated with cactus-*Agave-Yucca* and some shrubs. *Holospira aurantiaca* was very abundant on limestone cliffs under flags of limestone and under leaves of cliff-dwelling *Agave*.

**Distribution.**— Known only from the immediate vicinity of the type locality. Puebla: 2 km N of Tecamachalco, 2300 m alt. (UF 34282).

**Remarks.**— The species is distinguished by its slender shell that is weakly terete with an attenuated apex. It is moderately small, up to about 13.4 mm in length. The shell is opaque white, with an orange or rust-colored upper-most apex. The sculpture consisting of fine, close riblets on the apical whorls. The become stronger but obsolescent on spire, and then becoming stronger and more clearly developed on the last two whorls. The internal barrier is tetra-lamellate and extends from the anti-penultimate whorl to the body whorl. The parietal lamella extends through the length of last half of the anti-penultimate to the first half of the body whorl. The columellar lamella the basal lamella and the palatal lamella are confined to the penultimate whorl.

**Etymology.**— The name *aurantiaca* is from the

Table 13. *Holospira aurantiaca* n. sp. Shell parameters of the holotype (UF 190756) and 26 paratypes (UF 341545).

	L	W	AH	AW	Wh	W/L	AH/L	AW/AH
Holotype	13.2	3.3	2.3	2.3	13.9	0.25	0.17	1.00
Paratypes								
X	12.01	3.27	2.24	2.21	12.93	0.27	0.19	0.98
SD	0.68	0.12	0.15	0.22	0.44	0.02	0.01	0.12
Min.	10.8	3.0	1.9	1.8	12.0	0.24	0.16	0.84
Max.	13.4	3.5	2.5	2.5	14.6	0.31	0.21	1.20

New Latin, meaning orange colored, in reference to the color of the upper-most apical whorls, and the interior of the aperture.

The *Holospira scololaema* species-group

This is a small group of species found in eastern Puebla where they occur in isolated colonies. The species have opaque, glossy white shells that have obsolete ribs on the spire. They are characterized as a group by possessing minute spine-like bristles lining the inside of the lower-most whorls. The bristles point downward causing an obstruction of the opening into the shell. Undoubtedly this is a barrier evolved to impede the entrance of arthropods.

*Holospira scololaema* n. sp.

Figs. 137-144

Description.— Shell glossy, opaque white on spire with tan embryonic whorls and early whorls of apex; peristome white, interior of aperture light tan. Moderately large, 15.4-18.2 mm long, moderately stocky, about 0.25-0.32 times as wide as high. Cylindrical in shape with an extended convex apex. Last whorl extending forward on a short neck just slightly beyond body whorl (Fig. 141); rounded below and flattened above with a bluntly rounded posterior corner. Umbilicus rimate. Suture slightly impressed. Shell with 12.0-13.7 whorls. Spire with 5-6 nearly flat whorls. Apex consisting of 6-7 whorls. Embryonic whorls 1.5-2.0, smooth, enlarged and button-like, protruding and higher than succeeding whorl causing the tip of the apex to be slightly concave in outline. Succeeding post-embryonic whorls of apex sculptured with numerous closely spaced oblique ribs that are about as wide as their interspaces; ribs become weak and poorly define on the spire, but on last whorl ribs become well defined and are enlarged behind peristome. Aperture broadly auriculate in shape with a weakly impressed parietal margin; 0.88-1.11 times as wide as

high; 0.17-0.25 times length of shell. Peristome narrowest at posterior corner and widening along basal and columellar margins. Axis hollow, slightly twisted with a slight bulge along its middle; narrow, about 0.09-0.10 times width of shell. Internal barrier bi-lamellate, consisting of a well developed columellar lamella and a weak or obsolete parietal lamella. Columellar lamella beginning in the penultimate whorl and ending in the last whorl half a turn posterior to the peristome (Figs. 142, 143); lower end visible within aperture. Parietal lamella obsolete or weakly developed in penultimate whorl. Palatal and basal lamellae absent. Floor and roof of body whorl and penultimate whorl lined with forward pointing minute bristles.

Measurements of the holotype and 24 paratypes (UF 335731) are given in Table 14.

Type Locality.— Puebla, a limestone mountain side 1 km northeast of Yehualtepec; 2340 m alt. Holotype: UF 34289; collected 22 October, 1970 by Fred G. Thompson. Paratypes: UF 335731 (135), UF 335727 (SEM), ITCV (25); same data as the holotype.

Snails were found on a steep limestone slope under blocks of limestone and caliche. The surrounding vegetation consisted of low xeric shrubs dominated with cactuses and *Agave*. Other snails found associated with *Holospira scololaema* included *Euglandina* sp. and *Salasiella* sp.

Distribution.— Known from the type locality.

Remarks.— The species is recognized by its moderately large sized shell that is relatively slender with an extended apex and is glossy white. On the spire the flat sided whorls are nearly uniformly high and wide. The apical whorls are sculptured with numerous close rounded ribs, which become poorly defined on most of the spire but are well developed on the last whorl. The aperture is about as wide as high and lacks a conspicuous embayment at the posterior corner. The internal barrier is bi-lamellate with a low columellar lamella low extend-

Table 14. *Holospira scololaema* n. sp. Shell parameters in mm for the holotype (UF 34289) and 24 paratypes (UF 335731).

	L	W	AH	AW	Wh	W/L	AH/L	AW/AH
Holotype	17.0	4.8	3.4	3.6	13.1	0.28	0.20	1.06
Paratypes								
X	16.7	4.6	3.4	3.3	13.1	0.28	0.20	0.96
SD	0.88	0.22	0.27	0.28	0.50	0.02	0.02	0.07
Min.	15.4	4.3	2.7	2.8	12.0	0.25	0.17	0.88
Max.	18.2	5.0	3.9	3.7	13.7	0.32	0.25	1.11

ing from the penultimate whorl to half a whorl behind the peristome. The parietal lamella is obsolete or weakly developed in the penultimate whorl. The floor and roof of the body whorl and penultimate whorl are lined with minute bristles. *Holospira scololaema* differs from the next species by the numerous features that are outlined in the following diagnosis.

Etymology.— The name *scololaema* is from the Classical Greek *σκολος*, thorn, and *λαεμος*, throat, alluding to the thorny spines lining the roof of the lower most whorls.

*Holospira colymis* n. sp.

Figs. 145-150

Description.— Shell glossy, opaque white with light yellow-brown embryonic whorls; peristome white, interior of aperture light rust-color. Medium sized, 15.0-17.6 mm in length. Weakly clavate in shape with a moderately extended apex that is weakly convex in outline. Top whorl of spire widest and highest; lower whorls decreasing slightly in width and height until the penultimate whorl. Shell containing 12.7-14.2 moderately arched whorls with a strongly impressed suture. Apex consisting of about 5-6 whorls. Embryonic whorls smooth, protruding and enlarged compared to following post-embryonic whorl. Next 3-4 whorls of apex sculpture with weakly developed oblique riblets that become obsolete at top of spire, which is the widest whorl. Riblets most evident along the upper suture of following whorls until the antepenultimate or penultimate whorl where they develop into well defined ribs that continue to the peristome. Base of last whorl bluntly angular-rounded; rimate. Aperture 0.21-0.24 times length of shell; weakly advanced beyond previous whorl (Fig. 150). Aperture relatively narrower, 0.77-0.89 times as wide as high; strongly auriculate in shape with a conspicuous embayment at posterior corner. Peristome nearly uniformly narrow; slightly wider along basal margin; nearly straight across parietal margin to inner edge of embayment, and then curved around posterior corner. Axis narrow and straight; about 0.1 times the width of the shell. Internal barrier tetralamellate, consisting of four lamellae in last three whorls, and short bristles lining roof and floor of last 1.5 whorls (Fig. 148). Columellar lamella beginning as a low fold in anti-penultimate whorl. In penultimate whorl it becomes very much enlarged, and extends about a quarter of distance across cavity, and then diminishes again to a low fold in body whorl. Lower end of columellar lamella visible within aperture from an oblique view. The parietal lamella begins as a low fold in the center of roof 2.5 whorls above aperture. In the last half of the penultimate whorl the parietal lamella abruptly enlarges, extending

down nearly half-way across the cavity and then curving outward toward the outer wall. Then the parietal lamella is reduced to a low rounded fold in the following half whorl. Basal lamella confined to first half of the penultimate whorl; located on center of floor as a low but strong fold. Palatal lamella lying along lower third of outer wall in first half of penultimate whorl as a low fold apposite gap between parietal lamella and basal lamella, and opposite columellar lamella. Minute bristles line roof and floor of last 1.5 whorls above aperture. Bristles also occur on lower ends of parietal and basal lamellae.

Measurements of the holotype and the 13 paratypes are given in Table 15.

Type Locality.— Puebla, a limestone hillside 13.5 km west southwest of San Bartola Teontepac (18°26'03"N, 97°36'42"W), 2120 m alt., collected 21 February, 1992. Holotype: UF 200782; collected 21 February, 1962 by Fred G. Thompson. Paratypes: UF 335728 (9), ITCV (5); same data as the holotype.

Distribution.— Known only from the type locality and a nearby locality. Puebla: the north facing slope of a limestone hill about 7 km by road N of Los Reyes Metzontla (18°15'46"N, 97°30'22"W); 1800 m alt. (UF 233193).

Habitat.— The type locality was goat-grazed and covered with sparse xeric scrub vegetation. Snails were found under caliche slabs and limestone blocks. There the species was collected well into the dry season. Near Metzontla snails were found near the end of the wet season aestivating in small solution crypts on the surface of limestone cliffs and boulders. The surrounding vegetation consisted of xeric thorn shrubs and *Agave*.

Remarks.— This is another species with an opaque glossy white shell. The interior of the aperture is light rust-colored. The shell is weakly clavate in shape, and the whorls decrease in width and height below the widest part of spire. The apex is moderately extended, but less so than in *Holospira scololaema*. The apical sculpture consists of weakly defined oblique riblets that are nearly obsolete on the spire until the antepenultimate whorl where they become enlarged into well developed ribs. The aperture is relatively narrow and strongly auriculate in shape with the posterior corner extended as a small embayment. The tetra-lamellate internal barrier is located in last three whorls. Short bristles line the roof and floor of the last 1.5 whorls.

The short bristles lining the roof and floor within the last 1.5 whorls suggest a relationship with *Holospira scololaema*, but the strongly developed internal barrier consisting of four lamellae in *H. colymis* contrasts strongly with the former species. The two species are

Table 15. *Holospira colymis* n. sp. Measurements of the holotype (UF 200782) and 13 paratypes (UF 335728).

	L	W	AH	AW	Wh	W/L	AH/L	AW/AH
Holotype	16.3	4.7	3.7	3.0	13.6	0.29	0.23	0.81
Paratypes								
X	16.17	4.69	3.58	3.08	13.45	0.29	0.22	0.86
SD	1.03	0.13	0.19	0.12	0.52	0.01	0.01	0.04
Min.	15.0	4.5	3.4	2.9	12.7	0.27	0.21	0.77
Max.	17.6	4.9	4.0	3.3	14.2	0.31	0.24	0.89

very similar in general appearance, and are closely affiliated geographically.

Etymology.—The name *colymis* is from the Classical Greek *κολύμις* meaning an obstruction and refers to the internal barrier.

#### The *Holospira fortisculpta* species-group

This group is distinguished by its robust, cylindrical-conical shape with an abbreviated dome-shaped apex. The shell is solid, opaque white, and is elegantly sculptured with strong, widely spaced ribs. The internal barrier is tri- or tetra-lamellate, and is confined to the penultimate whorl and the upper half of the body whorl. The single known species occurs at higher elevations in extreme eastern Puebla.

#### *Holospira fortisculpta* n. sp.

Figs. 151-158

Description.—Shell pupiform with an abbreviated apex and protruding embryonic whorls. Spire cylindrical, consisting of about 6-8 whorls. Apex short, dome-shaped and strongly convex in outline. Shell medium-sized, about 11-14 mm long. Robust, about 0.28-0.36 times as wide as high. Shell solid, glossy, opaque, livid-white, with tan upper apical whorls, a white peristome and a weakly rust-colored throat deep within the aperture. Whorls 13.3-16.3; weakly arched with a decidedly impressed suture. Embryonic whorls 2.2-2.3; smooth. Subsequent whorls sculptured with prominent protracted ribs that are about half as wide as their interspaces; ribs becoming stronger and more widely spaced below; ribs slightly arched on spire with interspaces about four times width of ribs; 23-44 ribs on penultimate whorl. Umbilicus rimate or imperforate. Aperture ample with a prominently reflected peristome; very broadly auriculate with a weak embayment at posterior corner; plane of aperture slightly oblique to shell axis, not protruding beyond preceding whorl (Fig. 158). Peristome solute, reflected; nearly uniformly wide along

outer, basal and columellar margin; becoming narrower along parietal margin, which is only slightly separated from previous whorl. Axis straight and gradually increasing in size; about 0.15-0.20 times width of anti-penultimate whorl; axis slightly swollen below middle in anti-penultimate and penultimate whorls. Internal barrier tri- or tetra-lamellate; confined to penultimate whorl and first half of body whorl (Figs. 155-157); not visible from within aperture. Columellar lamella one whorl long; confined to last half of penultimate whorl and first half of body whorl; lying along lower third of axis, moderately stout, horizontal, low, projecting about 1/4 the width of cavity. Parietal lamella one whorl long, confined to penultimate whorl; large; originating vertically from center of roof and flaring outward slightly along edge. Palatal lamella generally absent (present in one of six specimens examined); confined to first quarter of penultimate whorl; weak, apparent as a slight calcareous ridge along lower 1/4 of outer wall. Basal lamella about a quarter whorl long, confined to last fourth of penultimate whorl very close to outer wall; low but stout.

Measurements for the holotype and 25 paratypes (UF 342779) are given in Table 16.

Type Locality.—Puebla, 5 km northwest of Atenco, 2650 m alt. Holotype: UF 34293; collected 21 October, 1970 by Fred G. Thompson. Paratypes: UF 342779 (165), ITCV (25); same data as the holotype.

Atenco is a small village located at 19° 04.6' N, 97° 31.6' W, and at 2500 m alt. The type locality lies northwest of Atenco on the road to San Salvador el Seco. Snails were collected on a hillside from under chips and blocks of limestone just below a pine forest.

Distribution.—Known only from the type locality.

Remarks.—This species is identified by its robust, medium-sized, pupiform shell with an abbreviated apex. It is solid, opaque white and glossy, and is sculptured with strong, widely spaced ribs. The aperture is very broadly auriculate with a widely reflected peristome that is narrowly separated from the body whorl.

Table 16. *Holospira fortisculpta* n. sp. Shell parameters of the holotype (UF 34293) and 25 paratypes (UF 342779).

	L	W	AH	AW	Wh	RPW	W/L	AH/L	AW/AH
Holotype	12.2	4.1	2.8	2.8	14.9	39	0.34	0.23	1.00
Paratypes									
X	12.37	3.99	2.59	2.76	14.81	33.2	0.32	0.22	1.07
SD	0.73	0.15	0.17	0.18	0.71	6.57	0.02	0.04	0.07
Min.	11.2	3.8	2.1	2.3	13.3	23	0.28	0.20	0.98
Max.	13.9	4.3	2.8	3.2	16.3	44	0.36	0.23	1.17

The tetra-lamellate internal barrier is confined to the penultimate and body whorls.

No close relationship is apparent between *Holospira fortisculpta* and other known species. Most of Puebla has been only superficially explored for mollusks. The state is large with an area of 33,919 km<sup>2</sup> and has vast, but fragmented habitat suitable for Holospirinae. It is not surprising that this and other disparate species-groups of *Holospira* are known from so few localities. Additional field work almost anywhere within the state can be expected to yield additional populations and species.

**Etymology.**— The name *fortisculpta* is from the Latin *fortis*, meaning strong, and *sculptus*, a sculpture, alluding to the strong sculpture characteristic of this species.

#### The *Holospira haploplax* species-group

The group consists of a single species from central Puebla. It is unique within *Holospira* by having a single lamella comprising the internal barrier. It resembles *Bostrichocentrum* (Figs. 165-168) in this trait, but the resemblance is superficial. *Bostrichocentrum* have stout white, opaque smooth or striate shells, and they lack a columellar lamella as such (Thompson 1964). Instead, they have a low hollow bulge around the base of the columella in the last whorl (Fig. 168). At one time all holospirids with a single lamella or lamella-like bulge were placed in *Bostrichocentrum*. Thompson (1974) demonstrated that *Bostrichocentrum* as previously understood was polyphyletic and restricted the genus to include only those species from southern Mexico. On the basis of the over-all shell morphology *Holospira haploplax* strongly resembles species of *Stalactella*. The latter group differs by having a strong columellar lamella and a dentate parietal lamella.

#### *Holospira haploplax* n. sp.

Figs. 159-164

**Description.**— Shell opaque; light brown with nearly white oblique ribs; peristome white; interior of aperture light brown. Cylindrical-conical in shape; apex relatively short and obtuse-convex; spire straight-sided. Medium-sized and stocky; length about 10.9-13.9 mm; 0.24-0.31 times as wide as long. Whorls 13.4-15.6; apex about 1/5 the length of the shell and consisting of about seven whorls; apical whorls convex; whorls on spire flat-sided with a distinct but shallow suture; embryonic whorls 2.0-2.3, smooth; subsequent whorls sculptured with strong, oblique posteriorly arched ribs separated by interspaces that are about 2-3 times as wide as ribs. Penultimate whorl with 32-54 ribs. Base of shell rimate or imperforate. Aperture broadly auriculate; about as wide as high; free from and projecting forward slightly beyond previous whorl (Fig. 162); prosocline at an angle of about 20° to shell axis. Peristome strong and moderately reflected; narrowest at posterior corner; widest along columellar margin. Columella about 0.1 times diameter of shell, straight, hollow. Internal barrier monolamellate, consisting of a single lamella (Figs. 163, 164); parietal, basal and palatal lamellae absent; columellar lamella strong; not visible from within aperture; originating at beginning of penultimate whorl and extending through first half of body whorl; located just below center of columella; projecting about a third of distance across cavity.

Measurements of the holotype and 25 paratypes (UF 337498) are given in Table 17.

**Type Locality.**— Puebla, 12.3 km east of Puebla, 2525 m alt. Holotype: UF 34381; collected 9 July, 1966 by Fred G. Thompson. Paratypes: UF 255392 (27), ITCV (10); same data as the holotype. Other specimens: UF 337498; same data as the holotype, preserved in 75% ethanol.



Table 17. *Holospira haploplax* n. sp. Shell parameters of the holotype (UF 34381) and 25 paratypes (UF 337498).

	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
Holotype	12.7	3.4	2.4	2.3	15.0	32	0.27	0.19	0.97
Paratypes									
X	12.23	3.45	2.44	2.41	14.35	39.58	0.28	0.20	0.99
SD	0.84	0.10	0.23	0.18	0.78	5.65	0.02	0.02	0.09
Min.	10.9	3.4	2.3	2.3	13.4	32	0.24	0.17	0.82
Max.	13.9	3.6	2.9	2.9	15.6	54	0.31	0.24	1.13

The type locality is about 1 km south of Hwy 150 on a limestone hill, and was in an open oak grove with a ground cover of grasses. Snails were found aestivating on limestone boulders among grasses and leaves close to the ground.

Distribution.— Known only from the type locality.

Remarks.— The shell is brown with strong white ribs, medium sized, stout, and cylindrical with a relatively short obtuse apex. The ribs are oblique, stout and about a third the width of their interspaces. The internal barrier consists of a single strong lamella, the columellar lamella, that is confined to penultimate whorl and the first half of the body whorl.

Etymology.— The species name *haploplax* is from the Classical Greek  $\mu\acute{\alpha}\pi\lambda\omicron\varsigma$  meaning single or simple, and  $\pi\lambda\alpha\zeta$ , something wide and flat. The name alludes to the single lamella comprising the internal barrier.

#### Subgenus *Stalactella* Bartsch, 1906

*Stalactella* Bartsch, 1906: 151. Rehder, 1940: 315. Pilsbry, 1953: 135.

Type species.— *Holospira (Stalactella) rosei* Bartsch, 1906. Four other species are included in *Stalactella*.

*Stalactella* includes a small group of species found in Puebla and immediately adjacent northeastern Oaxaca. The shell is opaque brown and bears low, crowded ribs. The smooth embryonic whorls are turgid and button-shaped and are about equal in size. The following half postembryonic whorl is wider but shorter, offsetting the two teat-like earlier whorls at a slightly oblique angle (Fig. 173a). The internal barrier is bi-lamellate, consisting of the columellar lamella and the parietal lamella. The columellar lamella is smooth, thick and wedge-shaped along its edge (Fig. 177). The parietal lamella is thin, low, rounded and bears slender denticles arranged in a single row. In some species the parietal lamella is reduced to a thin callus. The penultimate whorl

is abbreviate and thick-walled (Figs. 176, 177, 181, 183, 190, 195). This is the section of the spire that bears the principal portion of the internal barrier. Here the shell wall is 3-4 times as thick as in the preceding or following whorls. The abbreviate penultimate whorl with its thick wall appear to be unique in *Holospira*.

Previous authors (Rehder 1940, Pilsbry 1953) treat *Stalactella* as a section within *Propilsbrya* Bartsch, 1906 [Type species: *Epirobia (Propilsbrya) nelsoni* Bartsch, 1906]. Both *Propilsbrya* and *Stalactella* have fine pectinate denticles arranged in a single row along the parietal lamella similar to *Stalactella*. This similarity appears to be a matter of convergence. In *Stalactella* the parietal and the columellar lamella are confined to the lower most whorls of the spire, as is characteristic of the basic arrangement in the *Holospira*, and the parietal lamella bears a single row in elongate denticles.

*Propilsbrya* is a disparate assemblage of species found in Coahuila, Tamaulipas and San Luis Potosí. It includes three subgenera. *Propilsbrya (s.s.)* is bi-lamellate. The internal barrier consists of a columellar lamella and a parietal lamella. The columellar lamella is restricted to the whorls of the spire and is smooth. The parietal lamella extends through nearly the length of the apex and the spire, and its edge is serrate. *Pectinistemma* Rehder, 1940 also is bi-lamellate. The lamella are confined to the lower whorls of the spire, and both the columellar lamella and the parietal lamella are serrate. *Prionolopax* Pilsbry, 1953 is tri-lamellate with the barrier confined to the penultimate and anti-penultimate whorls. The columellar lamella and the basal lamella are smooth. The parietal lamella is serrate.

*Propilsbrya potosiana* Pilsbry, 1953 from Nuevo León was originally placed in *Stalactella* because it has a columellar lamella and a dentate parietal lamella. Pilsbry (1953) treated *Stalactella* as a section within *Propilsbrya*. The similarities in lamellar structure be-

tween *P. potosiana* and *Stalactella* appears to be due to convergence, not phylogeny. The species more strongly resembles typical species of *Propilsbrya* than *Stalactella* by having an elongate-tapered apex, the embryonic whorls are not offset as they are in *Stalactella*, and the penultimate whorl is not abbreviated and thick-walled.

The development of serrate or dentate lamella within mainland urocaptids occurs in several evolutionary lines, including *Propilsbrya*, *Pectinostemma*, *Holospira acanthidia*, *Coelocentrum*, subgenus *Ptychodonta* Bartsch, 1906, and *Anisospira*, subgenus *Trachycion* Thompson, 1968 (Thompson, 1968; Thompson & Correa-Sandoval, 1994). Until the systematics of the subgenera of *Propilsbrya* are better understood their relationships to *Stalactella* remains unresolved.

*Holospira (Stalactella) rosei* Bartsch, 1906

Figs. 169-171

*Holospira (Stalactella) rosei* Bartsch, 1906: 151-153; pl. 4, fig. 10.

Description.—The holotype (USNM 188181) and three fragmentary paratypes (USNM 188181a) are the only known specimens, all of which are broken. The following description is based on this material. The faded shells suggest that the live shell is light brown. Medium sized, broken holotype 14.4 mm long, 3.7 mm wide, and less than 0.26 times as wide as high. Shell elongate-cylindrical; apex attenuated, about half length of the shell. Suture around apex moderately impressed so that the whorls appear to be slightly telescoped. Last two whorls of the spire slightly narrower than previous whorls. Penultimate whorl shorter than preceding whorl. Last whorl enlarged and indented with a shallow longitudinal furrow below periphery so that neck is triangular in cross section with a narrowly rounded base. Neck of last whorl projecting forward for about 1/4 of diameter of shell (Fig. 170). Umbilicus open but narrowly perforate. Sixteen whorls remaining in holotype; about 3-4 earliest whorls are missing due to unnatural break, suggesting a species with about 19-20 whorls; remaining apex consisting of 8 whorls which are strongly arched between the suture. Whorls of spire flattened, with a moderately impressed suture. Apex has numerous, oblique, fine ribs that are as high as wide and are about half as wide as their interspaces. Ribs uniformly wide throughout their lengths. Ribs become vague and poorly defined on middle of spire, but becomes stronger and more clearly defined on last two whorls. Ribs continuous around neck of last whorl. Aperture trapezoidal in outline, 2.3 mm wide and 2.4 mm high, broadly auriculate in shape internally because of an external indenta-

tion into parietal wall; aperture 0.96 times as wide as high. Width of aperture 0.62 times width of shell. Parietal lip nearly straight. Peristome relatively thin and weakly reflected along outer, basal, and lower columellar lip; less strongly reflected along parietal and upper columellar lip. Plane of aperture in lateral profile parallel to axis of shell (Fig. 170). Axis hollow, about 0.1 times width of shell. Internal barrier consists of two lamellae (Fig. 171). Columellar lamella extending from anti-penultimate whorl to base of last whorl; its lower end visible within aperture. Columellar lamella thick and rounded along its outer edge; transversely sloping slightly downward. Parietal lamella 2.3 whorls long; originating in penultimate whorl and extending downward to last quarter of body whorl. Parietal lamella very weakly developed in holotype as a thin narrow ridge on middle of septum. Parietal lamella bearing a series of sharp denticles that are about as long as their interspaces and are curved outward. Approximately 30 denticles are present in penultimate whorl.

Type Locality.—Puebla, "Tehuacán". Holotype: USNM 188181; collected by Joseph N. Rose and Joseph H. Painter. Paratypes: USNM 188181a (fragments of 3 specimens).

Distribution.—Unknown. This species is reported to have been collected at Tehuacán, but the exact province is uncertain. We have found no populations in the vicinity of Tehuacán that resemble this species.

Remarks.—This is a species of *Stalactella* that is recognized by its dull brown shell with an attenuated apex. The apex and base of the shell are sculptured with numerous fine retractive ribs that are absent from the middle of the spire.

The dull brown color and the sculpture are most like the following species. The two differ in that with *Holospira rosei* the apical whorls are telescoped, as opposed to being scalariform. The attenuated apex of *H. rosei* is unlike the short abbreviate apex characteristic of other *Stalactella*. It is distinguished also from other known species by its numerous fine closely spaced ribs on the apex and on the lower part of the spire. The penultimate whorl has about 49 ribs whereas other species have fewer ribs.

Bartsch (1906:153) described this species as being decollated. Rehder (1940:315) and Pilsbry (1953:135) repeated this information. The apical whorls in the holotype are not decollated. They were broken from the shell subsequent to death, for there is no internal apical plug as would be formed if the shell was alive when the whorls were lost. The shells of all other *Stalactella* that we have examined have complete apices as is typical of the *Holospirinae*. We know of no examples in the

subfamily Holospirinae in which the apex is not normally complete.

*Holospira (Stalactella) cremnobates* n. sp.

Figs. 172-177

Description.— Periostracum uniform light brown with lighter colored ribs. Ribs on last one or two whorls usually white. Peristome white; interior of aperture light brown. Medium sized for subgenus, 11.6-14.1 mm long; 0.25-0.31 times as wide as long. Shell slightly club-shaped or nearly cylindrical. Widest at base of apex, and narrows toward last whorl, which is noticeably enlarged. Apex short and convex; with 3.0 button-shaped, strongly protruding mammaform embryonic whorls (Fig. 173a). Apical whorls weakly scalariform, not telescoped. Last whorl noticeably enlarged and with a short neck that in lateral profile projects forward beyond last whorl for about 1/6 diameter of shell (Fig. 173). Neck with a broad, weakly impressed longitudinal furrow below periphery. Dorsum of neck with an impressed longitudinal furrow that creates an elongate parietal denticle internally. Umbilicus open as a small, nearly round hole. Penultimate whorl shorter than preceding whorl and following whorls (Figs. 172, 176). Suture strongly impressed on apex and weakly impressed on spire. Shell with 15.0-17.7 whorls. Lower whorls of apex weakly arched. Upper whorls of spire flattened. Apex consists of about 9 whorls that are separated by a deeply impressed suture and are strongly rounded at the periphery. Embryonic shell consisting of about 3 smooth, strongly protruding whorls. First two embryonic whorls enlarged and button-shaped. The third embryonic whorl is noticeably shorter but wider. Following apical whorls have strong oblique ribs that are very narrow at their upper ends and increase in height and width toward their bases. The ribs are about 1/3 the width of their interspaces. Spire with weaker but distinct reversed-sigmoid ribs that are 1/3-1/5 the width of their interspaces. Ribs becoming stronger on penultimate and last whorls. They continue

onto neck where they diminish in width on base and inner edge of neck. Penultimate whorl with 27-42 ribs. Aperture broadly auriculate in shape, and projecting forward beyond preceding whorl (Fig. 173). Aperture width about equal to or slightly greater than aperture height, and about 0.7 times the width of the shell. Peristome moderately thickened and nearly uniformly reflected around aperture. Plane of aperture slightly oblique to axis of shell. Axis straight, hollow, and slightly concave below middle of whorls. Axis about 0.14-0.17 times width of shell. Internal barrier consists of two lamellae, the columella lamella and the parietal lamella, which are of about equal length and locations within the shell (Fig. 177). Columellar lamella not visible within aperture. Beginning in anti-penultimate whorls and extends downward to half a whorl behind aperture. Columellar lamella thick and wide in last two whorls; its outer edge forming a thickened cord along edge of lamella; extending about 1/3 of distance across width of cavity; without a noticeable outward slope. It then rapidly decreases in size to its upper termination. Parietal lamella a low narrow ridge located in anti-penultimate and penultimate whorls about 2/3 of distance from columella to outer wall; about 1.5-2.0 whorls long, extending downward to half a whorl behind aperture. It bears a row of fine denticles that curve outward. Denticles variable in size but are equal in length to or are slightly shorter than their interspaces. Five specimens have 21, 23, 25, 26 and 27 denticles respectively.

Measurements of the holotype and 25 paratypes (UF 21453) are given in Table 18.

Type Locality.— Puebla, 10 km north of Tehuacán (18° 37' 23" N, 97° 23' 35" W); 1990 m alt. Holotype: UF 190789; collected 2 April, 1991 by Fred G. Thompson and Elizabeth L. Mahalcik. Paratypes: UF 21453 (91), same data as the holotype; UF 34300 (107), ITCV (60), same locality, collected 8 August, 1965 by F. G. Thompson.

The type locality is on the north side of a canyon

Table 18. *Holospira (Stalactella) cremnobates* n. sp. Shell parameters in mm for the holotype (UF 190789) and 25 paratypes (UF 21453).

	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
Holotype	13.0	3.6	2.4	2.3	16.5	27	0.28	0.18	0.94
Paratypes									
X	12.9	3.6	2.4	2.5	16.2	32.8	0.28	0.18	1.04
SD	0.72	0.16	0.14	0.15	0.78	4.83	0.19	0.02	0.07
Min.	11.6	3.3	2.0	2.3	15.0	27	0.25	0.15	0.94
Max.	14.1	4.1	2.0	2.8	17.7	42	0.31	0.22	1.20

about 0.5 km east of Hwy 150. The area consists of a series of bare limestone cliffs with long talus slopes. A dense forest of submesic scrub covered the valley floor below the cliffs. The tops of the cliffs were covered with grasses. *Holospira cremnobates* was collected only on the face of nearly vertical limestone cliffs from under spalled slabs of limestone and clusters of dried mosses. *Bostrichocentrum* sp. was abundant in the talus slopes below the cliffs.

Distribution.— Known only from the type locality.

Remarks.— *Holospira cremnobates* is most similar to the following species, *H. (S.) psectra*. It is distinguished from the latter by its club-shaped shell sculptured with thinner, lower, sparser ribs that expand only slightly at their bases. The columellar lamella is longer and much stronger, bearing a cord-like thickening along its outer edge. The parietal lamella is a ridge that lies about 1/3 of the distance from the outer wall, and bears denticles that are about equal to or slightly shorter than their interspaces.

Etymology.— The species name *cremnobates* is from the Greek *κρηνοβατες*, meaning a frequenter of steep slopes, and alludes to the habitat of this species.

***Holospira (Stalactella) psectra* n. sp.**

Figs. 178-183

Description.— Periostracum uniform light brown in color, usually with ribs. Peristome white; interior of aperture light brown. Shell medium-sized for subgenus, 11.5-14.0 mm long; and 0.26-0.31 times as wide as high. Slightly club-shaped, widest at base of apex, and narrows toward last whorl. Apex relatively short, and conical. Last whorl noticeably enlarged, and has a short neck so that in lateral profile aperture hardly projects forward beyond the periphery of the preceding whorl (Fig. 179). Last quarter whorl constricted behind aperture and pinched inward below periphery. Umbilicus open but narrow. Penultimate whorl slightly shorter than preceding whorl. Whorls 15.1-18.1. Apex consisting of

about 9 strongly rounded, slightly scalariform whorls that are separated by a deeply impressed suture. Embryonic shell consisting of about 2-3 smooth, strongly protruding, button-like whorls. Last embryonic whorl noticeably enlarged. Following whorls of spire weakly arched; Apex sculptured with very strong oblique ribs that increase in height and width towards their bases, and are about 1/3 width of their interspaces. Spire sculptured with slightly weaker but distinct rib that are 1/3-1/5 width of their interspaces and are almost knob-like at their bases. Ribs become stronger on penultimate and last whorls and continue onto neck where they diminishing in width. Penultimate whorl with 35-47 ribs. Aperture broadly auriculate in shape. Aperture width about equal to or slightly greater than its height, and about 0.7 times width of shell. Peristome moderately thickened and nearly uniformly reflected. Plane of aperture slightly oblique to longitudinal axis of shell. Axis hollow and about 0.14-0.17 times width of whorl. Internal barrier bi-lamellate. Columella lamella (Fig. 183) begins in lower half of anti-penultimate whorl and extends downward to 0.5 whorls behind aperture; not visible within aperture. It lies about a third of distance above the floor of whorl. It is thickest and widest in the penultimate whorl and projecting outward for less than 1/4 of width of cavity without a noticeable downward slope; it is low and weakly developed in the last whorl. Parietal lamella a narrow weak spiral callus on parietal wall about a third of distance from outer wall. It begins in the lower half of anti-penultimate whorl and extends downward to about a half whorl behind aperture, although usually shorter than columellar lamella. It bears a row of fine short denticles that curve outward. Denticles variable in size, but usually less than half the length of their interspaces. Five specimens have 14, 18, 20, 21 and 22 denticles respectively.

Measurements of the holotype and 24 paratypes (UF 233197) are given in Table 19.

Type Locality.— Puebla, a limestone cliff on the

Table 19. *Holospira (Stalactella) psectra* n. sp. Shell parameters in mm for the holotype (UF 233197) and 25 paratypes (UF 41472).

	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
Holotype	12.4	3.7	2.2	2.2	16.0	36	0.30	0.28	0.97
Paratypes									
X	12.6	3.7	2.30	2.30	16.5	39.1	0.29	0.18	1.01
SD	0.6	0.1	0.1	0.1	0.6	3.4	0.01	0.01	0.30
Min.	11.5	3.5	2.2	2.2	15.1	35	0.26	0.16	0.97
Max.	14.0	3.9	2.6	2.4	18.1	47	0.31	0.20	1.10

south slope of Cerro Caolalote, 2 km east of El Carmen (18° 36'N, 97°26'01"W); 1870 m altitude. The type locality is at the base of a south-facing bare limestone cliff. Live specimens were found under limestone rubble and dead *Agave*. Holotype: UF 233197; collected 25 October, 1992 by Fred G. Thompson and Elizabeth Mihalcik. Paratypes: UF 41472 (106), ITCV (50); same data as the holotype.

Distribution.— Known only from the type locality.

Remarks.— This species is most closely allied to but differs from *Holospira cremnobates* by its nearly cylindrical-shaped shell in which the penultimate whorl is only slightly shorter than the preceding whorl. The ribs are white, more numerous, and stronger, and are almost knob-like at their bases. The columella lamella is weaker, and slopes outward slightly from the columella. The parietal lamella is reduced to a thin spiral callus and bears short, conical denticles that are less than half the length of their interspaces.

Etymology.— The species name *psectra* is from the Classical Greek  $\psi\epsilon\kappa\tau\rho\alpha$  meaning a currycomb, and alludes to the comb-like parietal lamella.

*Holospira (Stalactella) marmorata* n. sp.

Figs 184-190

Description.— Shell white with numerous irregular hydrophanus zones that form a marbled appearance. Ribs predominantly white in contrast to darker internodes and hydrophanus blotches. Embryonic whorls and early whorls of apex dark tan with lighter colored ribs. Peristome white; interior of aperture light rust-colored. Shell medium-sized, about 12-15 mm long; 0.24-0.29 times as wide as high; nearly cylindrical in shape; widest just above middle of shell and tapering slightly below. Apex is moderately short and convex with protruding embryonic whorls. Penultimate whorl shorter than preceding whorl. Last whorl greatly enlarged, and usually has a slightly longitudinal constriction below periphery. Last whorl with a short neck that projects forward about 1/5-1/6 diameter of shell (Fig. 185). Base of last whorl rounded. Umbilicus rimate, with a very narrow perforation. Suture moderately impressed with weakly arched whorls. Whorls 15.5-18.9. Apex consists of about 9-10 moderately arched whorls. Embryonic shell consisting of 2.5 smooth, protruding, button-shaped whorls. Following apical whorl considerably shorter but wider than embryonic whorls. Subsequent whorls of spire weakly arched, but surface curvature accentuated by ribbed sculpture. Sculpture of apex consisting of moderately strong ribs that are about 1/2-1/3 width of interspaces. They become wider, node-like and crenulate lower suture. Ribs on the middle of spire lower but

clearly defined and are about 1/3-1/4 width of interspaces. Ribs become stronger and higher on last two whorls, and then become weaker towards peristome. Penultimate whorl with 29-55 ribs. Aperture broadly auriculate in shape, with a strong longitudinal indentation on parietal wall. Aperture about 0.88-1.12 times as high as wide, and about 0.15-0.20 times the length of shell. Peristome thickened and nearly uniformly reflected around aperture. Plane of the aperture in lateral profile parallel or slightly oblique to the shell axis (Fig. 185). Internal barrier bi-lamellate (Fig. 190); not visible from within aperture. Columellar lamella two whorls long; beginning abruptly in penultimate whorl and ending at 1/2 whorl behind aperture; located just below middle of columella and sloping outward about half-way across cavity; conspicuously thickened along its middle and narrows to its outer edge forming a channel along columella on its upper side and a deep concavity below. Parietal lamella a low callus located along outer third of the roof, and is about half a whorl longer than columellar lamella. It begins in anti-penultimate whorl and ends a half whorl behind aperture. Parietal lamella with 17-22 denticles arranged in a single row along its crest. Denticles are about as long as their interspaces and curve outward.

Measurements of the holotype and 25 paratypes (UF 80954) are given in Table 20.

Type Locality.— Puebla, 13.5 km WSW of San Bartolo Teontepec (18° 26' 19" N, 97° 36' 42" W); 2120 m alt. The area is a xeric limestone hillside on the north side of the highway. Snails were found under caliche slabs and limestone boulders. Holotype: UF 233188; collected 21 February, 1992 by Fred G. Thompson. Paratypes: UF 80954 (30); same data as holotype.

Distribution.— Puebla: 6 km N of Santa Cruz Nueva (18° 20' 19" N, 97° 49' 35" W), 1760 m alt. (UF 200956); 4.5 km S of San Vicente Coyotepec (18° 20' 19" N, 97° 49' 59" W) 2080 m alt. (UF 200601); 3.7 km S of San Vicente Coyotepec, 1880 m alt. (UF 233190, ITCV).

Remarks.— Distinguished by its low dome-shaped apex. The enamel-like white shell is marked with irregular gray hydrophanus blotches producing a marbled color pattern. Columellar lamella is thickened in its center to form a channel above along columella and below a concavity. The parietal lamella bears 17-22 denticles that are about as long as their interspaces and curve outward.

This species shows considerable local variation in size. Specimens from near Coyotepec are smaller than typical, but there is broad overlap in all measurements between the various populations. A series of specimens

Table 20. *Holospira (Stalactella) marmorata* n. sp. Shell parameters in mm for the holotype (UF 233188) and 25 paratypes (UF 80945).

	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
Holotype	13.9	3.8	2.6	2.5	16.0	32	0.27	0.19	0.96
Paratypes									
X	13.4	3.6	2.4	2.4	16.9	34.9	0.25	0.18	1.02
SD	0.87	0.12	0.16	0.19	0.85	6.3	0.03	0.02	0.09
Min.	11.9	3.4	2.2	2.1	15.5	28	0.24	0.15	0.88
Max.	15.2	3.8	2.7	2.7	18.9	53	0.29	0.20	1.12

from 3.7 km south of Coyotépec vary in length from 10.1-13.6 mm and have 13.6-17.4 whorls with 35-54 ribs on the penultimate whorl. Other aspects of the shell, both external and internal, are typical.

**Etimology.**— The species name is from Latin, *marmorata*, meaning marbled, and alludes to the color of the shell.

***Holospira (Stalactella) chazumbae* n. sp.**

Figs. 191-195

**Description.**— None of the specimens comprising the type lot were live collected. However, many are fresh shells. Ground color enamel white with extensive hydrophanus zones on apex and spire. Embryonic whorls and upper half of apex tan colored, but with white ribs appearing on the postembryonic whorls. Peristome white; interior of the aperture rust-colored. Shell 12.5-17.3 mm long, and 0.21-0.30 times as wide as long. It is cylindrical or slightly club-shaped, widest just above middle. Apex relatively attenuated for subgenus. Embryonic whorls about 2.5, protruding, button-like; offset from the spire by first half postembryonic which is shorter, but wider. Penultimate whorl shorter than preceding whorl. Body whorl conspicuously enlarged with a short neck that is about 1/6 diameter of preceding whorl (Fig. 192, 193). Neck with a weak longitudinal furrow below periphery. Base narrowly rounded. Umbilicus rimate. Suture on spire moderately impressed between weakly arched whorls. Whorls 16.3-20.4. Apex attenuated, consists of 11-12 weakly arched whorls. Apical sculpture with moderately oblique ribs that are about half as wide as their interspaces. On middle of spire ribs tend to become obsolete, and then become strong and well defined on last two whorls. Penultimate whorl with about 32-50 ribs. Aperture broadly auriculate in shape with a strong longitudinal indentation protruding into parietal margin; aperture about 0.96-1.20 times as high as wide, and is about 0.12-0.19 times length of shell. Posterior

corner of aperture noticeably narrower and more sharply angular than in related species. Peristome thickened and moderately expanded; narrowest along posterior corner and widest along baso-columellar margin. Plane of aperture in most specimens nearly parallel to shell axis in lateral profile; occasionally sloped downward in some specimens. Axis is straight and hollow, and is about 0.15-0.19 times the width of the whorl. Internal barrier bi-lamellate (Fig. 195). Columellar and parietal lamellae, both extend to about 0.6 whorls behind the aperture; not visible from within aperture. Columellar lamella 2.5 whorls long and begins abruptly in anti-penultimate whorl; thickened along its middle, and slightly thinner along its periphery; widest and strongest in penultimate whorl where it projects slightly downward about half way across cavity and forms a concavity on its ventral surface along the columella. Parietal lamella a low callus on center of dorsal wall; with sparse, widely spaced denticles that curve outward and slightly forward. Three specimens have 19, 16 and 16 teeth respectively in penultimate whorl.

Measurements of the holotype and 24 paratypes (UF 214439) are given in Table 21.

**Type Locality.**— Oaxaca, hillside 2 km northeast of Santiago Chazumba; 1970 m alt. Snails were collected from under blocks of caliche among sparse growths of xeric scrub vegetation. Holotype: UF 34299; collected 20 October, 1970 by Fred G. Thompson. Paratypes: UF 214439 (80), ITCV (30); same data as the holotype. This species was found in association with *Bostrichocentrum* sp.

**Distribution.**— Known only from the type locality.

**Remarks.**— The shell is similar to *Holospira marmorata* because of its enamel-like white color marbled with hydrophanus blotches and streaks. It differs from *H. marmorata* in that the apex is more attenuate, approaching that of *H. rosei*. *Holospira marmorata* has a short dome-shaped apex. In *H.*

Table 21. *Holospira (Stalactella) chazumbae* n. sp. Shell parameters in mm for the holotype (UF 34299) and 24 paratypes (UF 214439).

	L	W	AH	AW	Wh	RP	W/L	AH/L	AW/AH
Holotype	14.1	3.6	2.3	2.2	18.2	30	0.25	0.16	0.96
Paratypes									
X	14.2	3.7	2.4	2.4	18.1	36.7	0.26	0.17	0.99
SD	1.1	0.23	0.21	0.29	0.99	4.1	0.02	0.12	0.12
Min.	12.5	3.5	2.1	2.2	16.6	30	0.21	0.15	0.81
Max.	17.3	4.0	3.0	3.7	20.5	46	0.30	0.19	1.40

*chazumbae* the posterior corner of the aperture is noticeably narrower and more sharply angulate than in related species.

Etymology.— The species name *chazumbae* is a patronymic taken from the Village of Santiago Chazumba, near the type locality.

#### Genus *Coelostemma* Dall, 1895

The following species is included in this account in order to clarify the identity and status of a name that has been in question since it was proposed.

#### *Coelostemma microstoma* (Pfeiffer, 1861)

Figs. 196-198

*Cylindrella microstoma* Pfeiffer, 1861: 27. Pfeiffer, 1862a: 81. Pfeiffer, 1868: 390.

*Holospira microstoma* (Pfeiffer). Fischer & Crosse, 1873: 337; pl. 17, figs. 9-9a. Martens, 1897: 287.

Pilsbry, 1902: 102-103; pl. 15, figs. 4-5.

*Coelostemma* (?) *microstoma* (Pfeiffer).- Bartsch, 1943: 58.

Description.— Color uniform opaque white; lectotype lusterless, suggesting that the specimen had been dead and sun-bleached before it was collected. Shell medium sized for the genus, 15.3 mm long, and 1/3 as wide as high; club-shaped and with aperture projected forward on a short neck that is about 1/4 the diameter of penultimate whorl (Fig. 197). Umbilical perforation round and about 1/8 the width of last whorl. Lectotype with 17.8 whorls. Whorls of spire nearly flat-sided and separated by a weakly impressed suture. Apex dome shaped with weakly arched whorls that tend to be slightly scalariform. Embryonic shell containing 2.0 smooth whorls; first whorl protruding and button-shaped; second whorl very short and wider. Following apical whorl distinctly ribbed, which over the next four whorls fade into increasingly finer protracted vertical striations. Spire smooth, except for the last whorl, which has weak low

rounded ribs. Ribs begin below the periphery and become increasingly stronger, more crowded and higher on last half of body whorl and neck. Axis large and hollow, 0.35 times width of spire; concave within each whorl (Fig. 198). Aperture about as high as wide; auriculate in shape with a strong impression on dorsal wall behind the peristome. Interior of aperture sub-ovate in shape; columellar wall nearly flat and vertical. Dorsal and outer lip thickened and weakly reflected; basal lip reflected, but not conspicuously thickened; columellar lip broken in lectotype.

Measurements of the lectotype are as follow: length, 15.3 mm, width, 5.1 mm; aperture height, 2.5 mm; aperture width, 2.5 mm.

Type Locality.— Unknown. Lectotype by present designation: British Museum (Natural History) 1996162. The specimen was labeled "Syntype?". It matches very closely the description, measurements and whorl count given by Pfeiffer (1861:27) to such a degree that there is little doubt that it is the specimen upon which the original description was based. Also, it is consistent with the figures made by Sowerby and published in Fischer & Crosse (1873: pl. 17, figs. 9-9a.), except that their figures show distinct riblets on the last whorl. It is not clear from Pfeiffer's description how many specimens he had examined. I have been unable to locate others.

Distribution.— Unknown.

Remarks.— A species distinguished by its medium size club-shaped shell, its dome-shaped apex that is nearly uniformly rounded, and its sculpture, which is ribbed on the earliest postembryonic whorls and then becomes increasingly finer over the surface of the apex; the whorls of the spire are smooth, except for the ribbed last whorl.

*Coelostemma microstoma* appears to be most closely related to *C. herrerae* (Bartsch, 1906) from Silaca Yoapan (= Silacayoapan), Oaxaca, because of their uniformly rounded dome-shaped apexes, their similar

sculpture and their claviform shapes. *Coelostemma herrerae* is a stockier species, being 0.35-0.44 times as high as wide, the columella is almost half the diameter of the shell, the columella is nearly straight sided, not concave as in *C. microstoma*, and it bears a low spiral swelling below the middle in the last three whorls.

#### ACKNOWLEDGMENTS

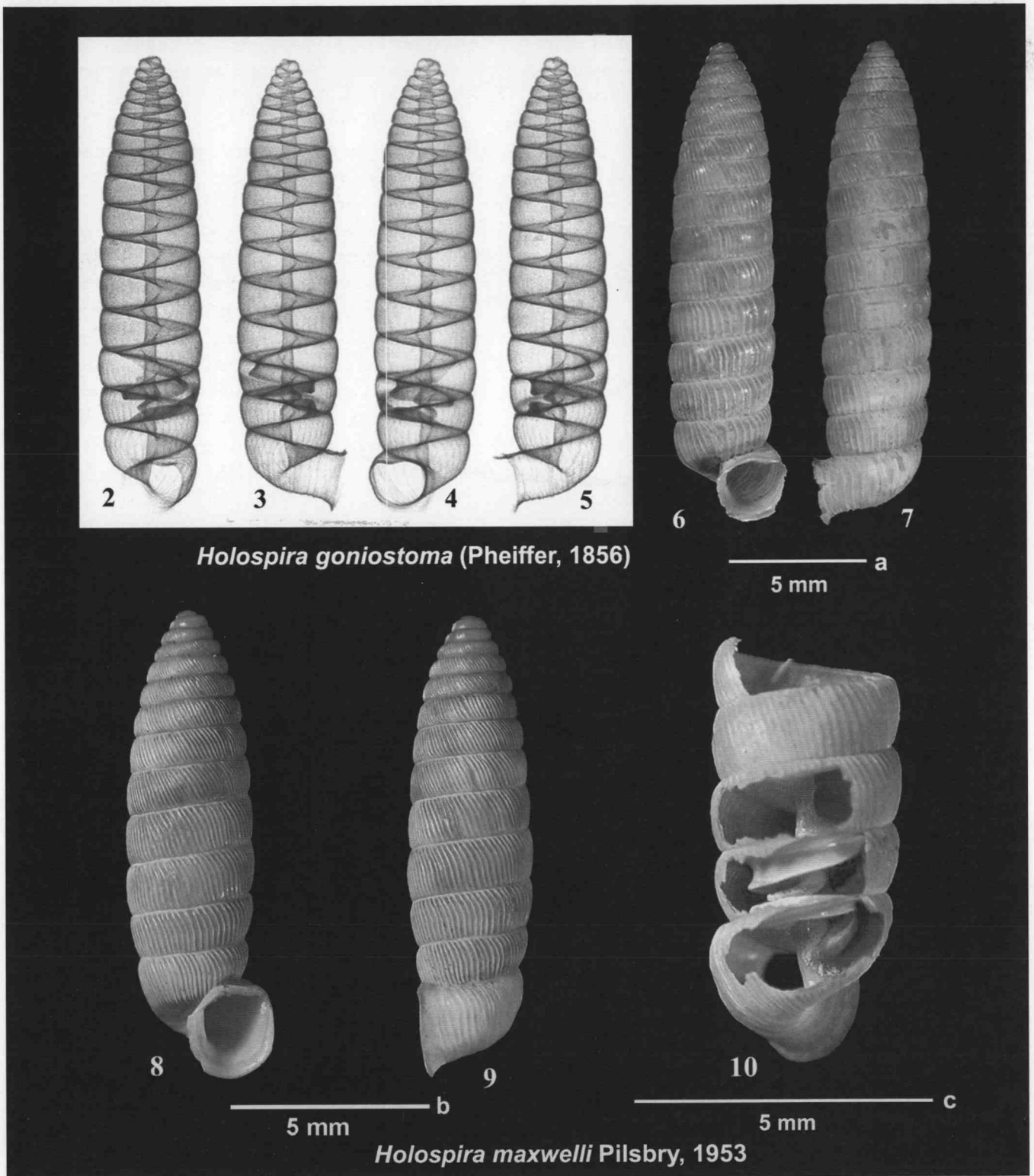
The following people have loaned specimens to us from the collection in their charge. Dr. Matthias Glaubrecht, Museum für Naturkunde, Hamberg Universität zu Berlin, Germany. Dr. Ronald Janssen, Senckenbergische Naturforschenden Gesellschaft, Frankfurt, Germany. Fred Naggs, British Museum (Natural History) London, UK. Dr. Robert Hershler, National Museum of Natural History, Washington, DC. We thank Anthony B. Falcetti and Heather Walsh-Haney of the C. A. Pound Laboratory, University of Florida, Gainesville, Florida for radiographs of the type specimens of *Cylindrella goniostoma*, *Cylindrella teres*, *Holospira hogeana*, *Cylindrella pfeifferi*, and *Cylindrella microstoma*. We thank John Slapcinsky, Florida Museum of Natural History, for assistance with the many tasks that were essential to the preparation of this report. Kenneth Emberton and Ned Strenth provided helpful reviews of this paper. Gregg Brewer, Fredericksburg, Texas. provided valuable field assistance in Mexico. Especially, we thank Alfonso Correa-Sandoval, Instituto Tecnológico de Cd. Victoria, Tamaulipas for his assistance with field work and for many other courtesies that have enhanced this project. Finally, we are grateful for reviews by Ned E. Strenth, Kenneth Emberton, and an anonymous reviewer. Their attention to detail have made this a better paper. Collecting permits for Mexico were issued by the Dirección General de Fauna Silvestre (1966-1991) and by the Dirección General de Vida Silvestre. 1995-2002.

#### LITERATURE CITED

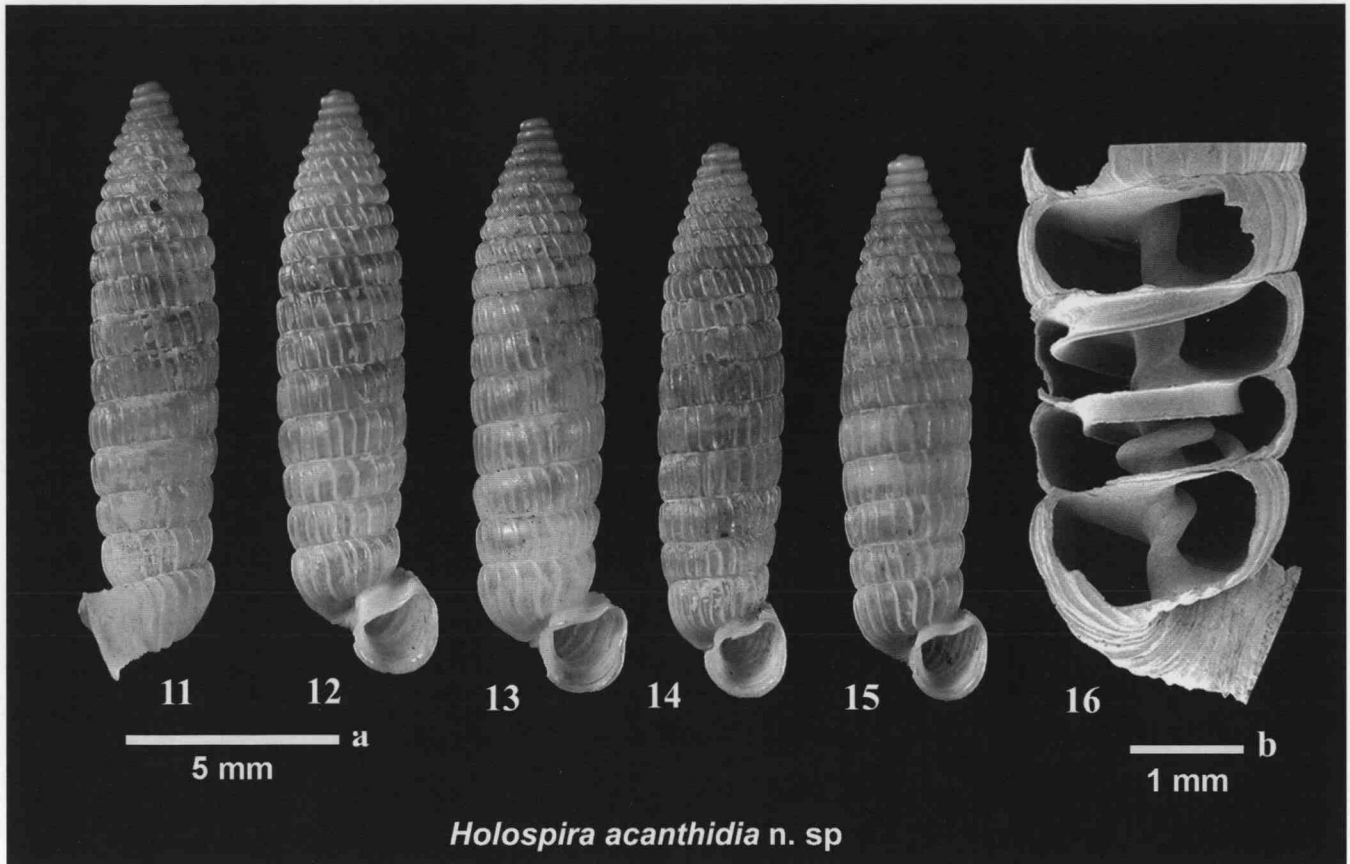
- Albers, J. C. 1860. Die Heliceen nach natürlicher Verwandtschaft systematisch geordnet. 2:1-359. Edition edited by E. von Martens. Leipzig.
- Bartsch, P. 1906. The urocoptid mollusks from the mainland of America in the collection of the United States National Museum. Proceedings of the United States National Museum, 31: 109-160; pls. 3-5.
- Bartsch, P. 1926. New urocoptid land shells from Mexico. Proceedings of the United States National Museum, 70: 1-13; pl. 1.
- Bartsch, P. 1945. New urocoptid mollusks from Mexico. Journal of the Washington Academy of Sciences, 35: 92-95.
- Bartsch, P. 1947a. Some Mexican Urocoptid mollusks. Journal of the Washington Academy of Sciences, 37: 141-142.
- Bartsch, P. 1947b. Notes on some Mexican urocoptid mollusks, with the description of new species. Journal of the Washington Academy of Sciences, 37: 284-288.
- Bequaert, J. E., & W. B. Miller. 1973. The mollusks of the arid southwest with an Arizona check list. University of Arizona Press. 1-271. Tucson.
- Cockerell, T. D. A. 1914. Tertiary Mollusca from New Mexico and Wyoming. Bulletin of the American Museum Natural History, 33: 101-107.
- Fischer, P., & H. Crosse. 1870-1878. Mission Scientifique au Mexique et dans L'Amérique Centrale. Études sur les mollusques terrestres et fluviatiles du Mexique et du Guatemala, I: 1-702; pl. 1-31. Paris.
- Gilbertson, L. H. 1989a. A new species of *Holospira* (Gastropoda: Pulmonata) from Sonora, with the reproductive anatomy of *Holospira minima*. Veliger, 32: 91-94; figs. 1-3.
- Gilbertson, L. H. 1989b. A new species of *Holospira* from Arizona, with the reproductive anatomies of *H. arizonensis* and *H. chiricahuana*. Veliger, 32: 308-312.
- Gilbertson, L. H. 1993. Reproductive anatomies of *Holospira* spp. (Gastropoda: Pulmonata: Urocoptidae) from Arizona and Sonora with a new subgenus and a new subspecies. American Malacological Bulletin, 10: 71-81; figs. 1-12.
- Gilbertson, L. H., & E. Naranjo-Garcia. 1998. A new subgenus and a new species of *Holospira* (Gastropoda: Pulmonata: Urocoptidae) from Sonora, Mexico. Veliger, 41: 314-318.
- Gilbertson, L. H., & E. Naranjo-Garcia. 2004. *Millerspira*, a replacement name for *Millerella* Gilbert and Naranjo-Garcia, 1998. Veliger, 47: 157.
- Haas, F. 1933. Kurze Bemerkungen. Archiv für Molluskenkunde, 65: 271.
- Martens, E., in Albers, J. C. 1860. Die Heliceen, nach natürlicher Verwandtschaft systematisch geordnet. Edit. 2. Edited by E. von Martens: 1-359. Berlin.
- Martens, E. von. 1890-1901. Biologia Centrali-Americana. Mollusca. 1-706. British Museum (Natural History).
- Menke, K. T. 1847. Vier neue Arten der Gattung *Cylindrella* Pr. Zeitschrift für Malakozoologie: 1-3.



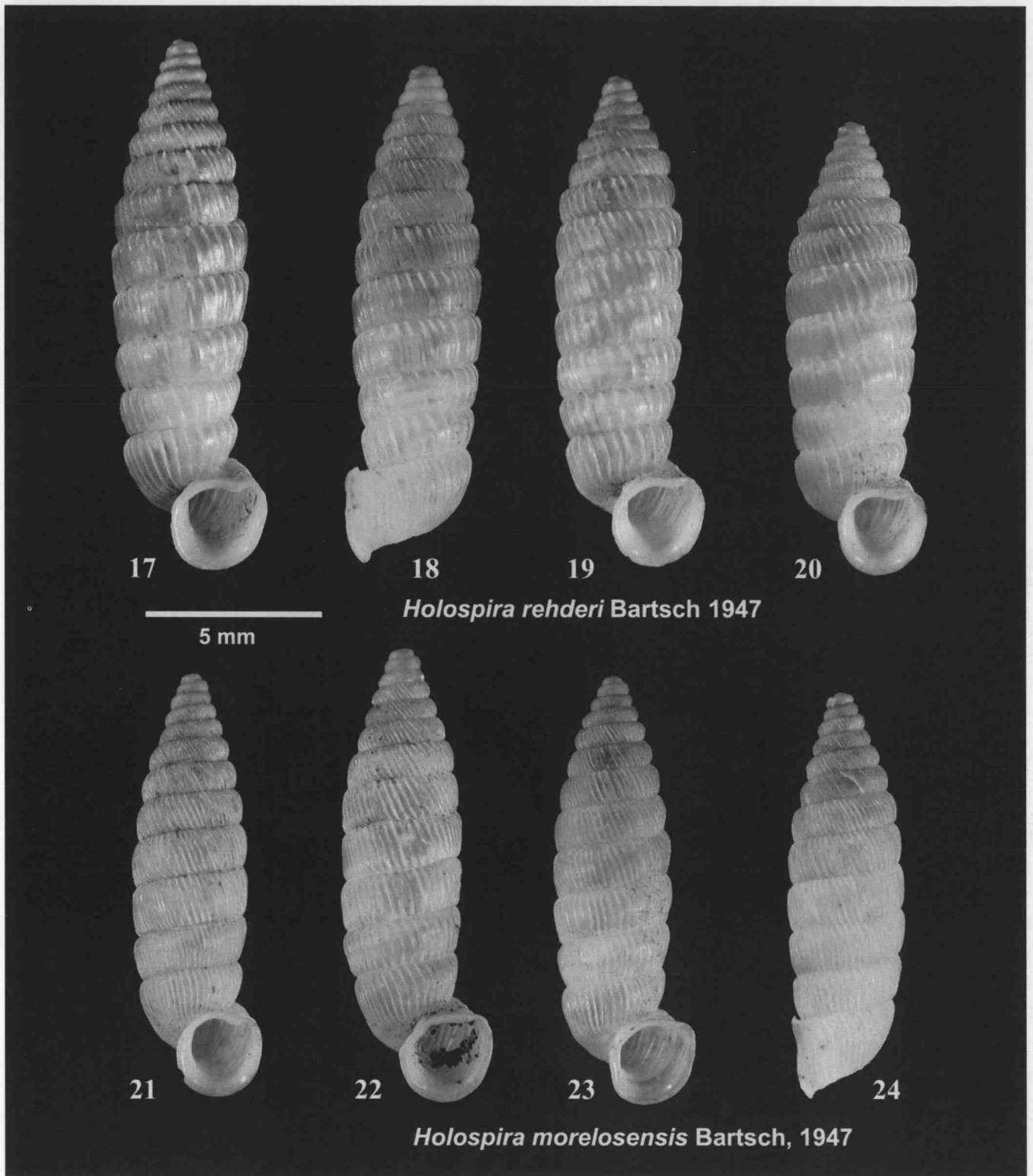
- Opinion 1932: International Commission of Zoological Nomenclature. 1999. *Holospira* Martens, 1860 (Mollusca, Gastropoda): *Cylindrella goldfussi* Menke, 1847 designated as the type species. Bulletin of Zoological Nomenclature, 56: 206-207.
- Pfeiffer, L. 1841. Symbolae ad Historium Heliceorum: 1-88. Casselis.
- Pfeiffer, L. 1848. Monographia heliceorum viventium, 2: 1-594. Liepsig. F. A. Brockhaus.
- Pfeiffer, L. 1859. Monographia heliceorum viventium, 4: 1-920. Liepsig. F. A. Brockhaus.
- Pfeiffer, L. 1861. Descriptions of forty-seven new species of land-shells from the collection of H. Cuming, Esq. Proceedings of the Zoological Society, 1861: 20-29.
- Pfeiffer, L. 1862a. Diagnosen neuer Heliceen. Malakozoologische Blätter 8 [1861]: 77-84.
- Pfeiffer, L. 1862b. Systematisches Conchylien-Cabinet: Die Gattung *Cylindrella*. 1-80; pls. 1-9.
- Pilsbry, H. A. 1902-1903. Manual of Conchology, Ser. II, 15:i-viii, 1-323; pls. 1-65.
- Pilsbry, H. A. 1946. Land Mollusca of North America. Monographs of the Academy of Natural Sciences of Philadelphia. 3,2 (1): 1-520.
- Pilsbry, H. A. 1953. Inland Mollusca of northern Mexico. II. Urocoptidae, Pupillidae, Strobilopsidae, Valloniidae, and Cionellidae. Proceedings of the Academy of Natural Sciences of Philadelphia, 105: 133-167; pls. 3-10; text figs. 1-3.
- Philippi, R. A. 1842-1847. Abbildungen und beschreibungen neuer oder wenig bekannter Conchylien, (I): 1-204. Cassel.
- Rehder, H. A. 1940. A new urocoptid mollusk from Mexico. Journal of the Washington Academy of Science, 30: 315-316.
- Strebel, H., & G. Pfeffer. 1880. Beitrag zur Kenntniss der Fauna mexikanischer Land- und Süsswasser-Conchylien. Theil IV: 1-122; pls. 1-15. Hamburg, J. J. Kerbst.
- Thompson, F. G. 1964. Systematic studies on Mexican land snails of the genus *Holospira*, subgenus *Bostrichocentrum* (STYLOMMATOPHORA, UROCOPTIDAE). Malacologia, 2: 131-143.
- Thompson, F. G. 1968. Some Mexican land snails of the family Urocoptidae. Bulletin of the Florida State Museum, 12:125-183; fig. 1-29.
- Thompson, F. G. 1971. Some Mexican land snails of the genera *Coelostemma* and *Metastoma* (Urocoptidae). Bulletin of the Florida State Museum, 15: 267-302; figs. 1-12.
- Thompson, F. G. 1974. A xeric landsnail from New Mexico. Southwestern Naturalist, 19: 53-56.
- Thompson, F. G. 1988. The hollow-ribbed land snails of the genus *Coelostemma* of the southwestern United States and Mexico. Bulletin of the Florida Museum of Natural History, 33: 87-111; figs. 1-53.
- Thompson, F. G. 1998. *Holospira* Martens, 1850 (MOLLUSCA, GASTROPODA, UROCOPTIDAE): proposed designation of *Cylindrella goldfussi* Menke, 1947 as the type species. Bulletin Zoological Nomenclature, 55: 87-87.
- Thompson, F. G., & A. Correa-[Sandoval]. 1991. Mexican land snails of the genus *Hendersoniella*. Bulletin of the Florida Museum of Natural History, 36: 1-23.
- Thompson, F. G., & A. Correa-[Sandoval]. 1994. Land snails of the genus *Coelocentrum* from north-eastern México. Bulletin of the Florida Museum of Natural History, 36: 141-173.
- Tryon, G. 1868. Monograph of the terrestrial Mollusca of the United States. American Journal of Conchology, 3: 306-327.
- Tozer, E. T. 1956. Uppermost Cretaceous and Paleocene non-marine molluscan faunas of western Alberta. Geological Survey of Canada, Memoir 280: 1-125.



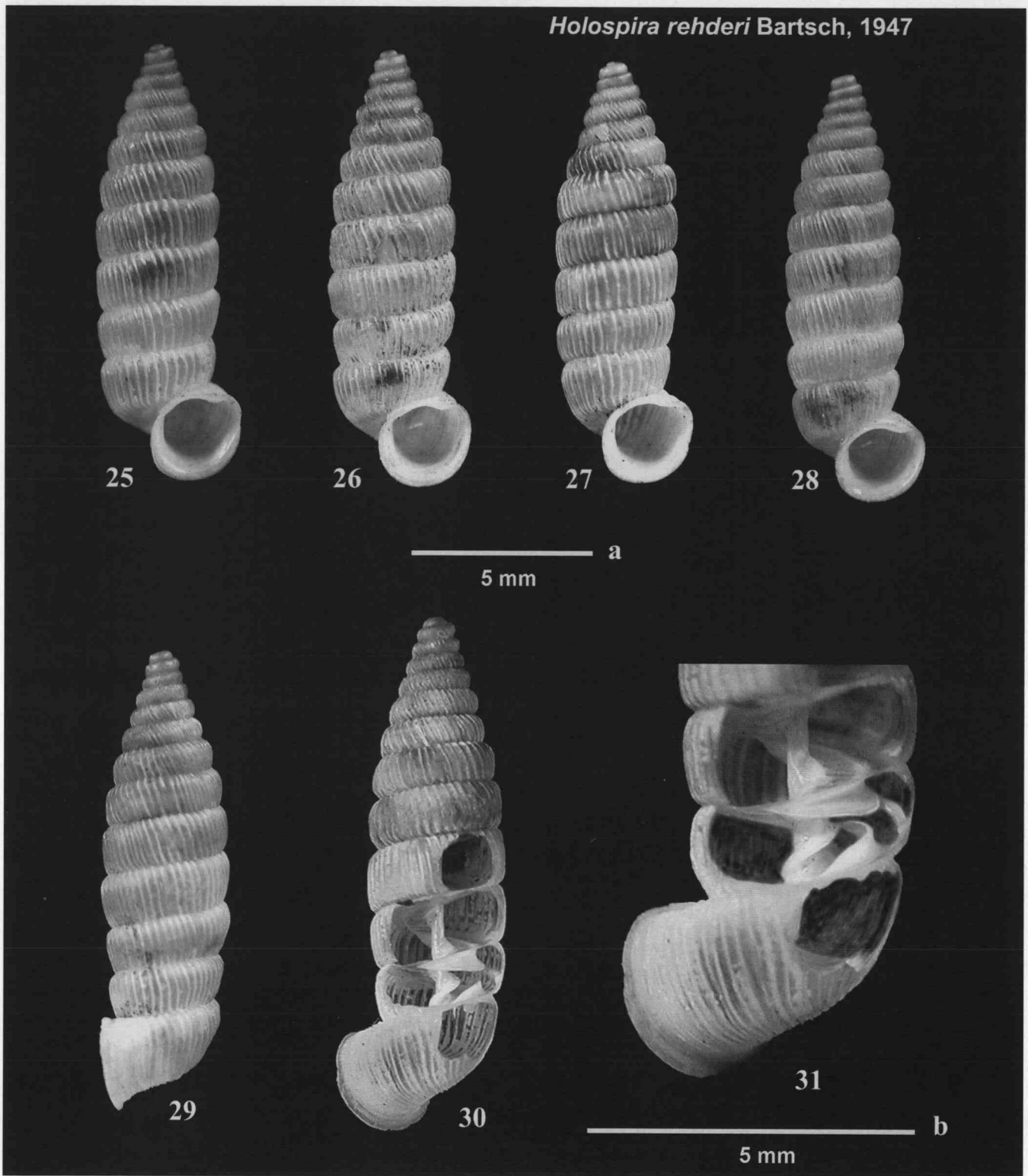
Figures 2-10. *Holospira*. Figures 2-7. *Holospira goniostoma* (Pfeiffer, 1856). Lectotype (British Museum, Natural History 1996153). Figures 2-5: Radiographs showing the positions of the internal lamellae. Figures 6, 7: Lectotype. Figures 8-10. *Holospira maxwelli* Pilsbry, 1953. Paratype (UF 50207). Scale bar **a** is for Figures 6, 7; scale bar **b** is for Figures 8, 9; scale bar **c** is for Figure 10.



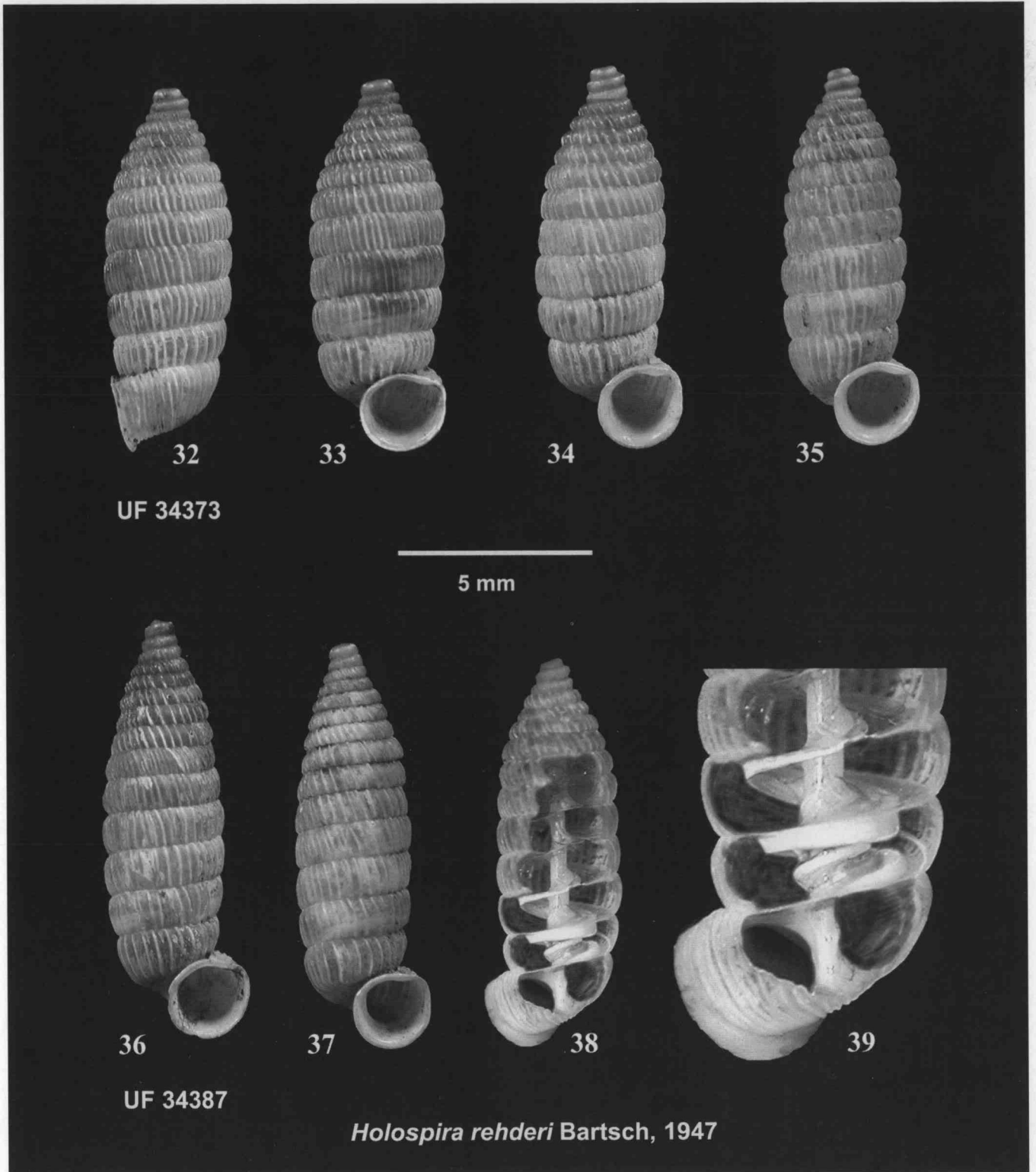
Figures 11-16. *Holospira acanthidia* n. sp. Figures 11, 12: Holotype (UF34377). Figures 13-16: Paratypes (UF 80952). Scale bar **a** for Figures 11-15. Scale bar **b** for Figure 16.



Figures 17-24. *Holospira rehderi* Bartsch, 1947. Figures 17, 18: Holotype (USNM 543590). Figures 19, 20: paratypes (USNM 543590). Figure 21: Holotype of *Holospira morelosensis* Bartsch, 1947 (USNM 543591). Figures 22-24: paratypes of *Holospira morelosensis* (USNM 543592). Scale bar for Figures 17-24.

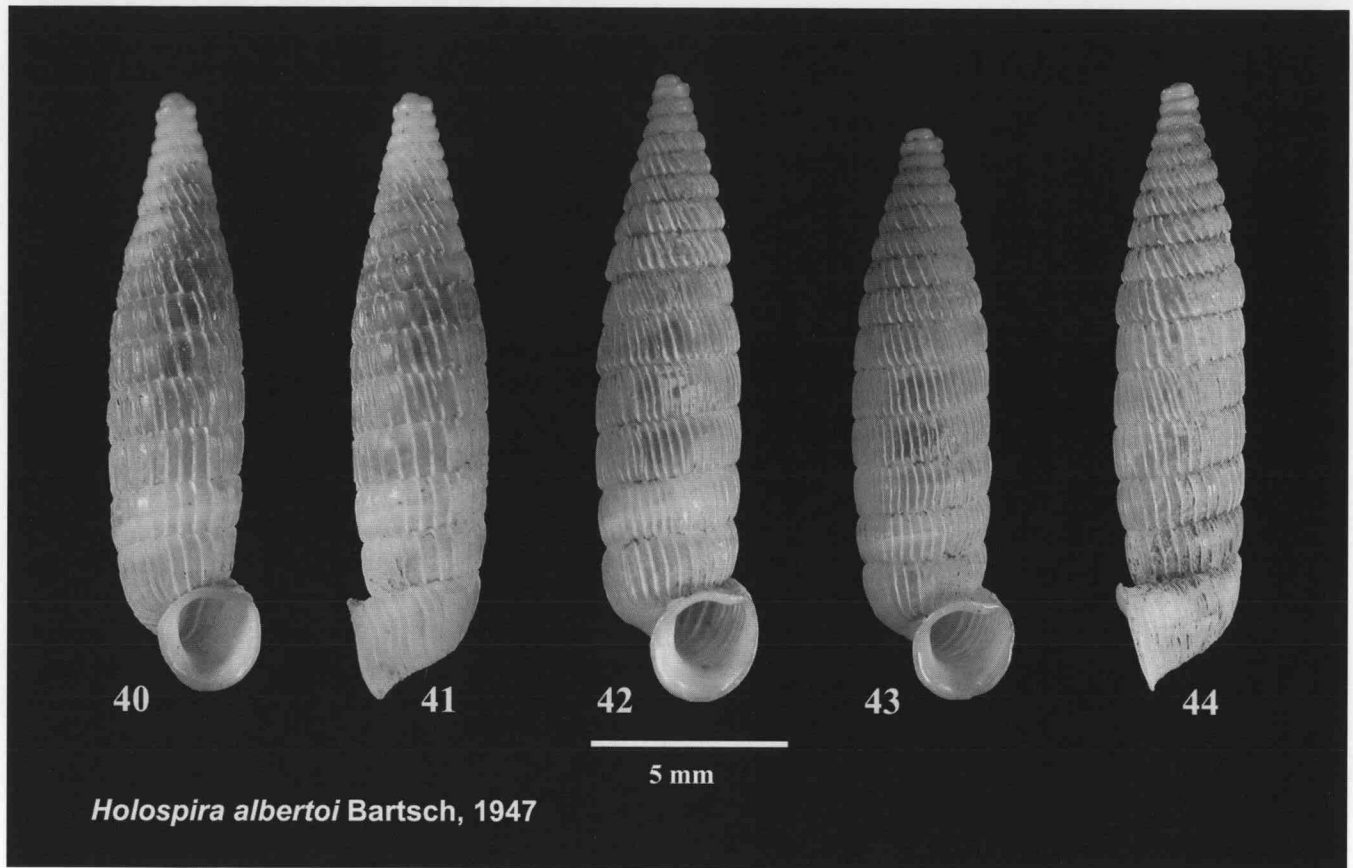


Figures 25-31. *Holospira rehderi* Bartsch, 1947. Morelos, 2 km NW of Nopalera (UF 200399). Scale bar **a** for Figures 25-30. Scale bar **b** for Figure 31.

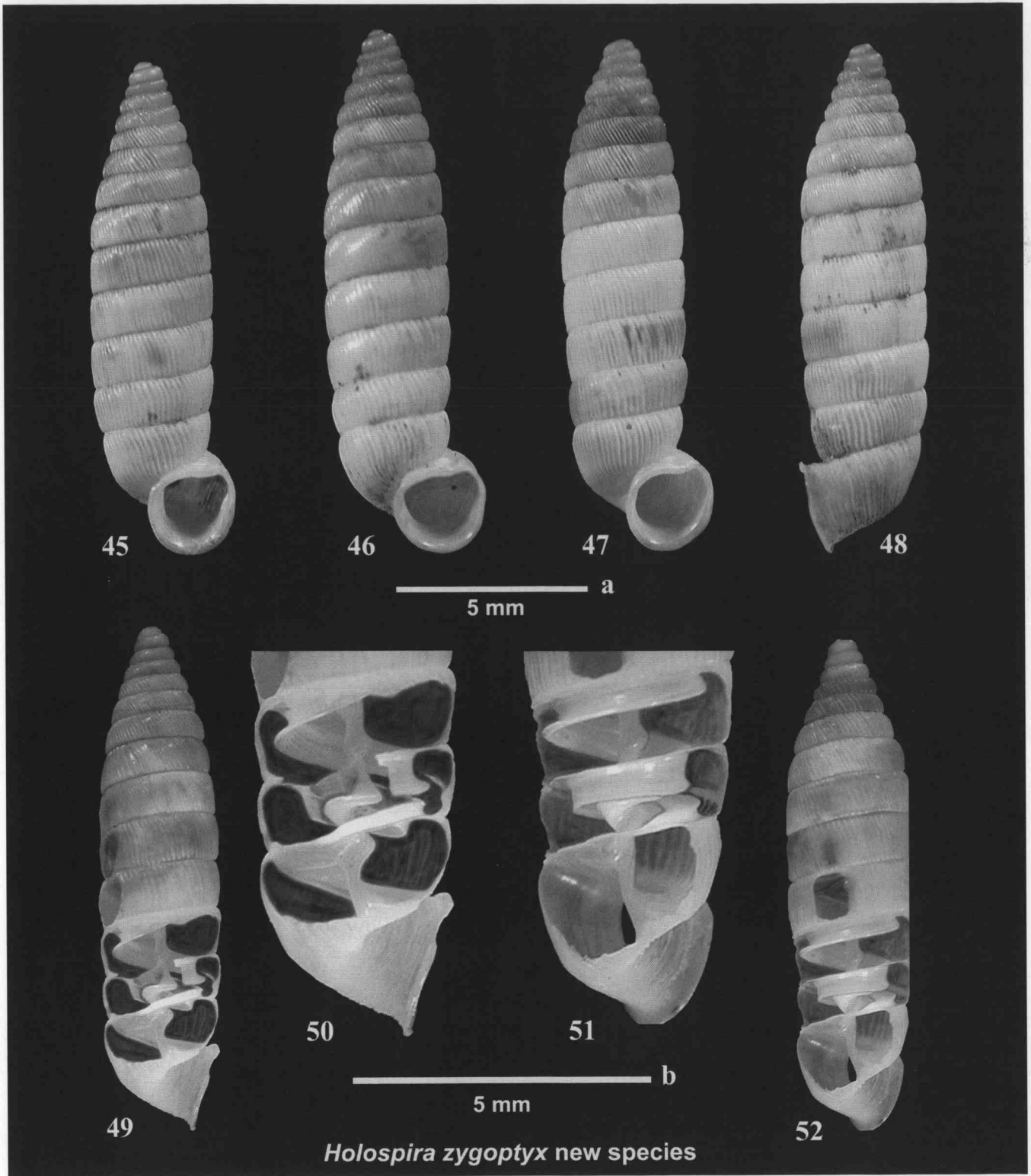


Figures 32-39. *Holospira rehderi* Bartsch, 1947. Figures 32-35: Morelos, 7 km W of Jojutla (UF 34287). Figures 36-39: Puebla, 13 km SE of Izucar de Matamoros (UF 34373). Scale bar for Figures 32-39.



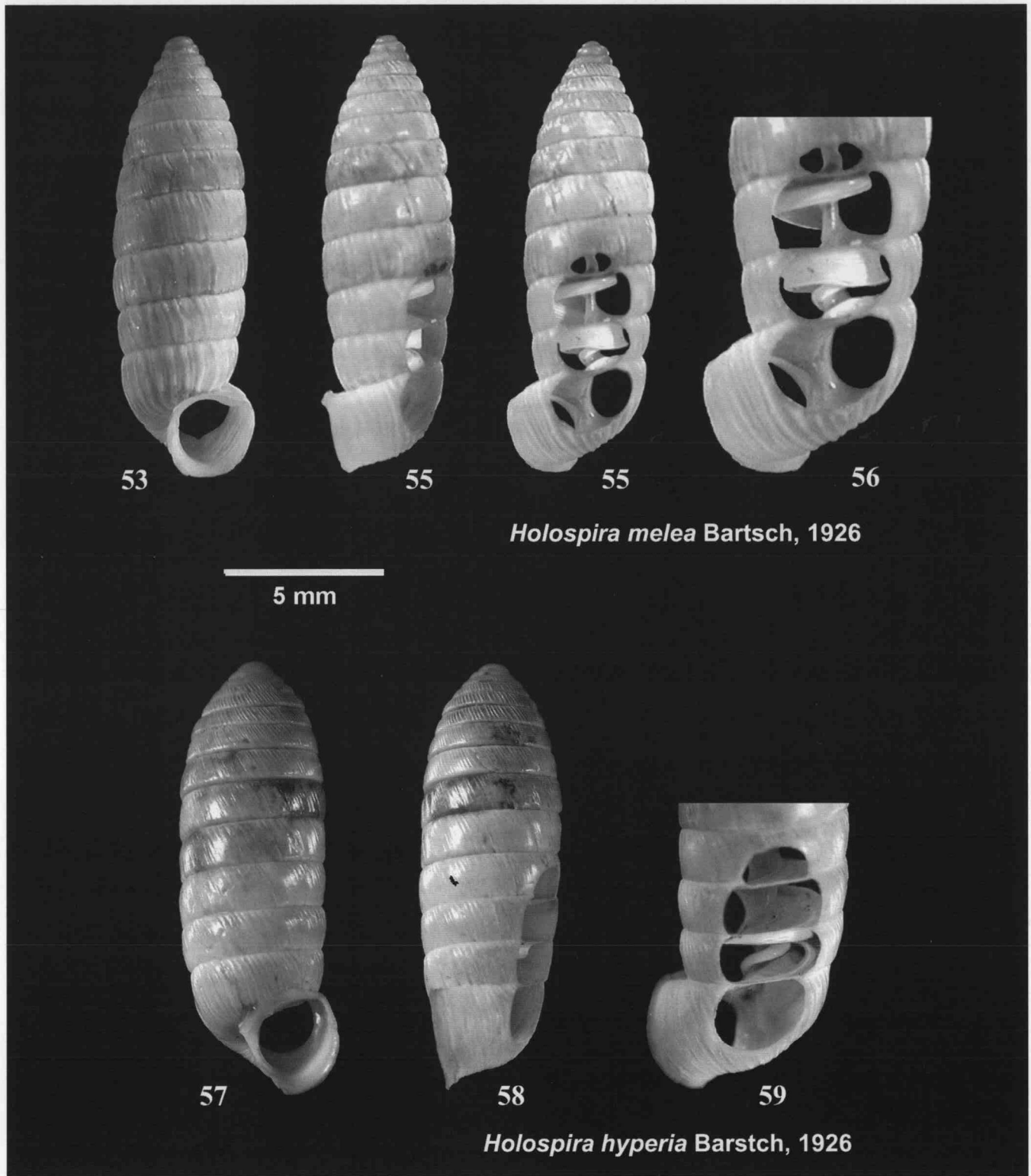


Figures 40-44. *Holospira albertoi* Bartsch, 1947. Figures 40, 41: Holotype (USNM 543495). Figures 42-44: Puebla, 5 km NW of Petlalcingo (UF 34383). Scale bar for Figures 40-44.

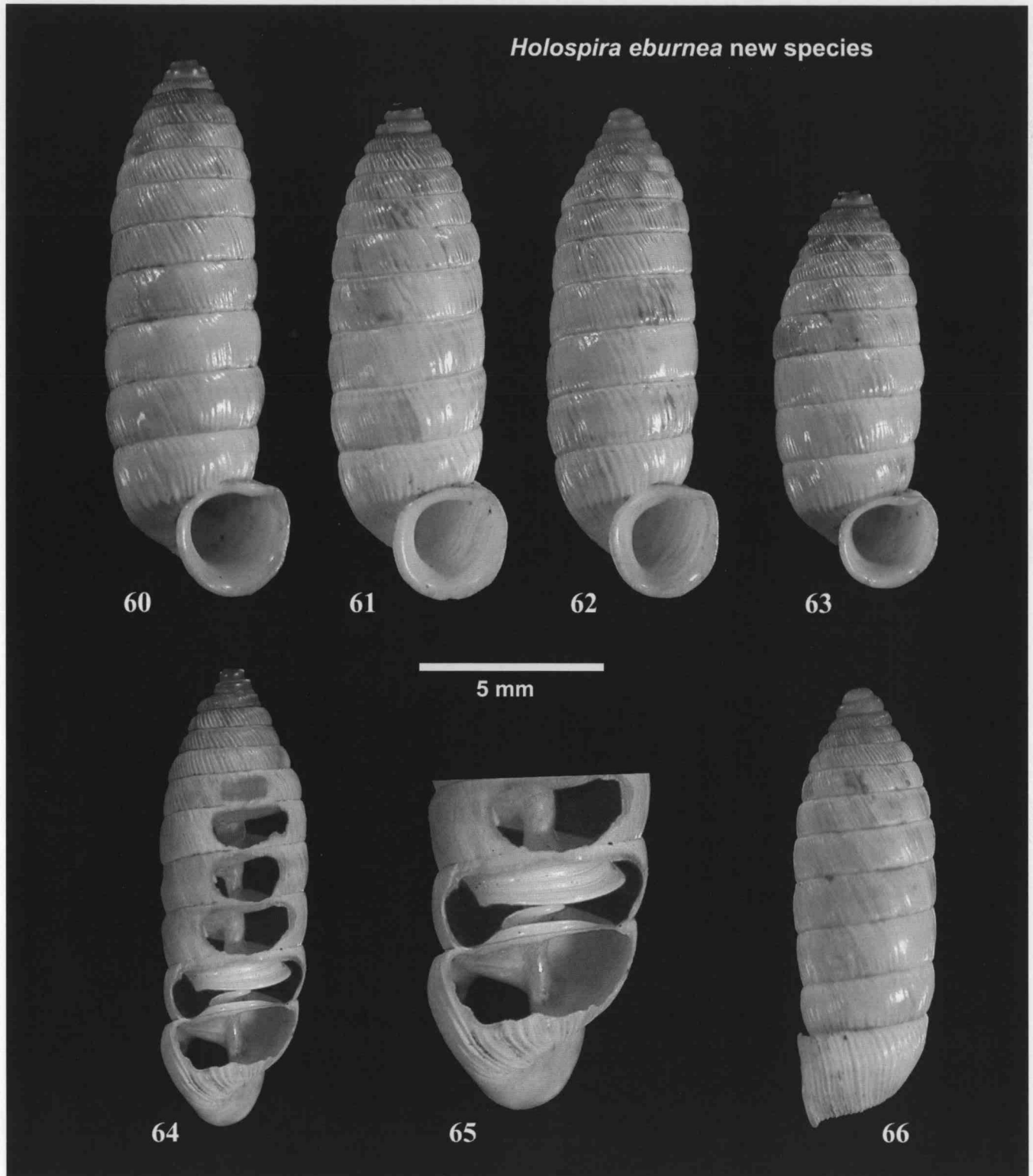


Figures 45-52. *Holospira zygoptyx* n. sp. Figure 45: Holotype (UF190771). Figures 46-52: paratypes (UF 337051). Scale bar **a** for Figures 45-49, 52. Scale bar **b** for Figures 50, 51.

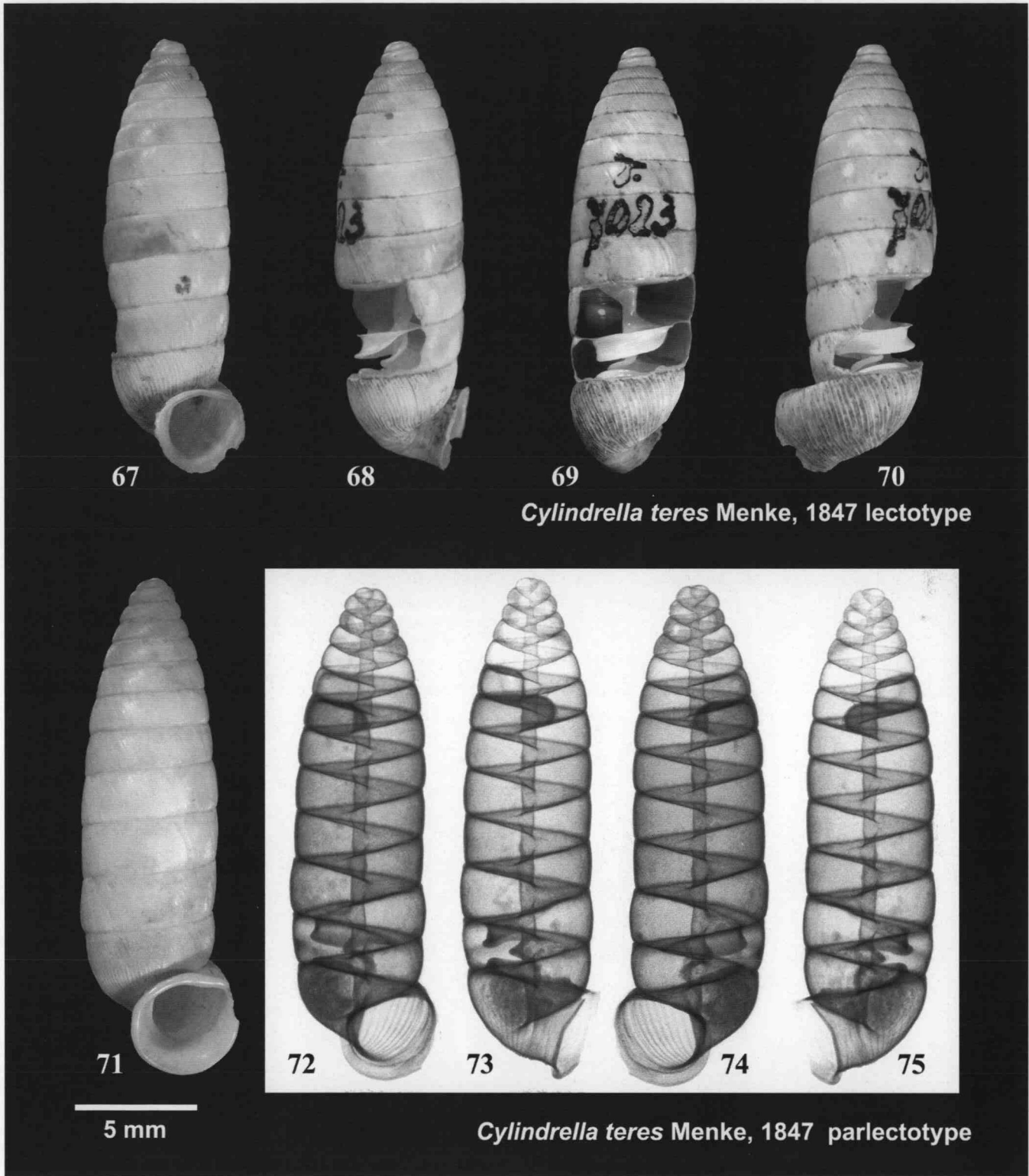




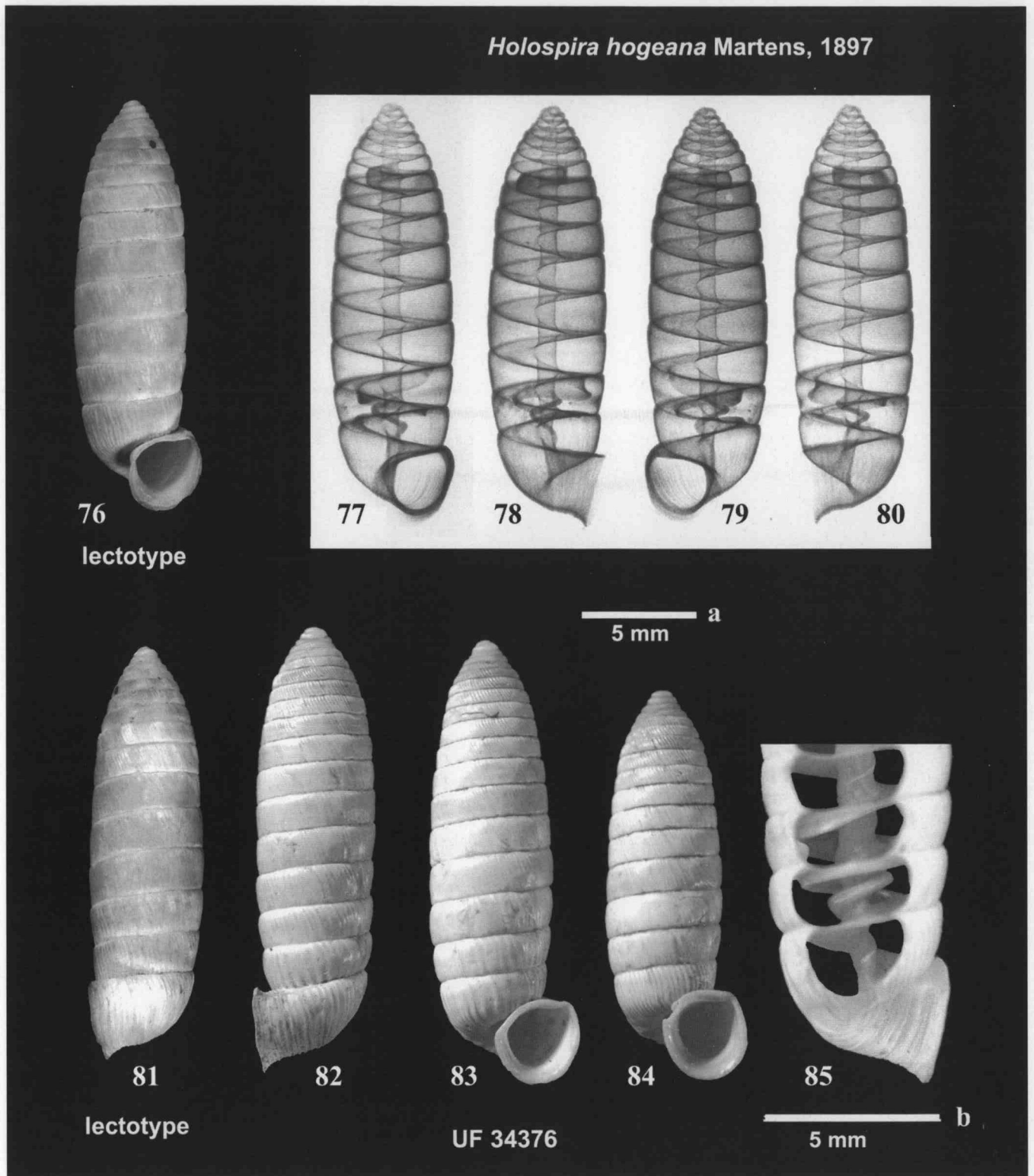
Figures 53-59. *Holospira*. Figures 53-56: *Holospira melea* Bartsch, 1926. Puebla, Ixcaquixtla, Holotype (USNM 363145). Figures 57-59: *Holospira hyperia* Bartsch, 1926. Puebla, Esperanza, Holotype (USNM 363146). Scale bar for Figures 53-59.



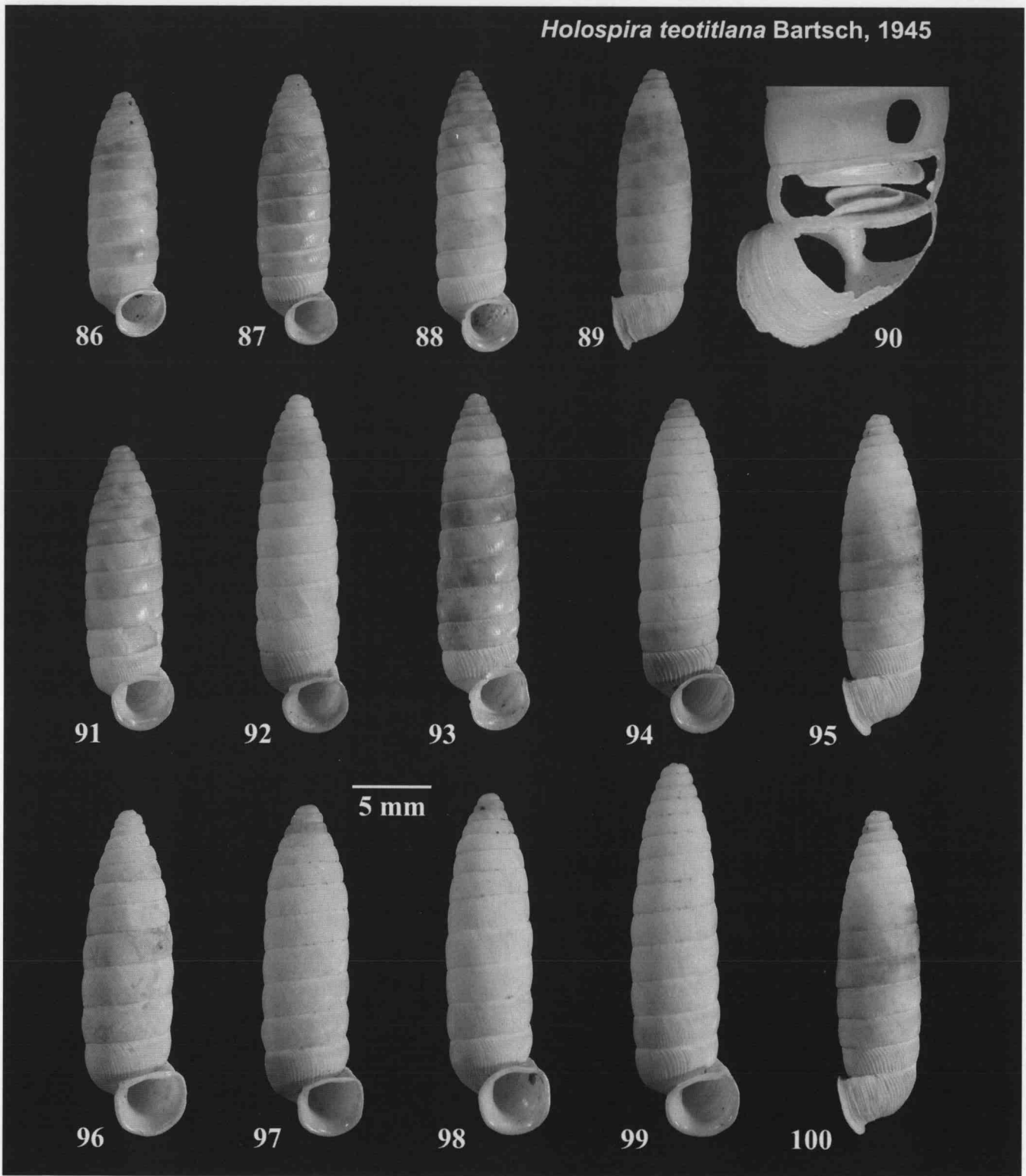
Figures 60-66. *Holospira eburnea* n. sp. Puebla, limestone hilltop 7.6 km SSW of Molcaxac. Figure 61: Holotype (UF 34294). Figures 60, 62-66: Paratypes (UF 351576). Scale bar for Figures 60-66.



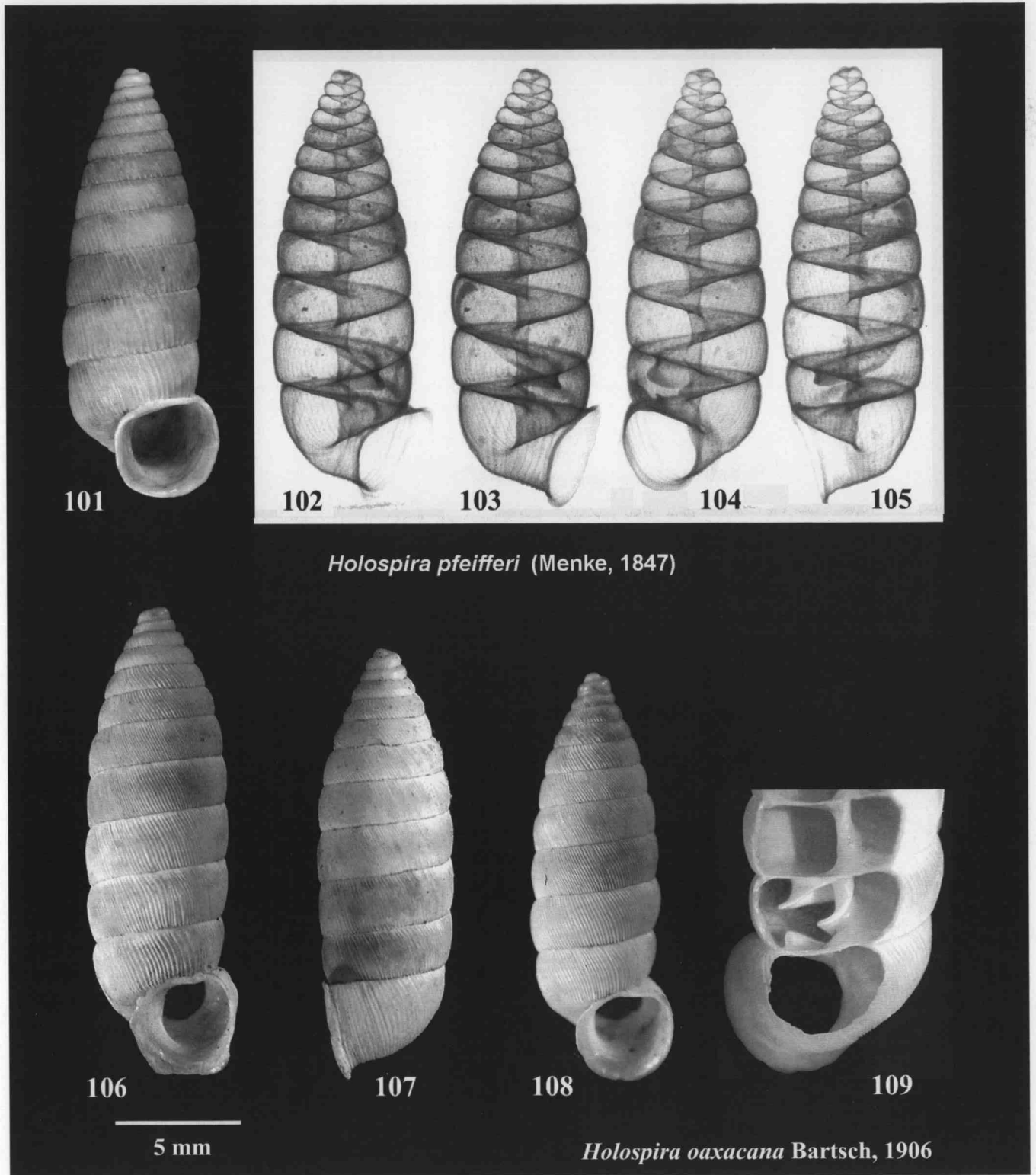
Figures 67-75. *Holospira teres* (Menke, 1847). Figures 67-70: Lectotype (SMF 7023). Figures 71-75: Lectoparatype (BMNH 1996135). Scale bar for Figures 67-75.



Figures 76-85. *Holospira hogeana* Martens, 1897. Figures 76-81: Lectotype, Veracruz, Maltrata (BMNH 1901.6.22.1903). Figures 82-85: Puebla, 1 km NE of Chapulco (UF 34376). Scale bar **a** for Figures 76-84. Scale bar **b** for Figure 85.

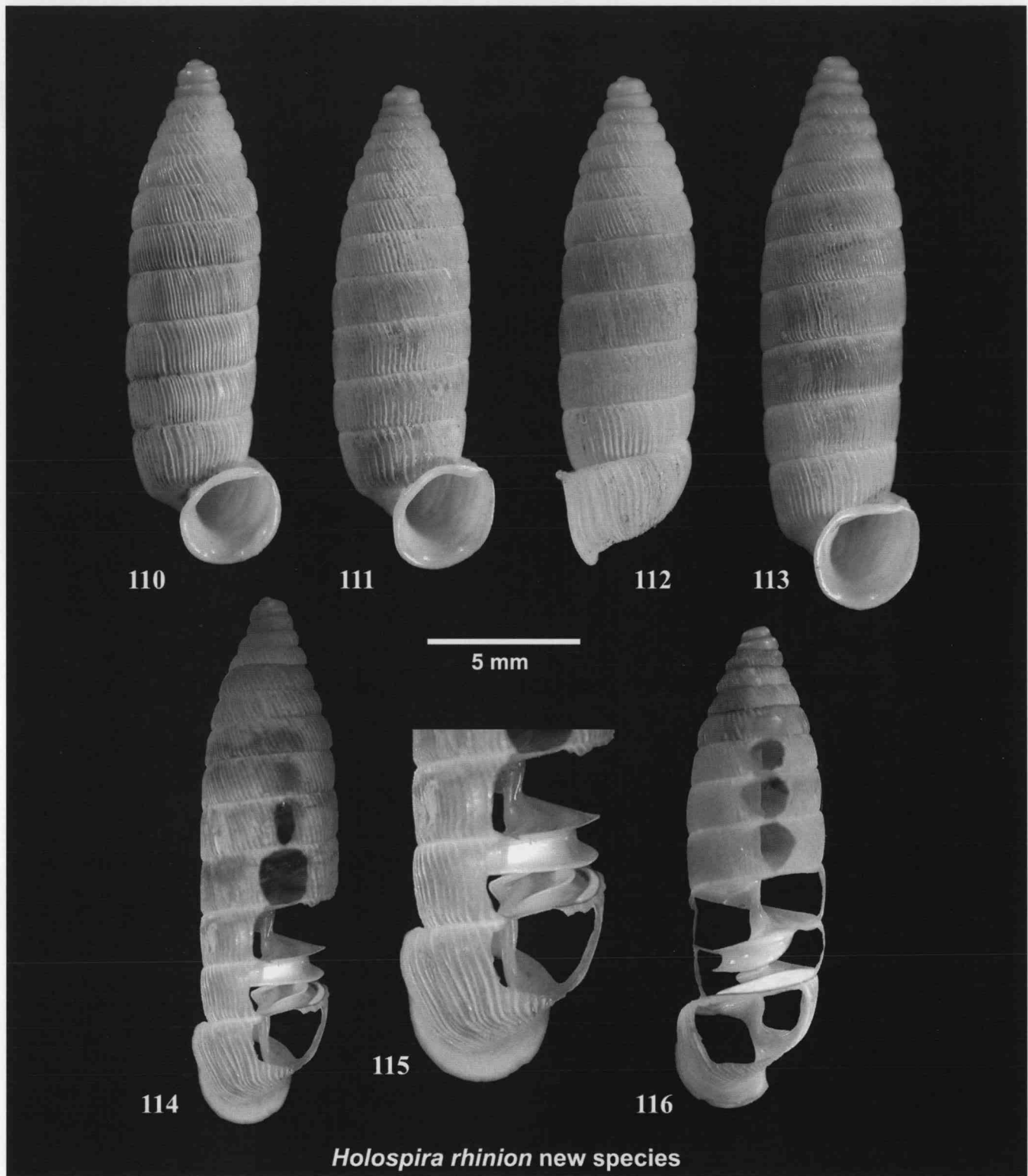


Figures 86-100. *Holospira teotitlana* Bartsch, 1945. Figures 86-90: Oaxaca, 2.5 km N of San Juan de Los Cues (UF 337284). Figures 91-95: Oaxaca, 8 km S of Teotilán de Camino (UF 200425). Figures 96-100: Puebla, 11.5 km SSE of Coxcatlán (UF 337317). Scale bar for Figures 86-89, 91-100.

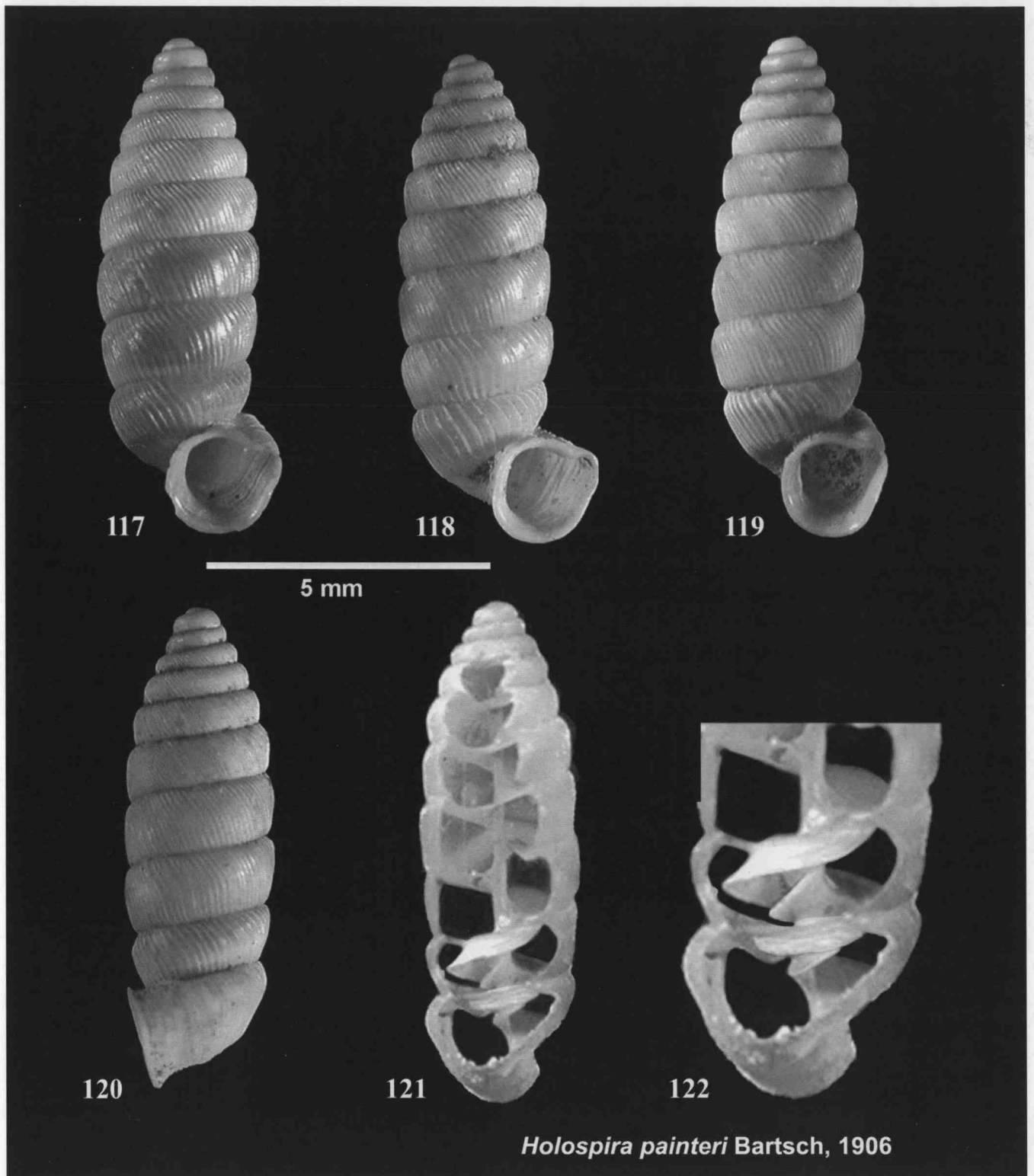


Figures 101-109. *Holospira*. Figures 101-105: *Holospira pfeifferi* (Menke, 1847), Puebla, Tehuacán; Lectotype (BMNH 1996134). Figures 106-109: *Holospira oaxacana* Bartsch, 1906, Oaxaca, Tomallín. Figures 106 Lectotype (USNM 175085). Figures 107-109: Paralectotypes (USNM 1025749). Figure 109 is the internal barrier of Figure 108. Scale bar is for Figures 101-108.



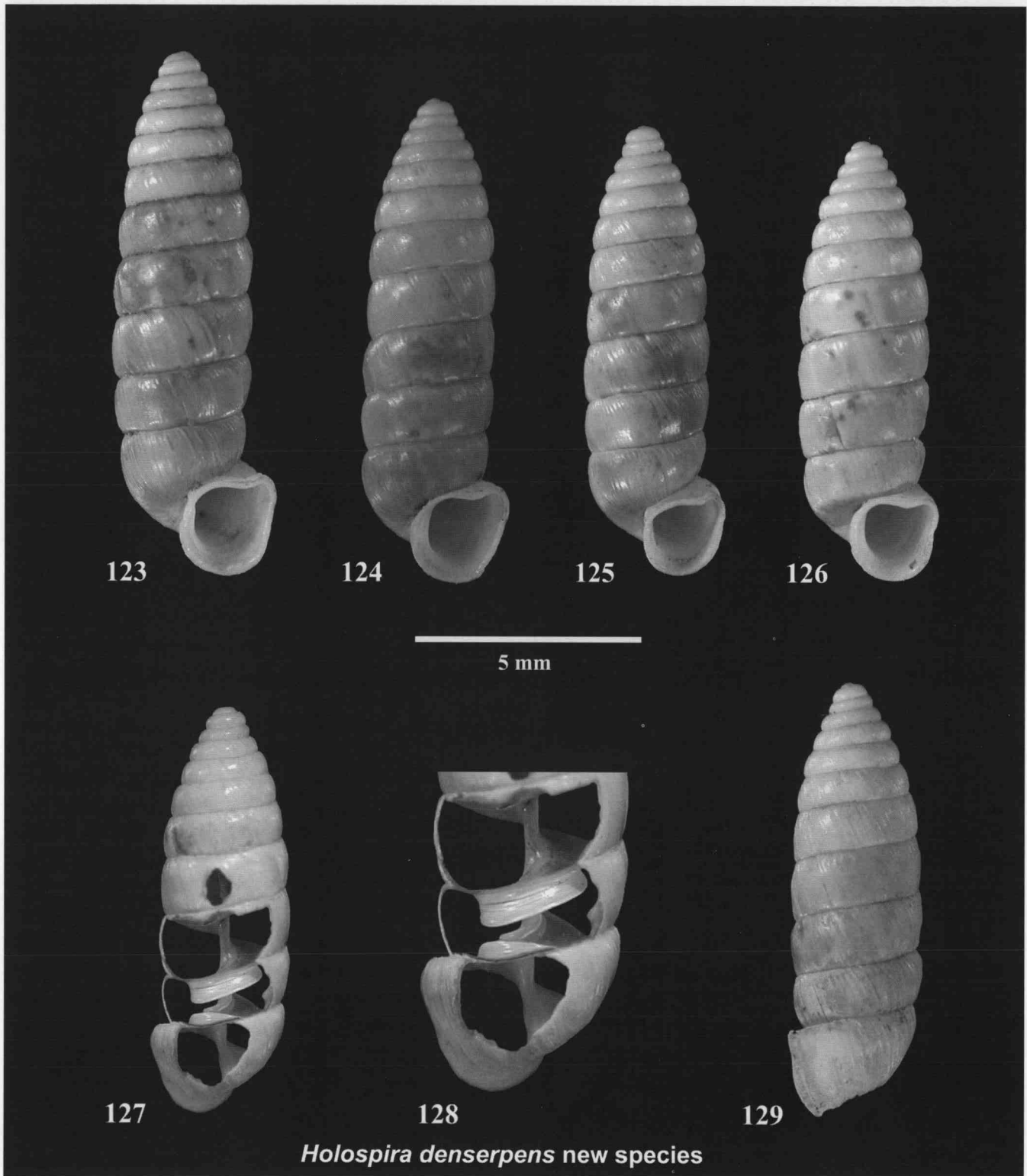


Figures 110-116. *Holospira rhinion* n. sp. Puebla, 15 km SE of Tehuacán. Figure 110: Holotype (UF 34375). Figures 11-116: Paratypes (UF 342782). Figure 15 is an enlargement of Figure 14. Scale bar is for Figures 110-114, 116.

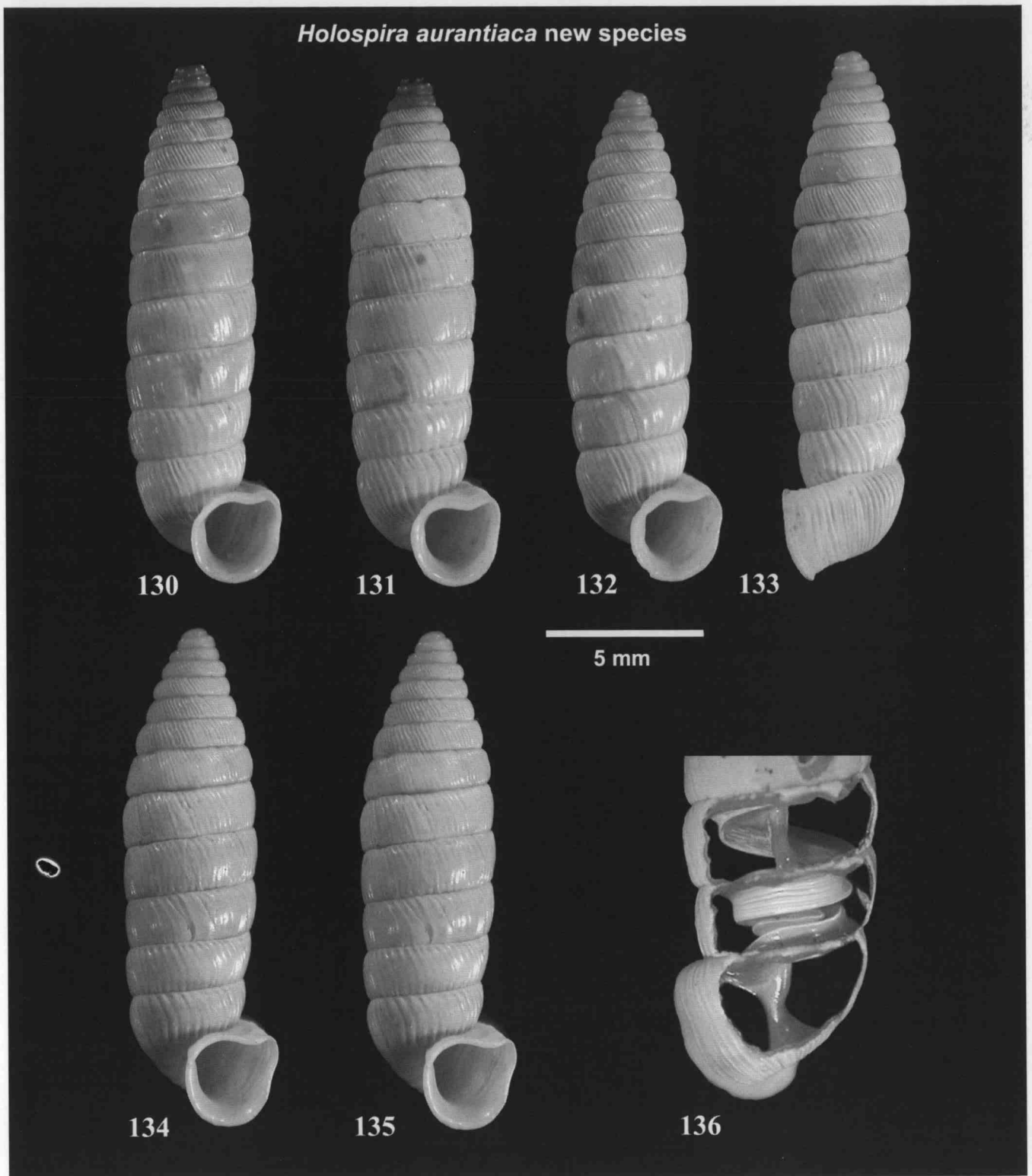


Figures 117-122. *Holospira painteri* Bartsch, 1906. Puebla, Tehucán. Figure 117: Holotype (USNM 187675). Figures 118-122: Paratypes (USNM 1025750). Figure 122 is an enlargement of Figure 121. Scale bar is for Figures 117-121

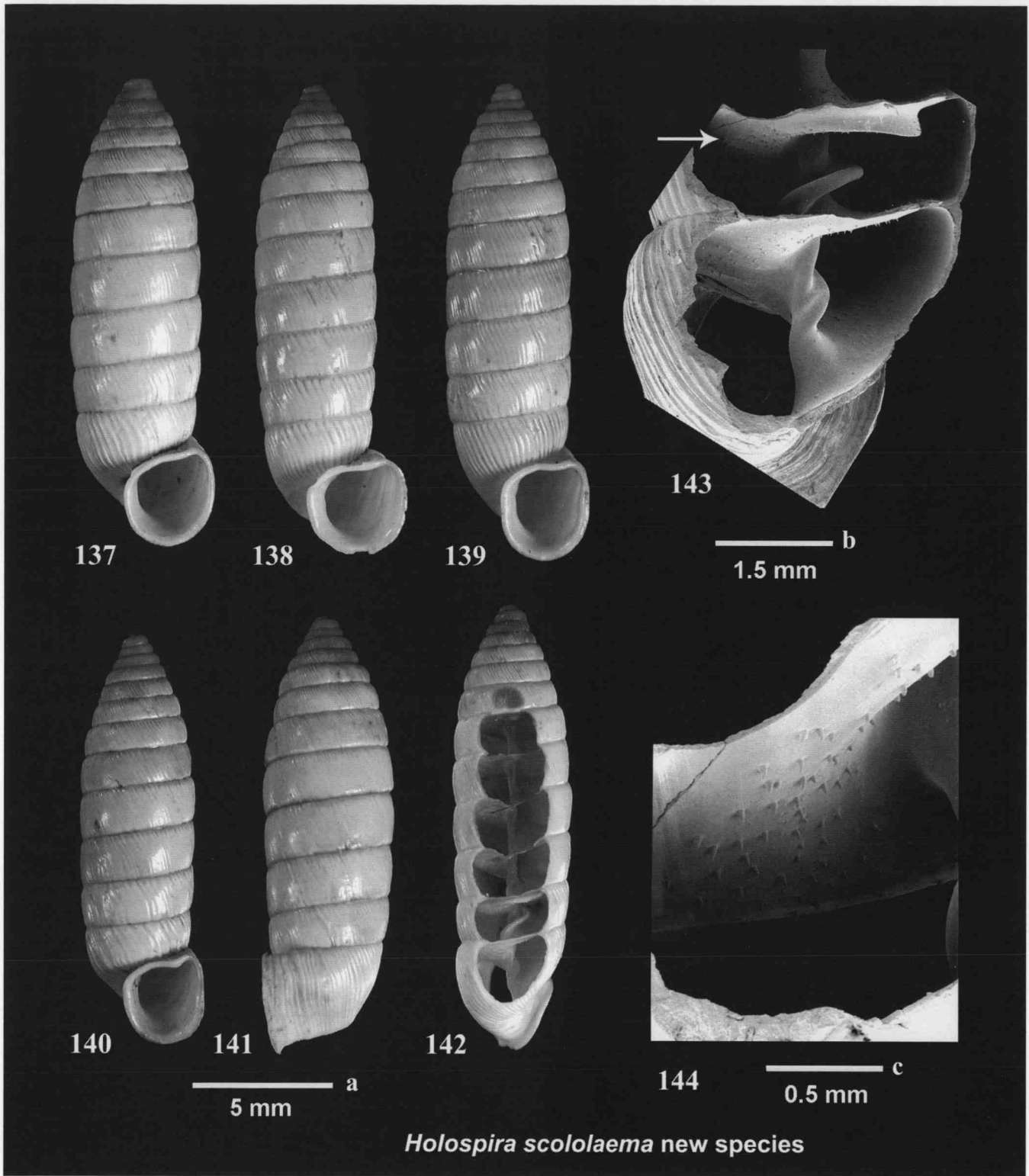




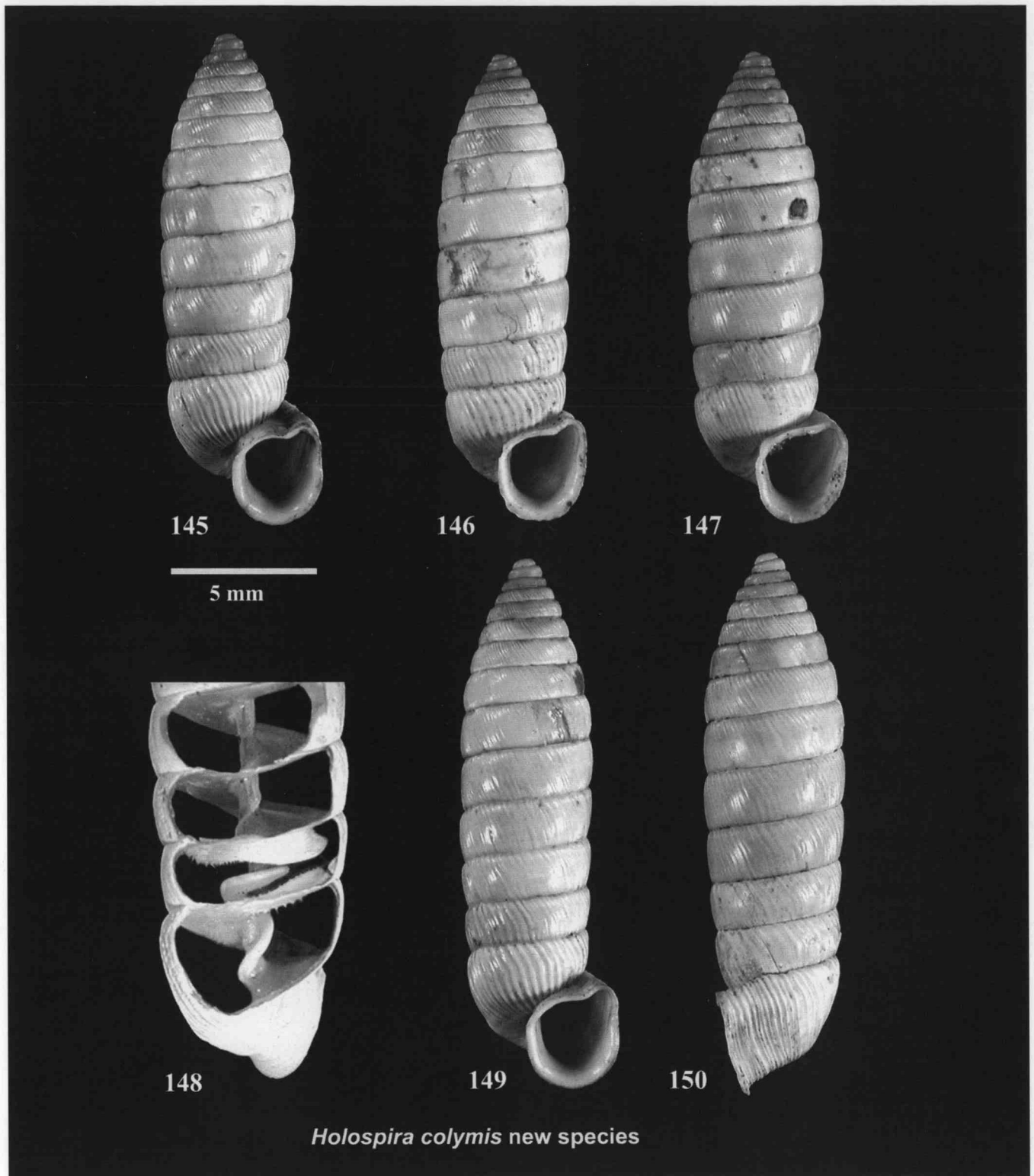
Figures 123-129. *Holospira denserpens* n. sp. Puebla, 1 km E of Azumbilla, 23 km N of Tehuacán. Figure 124: Holotype (UF 190783). Figures 123, 125-129: Paratypes (UF 341543). Figure 128 is an enlargement of Figure 127. Scale bar is for Figures 123-127, 129.



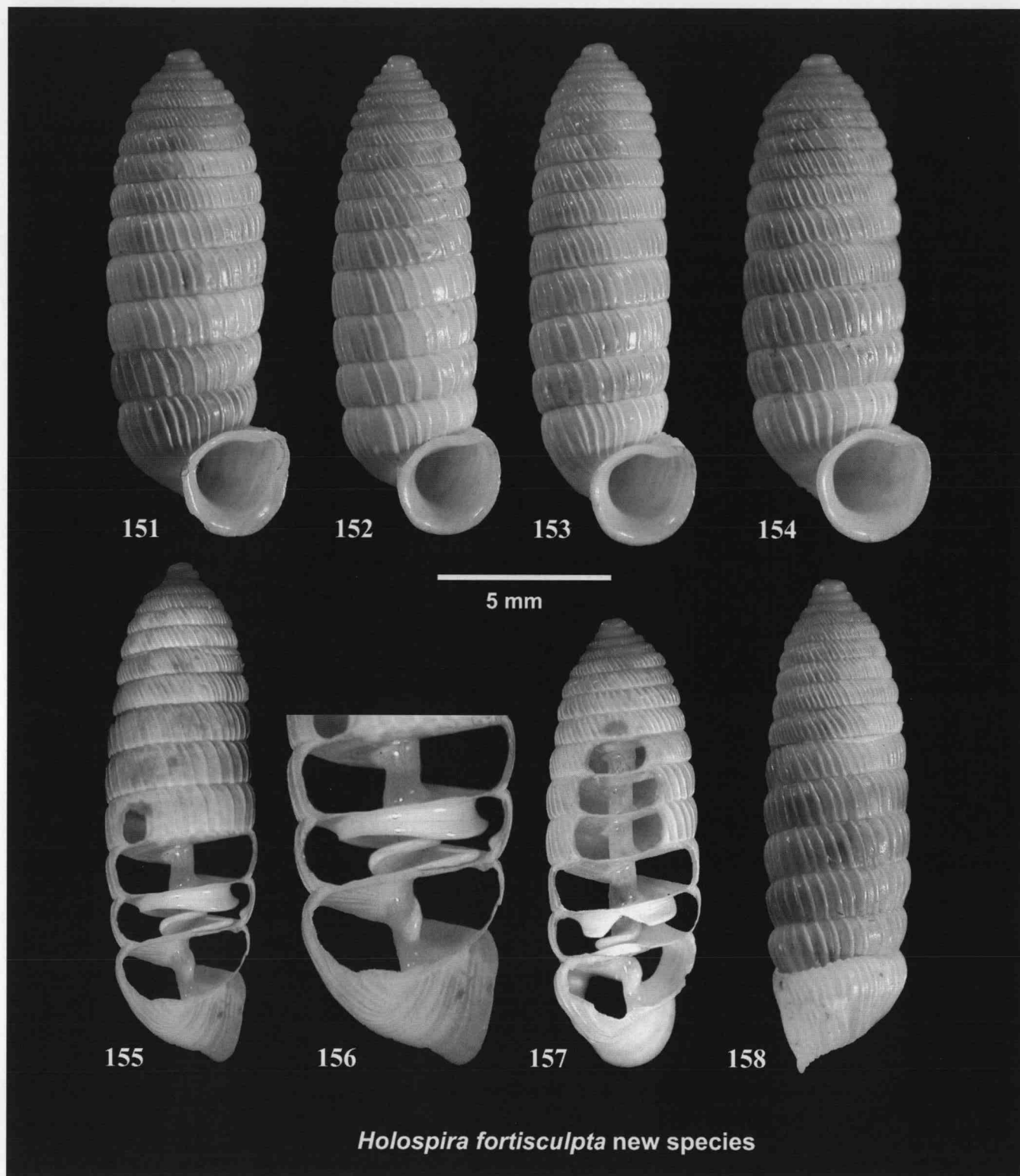
Figures 130-136. *Holospira aurantiaca* n. sp. Puebla, canyon 2 km SE of Tecamachalco. Figure 130: Holotype (UF 190765). Figures 131-136: Paratypes (UF 341545). Scale bar is for Figures 130-135.



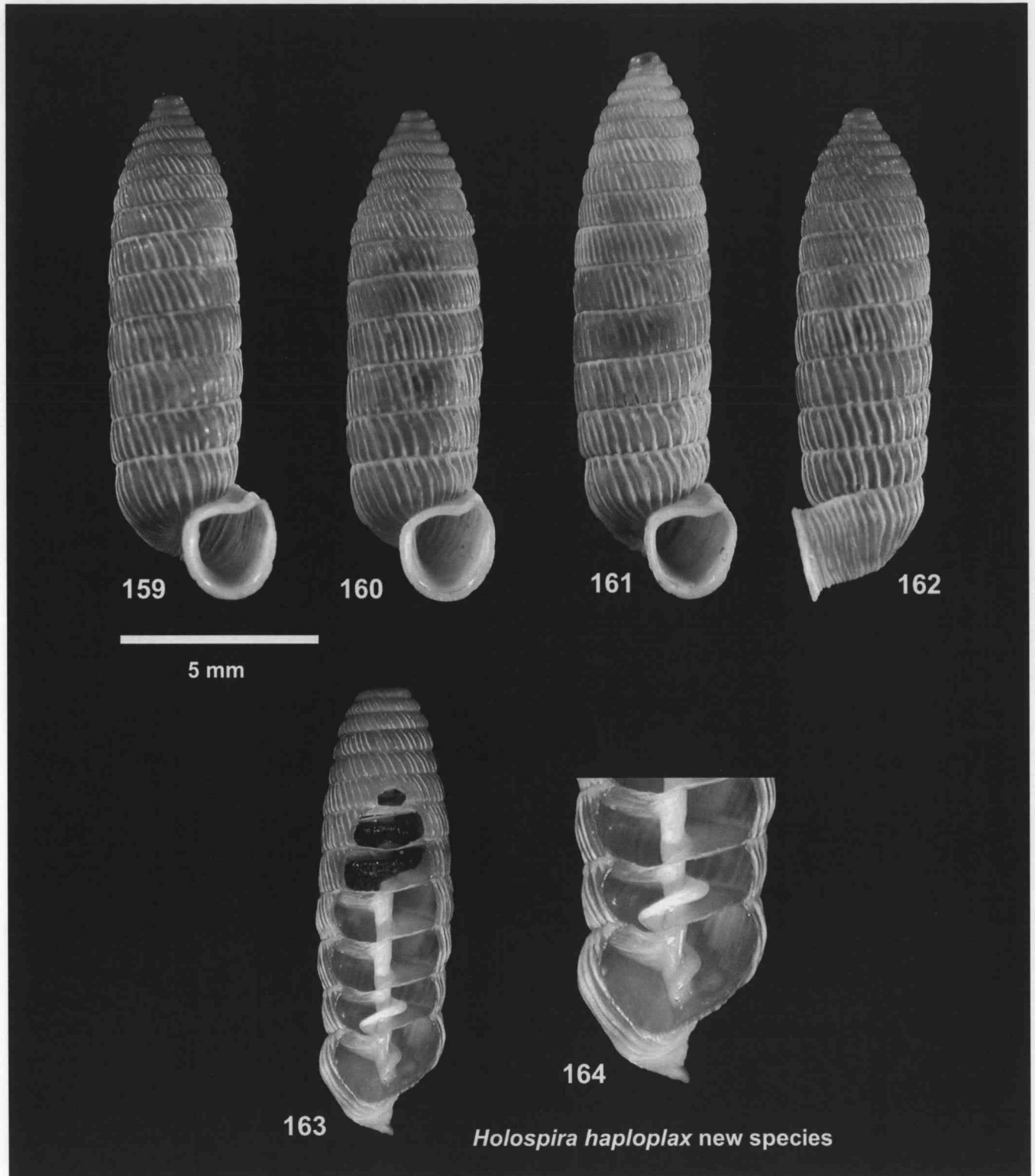
Figures 137-144. *Holospira scololaema* n. sp. Puebla, 1 km NE of Yehualtepec. Figure 137: Holotype (UF 34287). Figures 138-142: Paratypes (UF 335731). Figures 143, 144: Paratype (UF 335727). Figure 144 is an enlargement of Figure 143. Scale bar **a** is for Figures 137-142. Scale bar **b** is for Figure 143. Scale bar **c** is for Figure 144.



Figures 145-150. *Holospira colymis* n. sp. Puebla, limestone hillside 13.5 km WSW of San Bartola Teontepec. Figur. 145: Holotype (UF 200782). Figures 146-150: Paratypes (UF 335728). Scale bar is for Figures 145-147, 149-150.

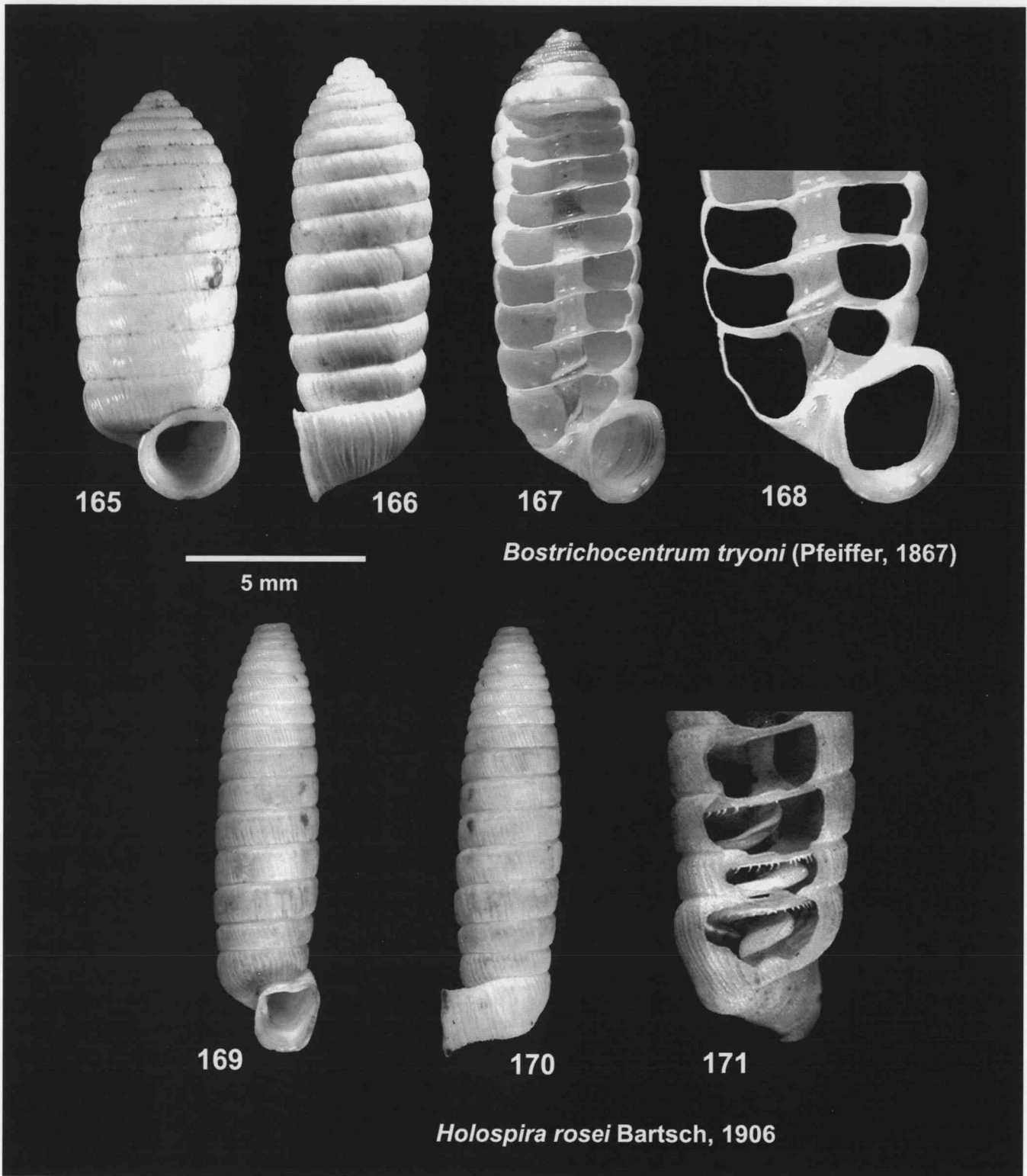


Figures 151-158. *Holospira fortisculpta* n. sp. Puebla, 5 km NW of Atenco. Figure 151: Holotype (UF 34293). Figures 152-158: Paratypes (UF 342779). Figure 156 is an enlargement of Figure 155. In Figure 157 the parietal lamella has been broken to expose the columellar lamella. Scale bar is for Figures 151-155, 157-158.

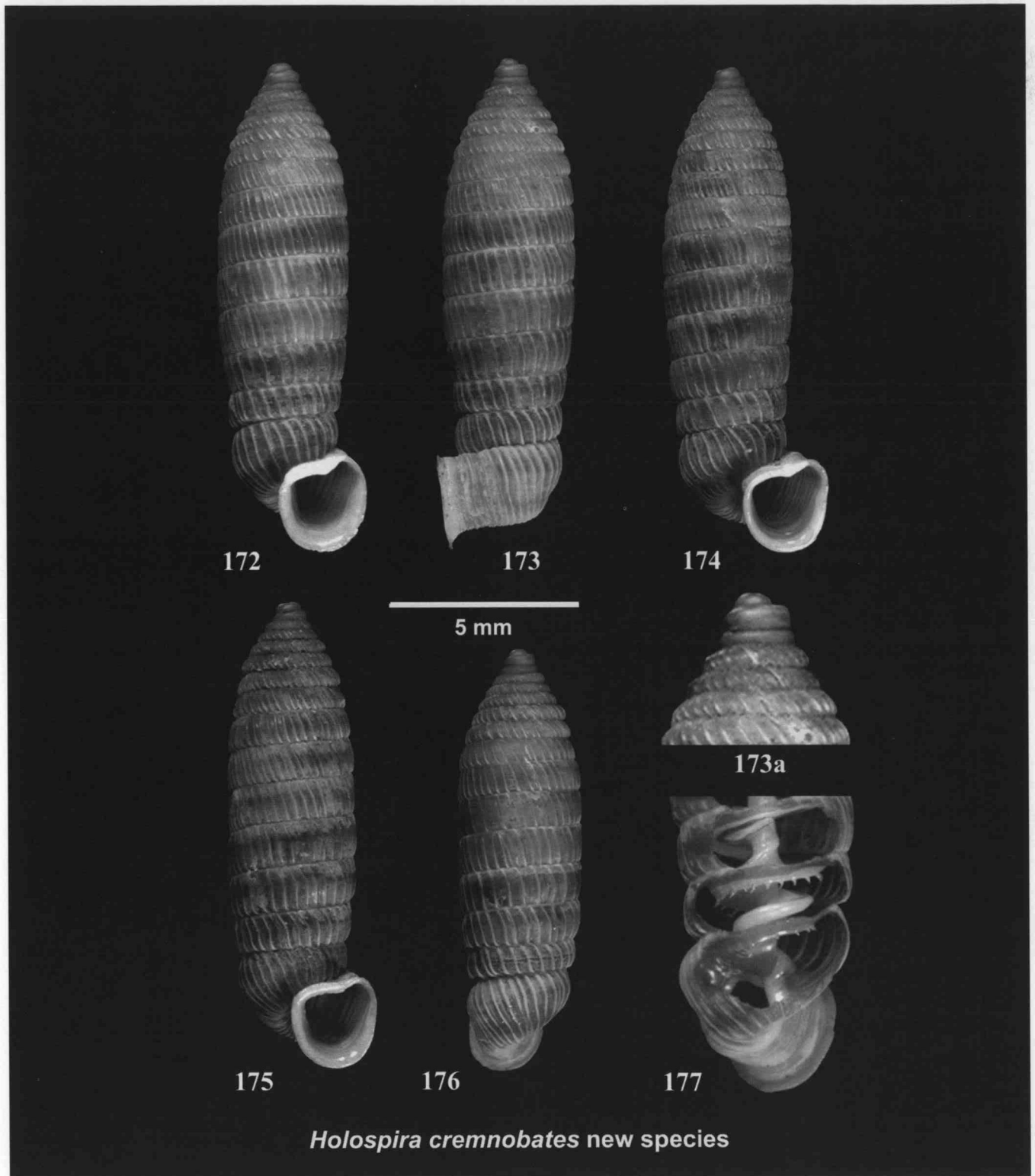


Figures 159-164. *Holospira haploplax* n. sp. Puebla, 5 km NW of Atenco, Figure 163: Holotype (UF 34293). Figures 164-168: Paratypes (UF 342779). Figure 168 is an enlargement of Figure 167. Scale bar is for Figures 163-167.



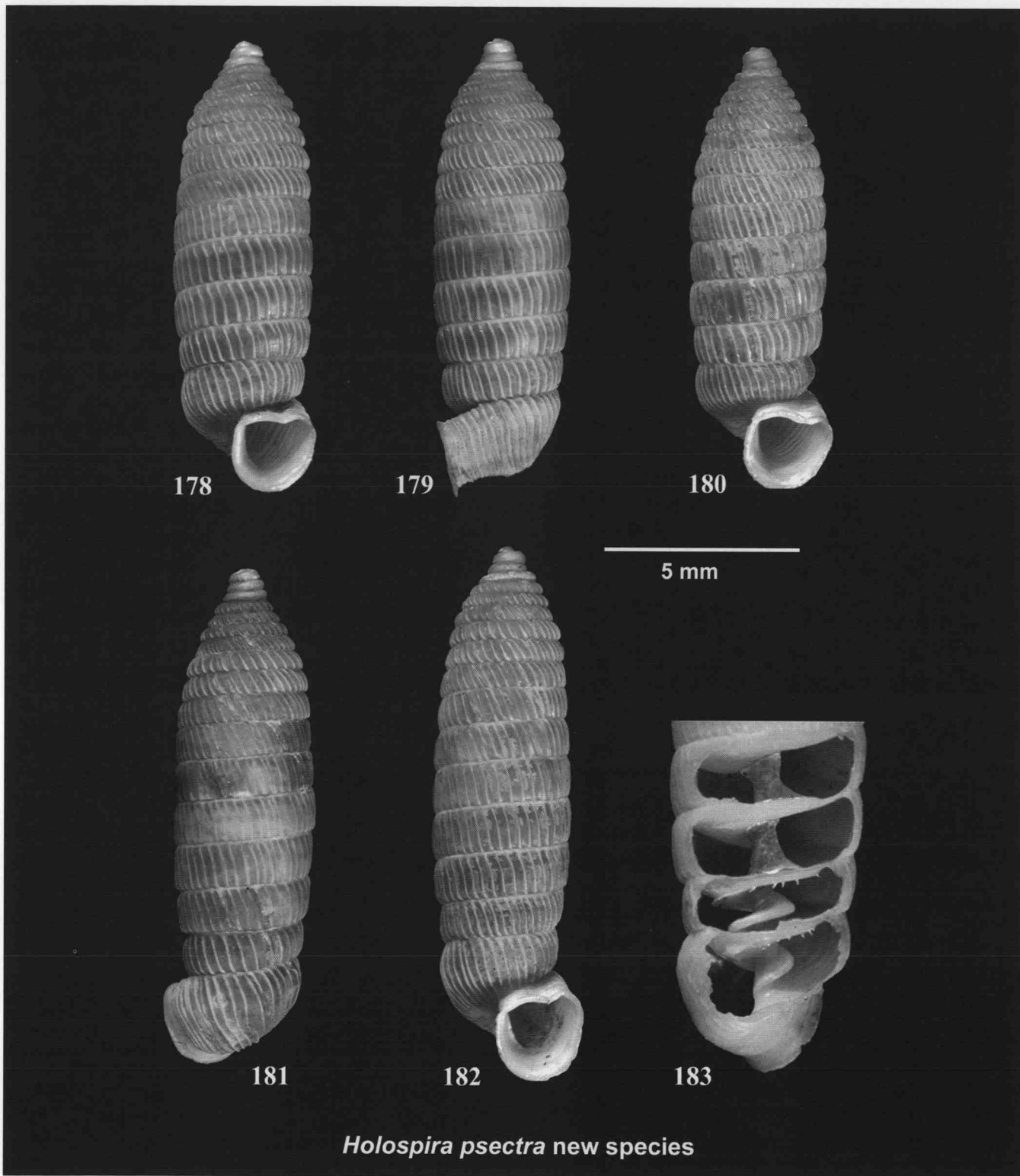


Figures 165-170. *Bostrichocentrum* and *Holospira* (*Stalactella*). Figures. 165-168. *Bostrichocentrum tryoni* (Pfeiffer, 1867). Puebla, Puebla (UF 179808). Figure 168 is an enlargement of Fig. 167. Figures 169-171. *Holospira* (*Stalactella*) *rosei* Bartsch, 1906. Puebla, Tehuacán. Holotype (USNM 188181). Figure 171 is the opened posterior side of Figure 169 enlarged. Scale bar is for Figures 165-167, 168-170.

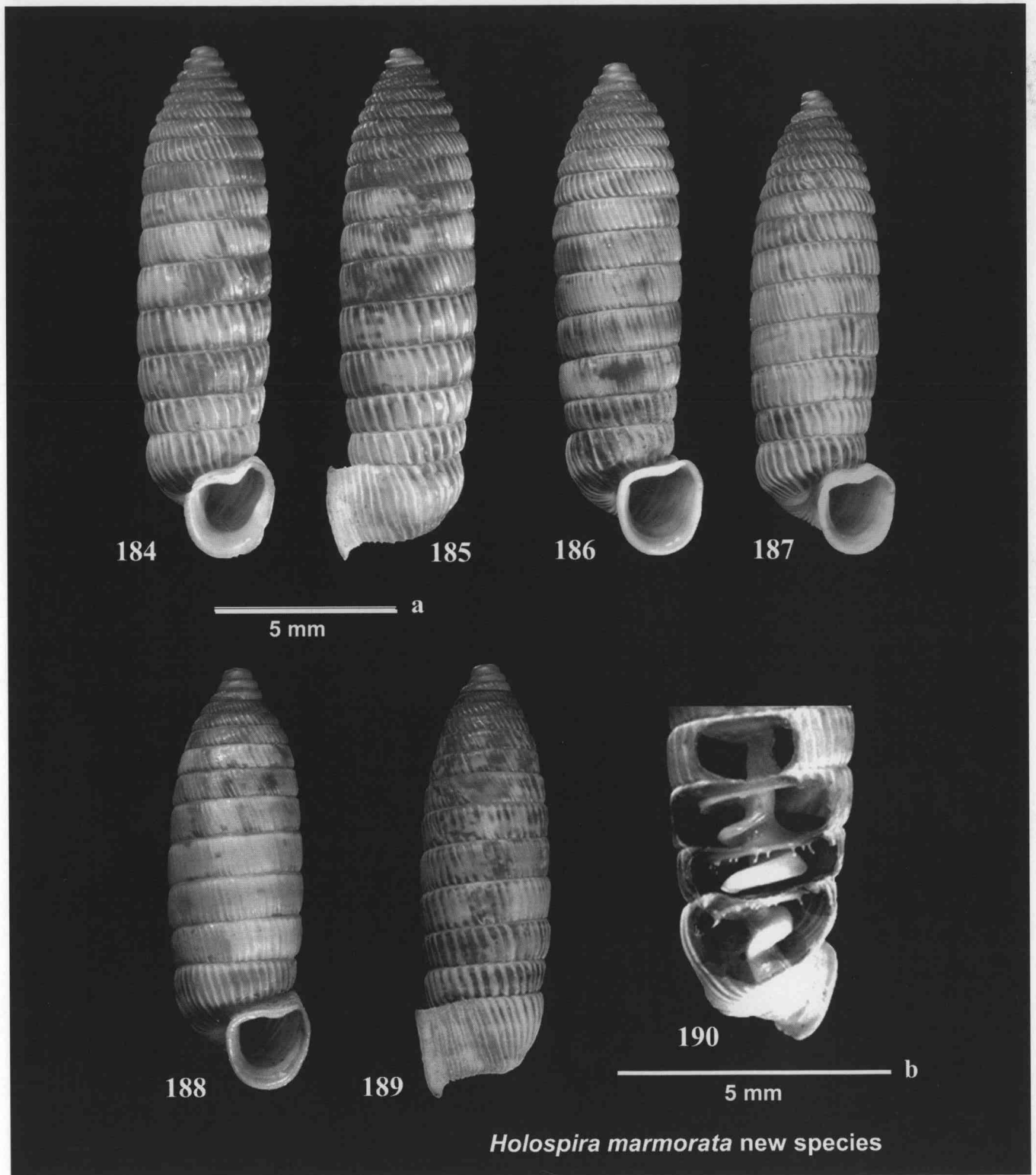


Figures 172-177. *Holospira (Stalactella) cremnobates* n. sp. Puebla, 10 km N of Tehuacán. Figures 172, 173, 173a: Holotype (UF 190789). Figures 174-177: Paratypes (UF 21453). Scale bar is for Figures 172-176.

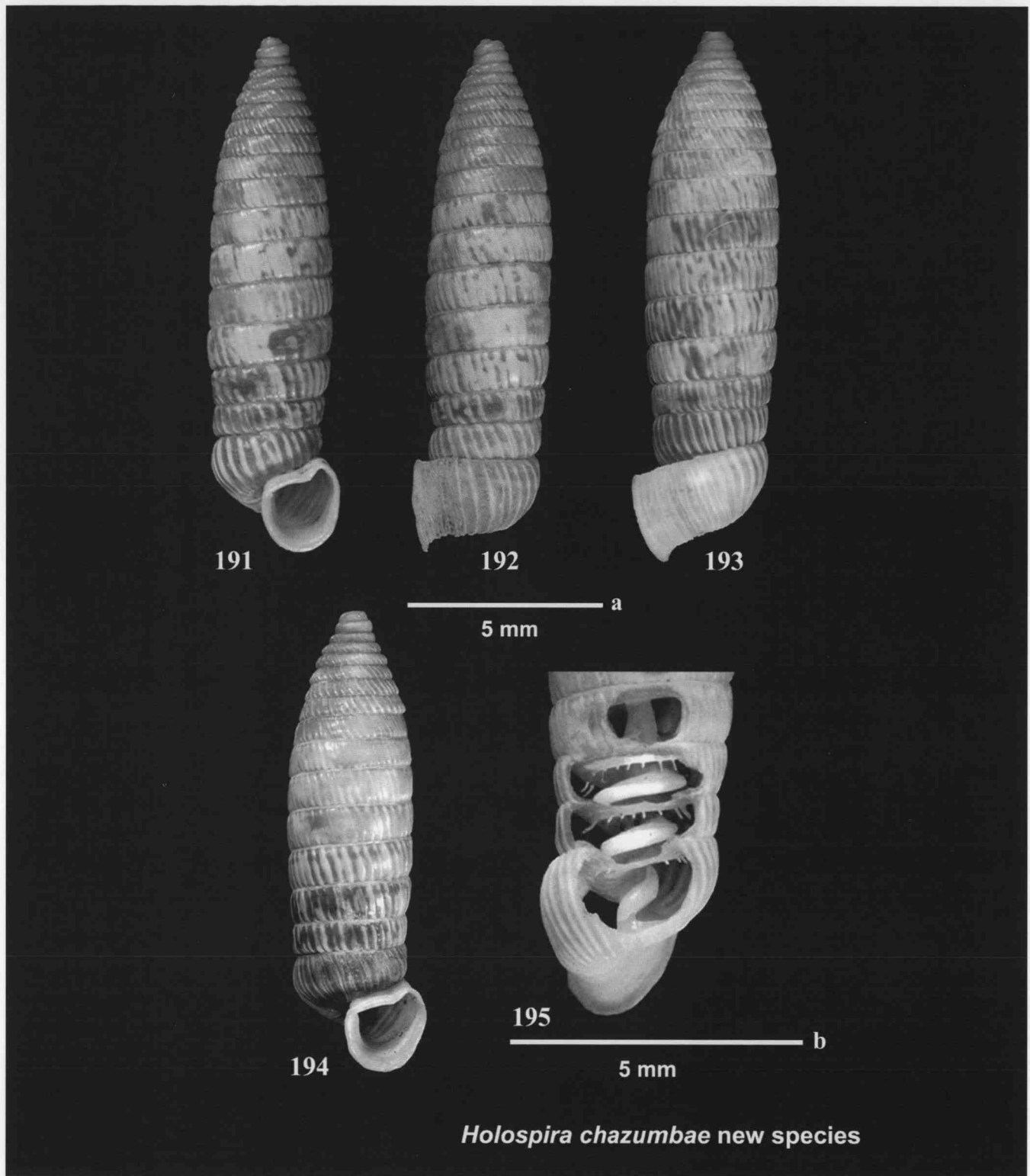




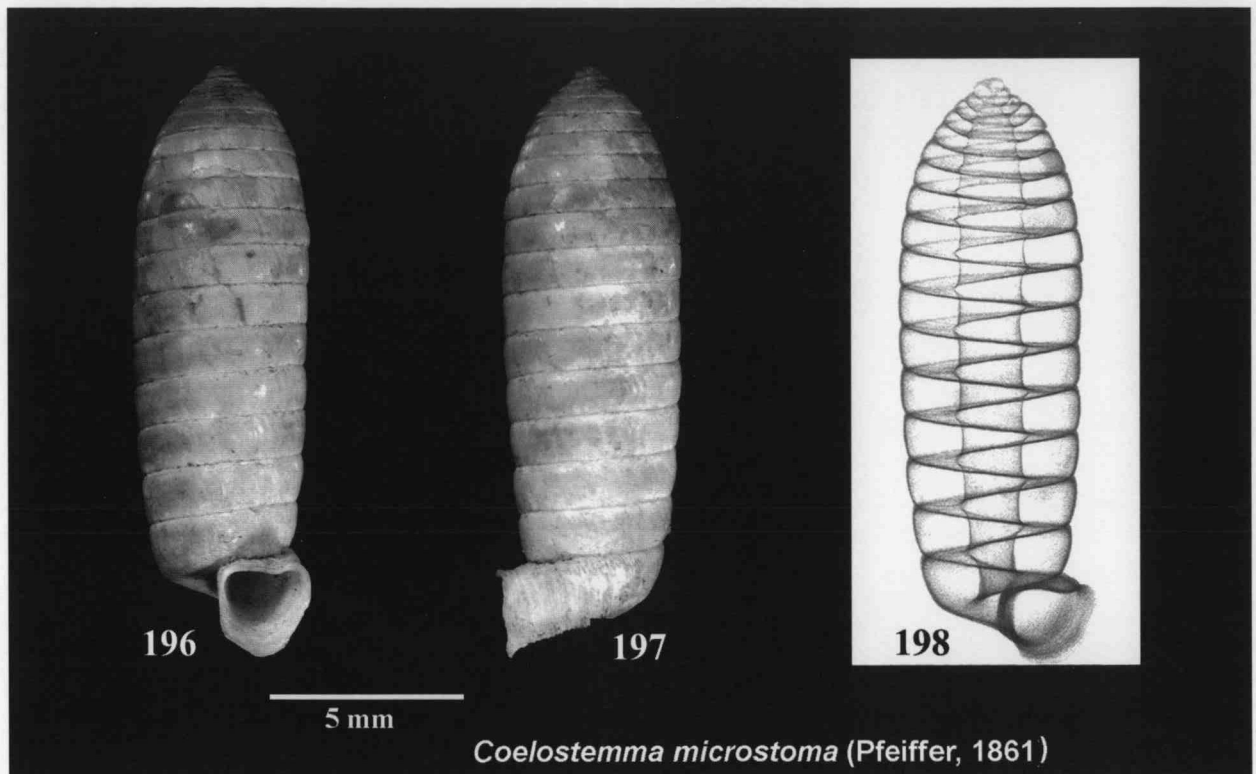
Figures 178-183. *Holospira (Stalactella) psectra* n. sp. Puebla, a limestone cliff on the S slope of Cerro Caolalote, 2 km E of El Carmen. Figures 178, 179: Holotype (UF 233197). Figures 180-183: Paratypes (UF 41472). Scale bar is for Figures 178-182.



Figures 184-190. *Holospira (Stalactella) marmorata* n. sp. Puebla, 13.5 km WSW of San Bartolo Teontepec. Figures 184, 185: Holotype (UF 233188). Figures 186-190: Paratypes (UF 80954). Scale bar **a** is for Figures 184-189. Scale bar **b** is for Figure 190.



Figures 191-195. *Holospira (Stalactella) chazumbae* n. sp. Oaxaca, 2 km NE of Santiago Chazumba. Figures 191, 192: Holotype (UF 34299). Figures 193-195: Paratypes (UF 214439). Scale bar **a** is for Figures 191-194. Scale bar **b** is for Figure 195.



Figures 196-198. *Coelostemma microstoma* (Pfeiffer, 1861). Lectotype, British Museum (Natural History) 1996162. Scale bar is for Figures 196-198.

The **BULLETIN OF THE FLORIDA MUSEUM OF NATURAL HISTORY** publishes research conducted by our faculty, staff, students, and research associates. We also encourage appropriate, fully funded manuscripts from external researchers. Manuscripts concerning natural history or systematic problems involving the southeastern United States or the Neotropics are especially welcome, although we will also consider research from other parts of the world. Priority is given to specimen-based research. We consider thirty-five double-spaced pages (excluding figures and tables) as the minimum length for manuscripts, although there can be exceptions as determined by the Editor and Bulletin Committee.

### INSTRUCTIONS FOR AUTHORS

The INSTRUCTIONS FOR AUTHORS can be found on the Florida Museum web site. See <http://www.flmnh.edu/bulletin/>. We suggest authors also consult recent numbers (2005 and forward) of the BULLETIN if there are specific questions about format and style. All taxonomic papers must adhere to the rules published in the appropriate international code of systematic nomenclature.

### RECENT PUBLICATIONS OF THE BULLETIN

Thompson, F.G., & E.L. Mihalcik. 2005. Urocoptid landsnails of the Genus *Holospira* from southern Mexico. Bull. Florida Mus. Nat. Hist. 45(3): 65-124. Price \$8.50

Neubert, E., & H. Nordsieck. 2005. New South American Clausiliidae from the collections of the Florida Museum of Natural History (Gastropoda, Clausiliidae, Neniidae). Bull. Florida Mus. Nat. Hist. 45(2): 45-64. Price \$5.00

Dilcher, D.L. & T.A. Lott. 2005. A Middle Eocene fossil plant assemblage (Powers Clay Pit) from western Tennessee. Bull. Florida Museum Nat. Hist. 45(1):1-43. Price \$7.00

King, F. W. and C. M. Porter, (Editors). 2003. Zooarchaeology: Papers to honor Elizabeth S. Wing. Volume 44, No.1, pp.1-208. Price \$20.00

MacFadden, B. J. and O Carranza-Castaneda. 2002. Cranium of *Dinohippus mexicanus* (Mammalia: Equidae) from the early Pliocene (Latest Hemphillian) of central Mexico, and the origin of *Equus*. Volume 43, No.5, pp.163-185. Price \$5.00

Kratter, A. W., T. Webber, T. Taylor, and D. W. Steadman. 2002. New specimen-based records of Florida birds. Volume 43, No.4, pp.111-161. Price \$5.50

MacFadden, B. J. 2001. Three-toed browsing horse *Anchitherium clarencei* from the early Miocene (Hemingfordian) Thomas Farm, Florida. Volume 43, No.3, pp. 79-109. Price \$5.50

F. G. Thompson and G. P. Brewer. 2000. Land snails of the genus *Humboldtiana* from northern Mexico (Gastropoda, Pulmonata, Helicoidea, Humboldtianidae). Volume 43, No. 2, pp. 49-77. Price \$5.00

Hayes, F. G. 2000. The Brooksville 2 local fauna (Arikarean, latest Oligocene): Hernando County, Florida. Volume 43, No.1, pp. 1-47. Price \$6.50

\*A complete list of publications in the Bulletin of the Florida Museum of Natural History can be found on the Florida Museum web site [http://www.flmnh.ufl.edu/bulletin/bulletin\\_vols.htm](http://www.flmnh.ufl.edu/bulletin/bulletin_vols.htm). Order publications from the Managing Editor. Florida residents are required to add 6.25% sales tax for all purchases. Add \$1.50 per publication for shipping.