Arch. Moll. | 113 (1982) | (1/6) | 7—15 | Frankfurt a. M., 18. 3. 1983

Identity of *Ferrissia irrorata* and *Gundlachia radiata*, GUILDING's species of Ancylidae from St. Vincent, W. I.

(Gastropoda: Pulmonata).

By

ARTHUR D. HARRISON,
Waterloo, Ontario.

With 9 figures.

Abstract: The status of *Ferrissia irrorata* and *Gundlachia radiata* is reassessed by examination of specimens from the type localities in St. Vincent, Eastern Lesser Antilles. Specimens from the islands of St. Lucia and Grenada are compared with those from St. Vincent. Scanning electron microscope studies on shell sculpture and radulae are included. The systematic placement of similar ancylids from other West Indian islands, within these two species, may require further consideration.

Abstrakt Der Status von *Ferrissia irrorata* (GUILDING) und *Gundlachia radiata* (GUILDING) wird durch Untersuchungen an Material von den Typuslokalitäten auf St. Vincent (Östliche Kleine Antillen) neu bestimmt. Proben von den Inseln St. Lucia und Grenada werden mit denen von St. Vincent verglichen. Mit dem Rasterelektronenmikroskop ausgeführte Untersuchungen von Gehäusestruktur und Radulae sind ebenfalls Bestandteil der Arbeit. Die systematische Stellung ähnlicher Ancyliden von anderen westindischen Inseln bedarf vielleicht erneuter Untersuchung.

HARRY & HUBENDICK (1964) state that all the nominal species of Ancylidae described from the West Indies are synonyms either of *Ferrissia irrorata* (GUILDING) or *Gundlachia radiata* (GUILDING), both of which were described originally from St. Vincent, Eastern Lesser Antilles. Unfortunately these authors and HUBENDICK (1964) examined Ancylidae from a number of West Indian Islands but had none available for study from St. Vincent. This paper redefines and establishes the true identities of GUILDING's species using material from localities in St. Vincent; the ecology of both species was studied during a biological survey of St. Vincent (HARRISON & RANKIN 1975, 1976, 1978), and *G. radiata* during a similar study on St. Lucia (MCKILLOP & HARRISON 1980). It is hoped that these descriptions will help to prevent the taxonomic confusion that may arise if specimens from other parts of the Caribbean region are used to define GUILDING's species.

The Rev. LANSDOWN GUILDING lived on St. Vincent during the early 19th Century and described his species from living material (GUILDING 1828); his

Latin descriptions are short, based on external features, but his illustrations are excellent, even although he could not have had more than a strong hand lens to help him. There is no problem in separating the two species from his descriptions and drawings, but more details are required for comparison with ancylids from other West Indian islands and the American mainland.

The importance of the structure of the protoconch in taxonomic studies has been emphasised by BURCH & LOVERDE (1974) and BURCH (1975), who used scanning electron microscopes to study shell sculpture. In this present paper SEM studies on the shells and radulae of both of GUILDING's ancylids are described.

Methods: Shells were cleaned by immersing them in sodium hypochlorite to remove the periostracum, rinsed in distilled water, air dried, mounted and coated with gold for SEM studies. Radulae were removed, after macerating the animals with 10% KOH, washed with distilled water and 70% alcohol, placed in a drop of alcohol on a stud covered with double-sided tape, air dried and coated with gold for SEM examination.

Descriptions: The genera *Ferrissia* WALKER 1903 and *Gundlachia* PFEIFFER 1849 as used here follow the revised definitions of HARRY & HUBENDICK (1964), with the amendment regarding the radula of *Gundlachia* by HUBENDICK (1964).

Ferrissia irrorata (GUILDING).

Figs. 1, 2, 3B, 4 and 5.

Ancylus irroratus GUILDING 1828, Zool. J., 3: 535, pl. 26 f. 1-6.
Ancylus irroratus GUILDING, — SMITH 1895, Proc. malac. Soc. Lond., 1: 311.

Original diagnosis (textual transl. from the Latin): Living animals are "palely yellow, sprinkled with black, front and abdomen reddish, eyes black, sole pale and unspotted. Shell concentrically ridged, almost diaphanous; periostracum black-green, sprinkled with black; apex subobtuse, directed posteriorly; aperture almost round to elliptical."

Original diagnosis (illustrative): GUILDING's illustrations clearly show that the shell is well-elevated, with the blunt apex in the posterior third and well to the right of the midline. The foot is short and its posterior end does not protrude beyond the shell in life; the pseudobranch appears to be fluted. The animal he drew was large for the species, with a shell 6·35 mm long.

Revised diagnosis: A species of *Ferrissia* WALKER 1903, rev. HARRY & HUBENDICK 1964, as defined by GUILDING and with shell having a central, deep protoconch pit (apical scar) circled by inner raised ridge, with grooves radiating from an outer low protoconch ridge and crossed by numerous ridges or notches; with small mantle cavity, narrow mantle attachment and one large, fluted pseudobranch; with three rounded or ovoid retractor muscle attachments, well-spaced; with radular formula 13-1-13, asymmetrical rachidian (central) tooth basically quadricuspid but with 3 sub-cusps in addition, mesolateral teeth with 6 main cusps and one sub-cusp, outer lateral teeth with 6 main cusps and 2 sub-cusps; usually aphallic.

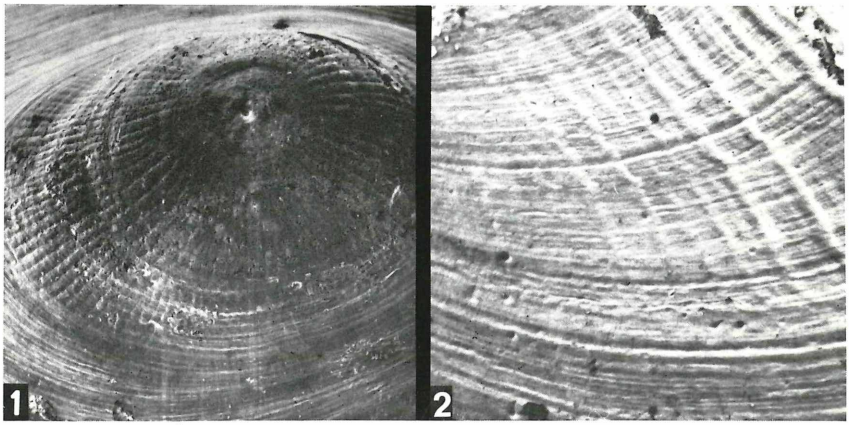

Fig. 1-2. *Ferrissia irrorata.* — 1) protoconch, 2) postembryonic shell.

Revised description: The dimensions of the largest shell examined under the SEM are: length 3·83 mm, width 2·43 mm, height 0·85 mm, the maximum height being at the front edge of the protoconch. At the centre of the protoconch is a deep pit surrounded by an inner raised ridge, rather irregular in height and width (Fig. 1); radiating grooves start a short distance from the central pit at an outer low irregular ridge. These grooves radiate to the edge of the protoconch and, as the distance between them widens, additional grooves are interspersed between them. All grooves are crossed by numerous ridges, many in the form of V-notches.

As noted by GUILDING, the post-embryonic shell bears numerous concentric ridges and grooves (Fig. 2), but there are also low, irregularly placed radiating ridges which may be missing from some parts of the shell. These are not seen easily on shells with periostracum.

The mantle cavity is small and there is one, large, fluted pseudobranch with the rectum passing through its base. Figure 3B shows the dorsal appearance of the three parts of the retractor muscle and the mantle attachment.

The jaw consists of two lateral portions of about 15 overlapping scales, and a dorsal portion consisting of a bar of approximately 12 subrectangular scales overlapped by an indeterminate number of smaller scales. All scales bear minute longitudinal ridges.

The radular formula is 13-1-13. The rachidian tooth is asymmetrical but basically quadricuspid (Fig. 4); however, both lateral cusps are divided into two sub-cusps, and the left central cusp has a small sub-cusp attached centrally. The rachidian tooth therefore appears at first sight to have 7 cusps. Mesolateral teeth have 6 main cusps with a small sub-cusp between cusps 2 and three (numbering from median of radula); lateral teeth towards the edge of the radula are similar but have a further sub-cusp between cusps 1 and 2 (Fig. 5).

All specimens examined were aphallic.

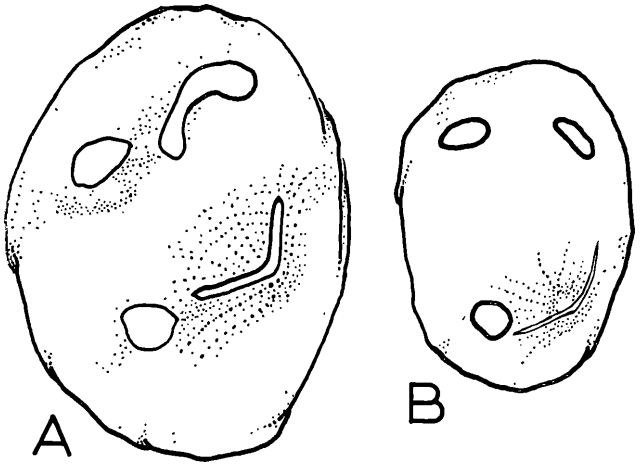

Fig. 3. Dorsal view of visceral humps showing three parts of the retractor muscle and the V-shaped mantle attachment. — A) *Gundlachia radiata*, B) *Ferrissia irrorata*.

Fig. 4. Rachidian tooth (right) and mesolateral tooth of *Ferrissia irrorata*. Drawn from SEM photographs.

Material and localities Material was collected mostly by the author. St. Vincent (station numbers taken from HARRISON & RANKIN 1976): 4 from South Rivers (PSS 33), 15 March 1971; 1 from Montreal Estate (PSS 130), 6 December 1971; 4 from Greathead River (PSS 72), 1 December 1972; 13 from Yambou River, Mesopotamia (PSS 66B), May 1970; 1 (collected by S. CORBET) from Mesopotamia, 8 April 1979. Grenada: 2 from Chemin River, 21 July 1973.

In this study eight shells ranging from 0·96 to 3·85 mm in length were studied in detail under the SEM.

Comments: The St. Vincent specimens resemble those placed in this species from Puerto Rico by HARRY & HUBENDICK (1964) in the sculpturing of the protoconch, the structure of the pseudobranch and the arrangement of

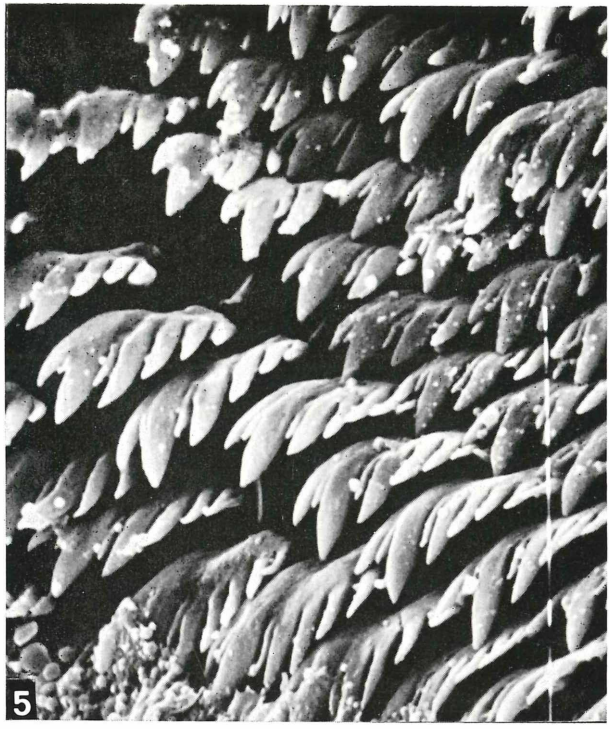

Fig. 5. Lateral radular teeth of *Ferrissia irrorata.*

the three parts of the retractor muscle dorsally. The Puerto Rican specimens were also aphallic.

However, the postembryonic shells of the Puerto Rican specimens appear to have no radiating ridges; these also seem to be missing from *F. rivularis* (SAY), as illustrated by HUBENDICK (1964). The sculpturing of the protoconch of St. Vincent shells of *irrorata* is very similar to that of *rivularis* as illustrated by BURCH & LOVERDE (1974), but *rivularis* does not appear to have the low ridge at the origin of the radiating protoconch grooves.

The presence of a sub-cusp between the central cusps of the rachidian tooth is not unique to *F. irrorata,* as it is reported also from *Burnupia caffra* (KRAUSS) by HUBENDICK (1964). Nevertheless, it does not appear to have phylogenetic significance as it occurs in some species of the planorbid *Gyraulus* (MEIER-BROOK 1979).

According to HARRY & HUBENDICK (1964) the first lateral (mesolateral) radular tooth of the genus *Ferrissia* characteristically has 5 cusps; however, this seems to apply only to their Puerto Rican specimens. *F. irrorata* from St. Vincent has six main cusps and one sub-cusp, all visible under the light microscope, and *rivularis* from the U.S.A. appears to have seven cusps and one sub-cusp (HUBENDICK 1964).

Gundlachia radiata (GUILDING).
Figs. 3A, 6-9.

Ancylus radiatus GUILDING 1828, Zool. J., **3**: 536, pl. 26 f. 7-9.
Ancylus radiatus GUILDING, — SMITH 1895, Proc. malac Soc. Lond., **1**: 311.

Original diagnosis (textual, transl. from the Latin): Living animals are "yellow, sprinkled with black, three spots or four large pale areas dorsally; reddish appearance; abdomen dark. Shell oval-elliptical, glassy, diaphanous, concentrically ridged, radially striate, periostracum imperceptible."

Original diagnosis (illustrative): GUILDING's diagrams show a well-elevated shell with the apex on the posterior third and well to the right of the midline. He shows the foot protruding well beyond the posterior edge of the shell in life. He also illustrates the three dorsal parts of the retractor muscles, the right anterior portion being large and somewhat chevron-shaped, although partially obscured in his drawing by shell encrustations.

Revised diagnosis: A species of *Gundlachia* PFEIFFER 1849 rev. HARRY & HUBENDICK 1964 as defined and illustrated by GUILDING, and with shell having shallow protoconch pit surrounded by broad protoconch region without radii but with low concentric ridges in its outer $^{2}/_{3}$ to $^{3}/_{4}$ area and numerous small pits in its outer $^{1}/_{2}$ to $^{2}/_{3}$; with rest of shell having concentric grooves and radial ridges, the latter weakly developed on early post-embryonic shells; with irregularly pigmented mantle having fairly broad chevron-shaped, anterior right muscle attachment; with large mantle cavity, large ventral, fluted pseudobranch and small, less fluted dorsal pseudobranch; with large right anterior retractor muscle attachment chevron-shaped; with radular formula 17-1-17, quadricuspid central tooth somewhat asymmetrical, mesolateral teeth with 4 cusps plus sub-cusps arranged asymmetrically and increasing in number and size towards edges of radula.

Revised description: St. Vincent shells ranged from 3·08 to 4·54 mm in length with measurements of largest shell being: length 4·54 mm, width 3·25 mm, height 1·19 mm. Maximum height is just anterior to the front edge of protoconch. Protoconch pit is shallow and central, surrounded by a fairly

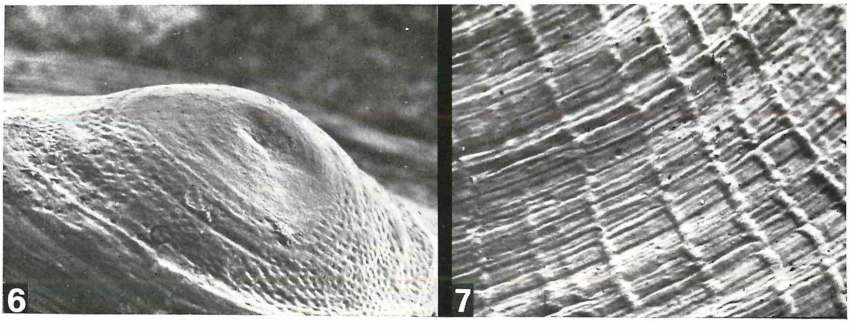

Fig. 6-7. *Gundlachia radiata*. — 6) protoconch, 7) postembryonic shell.

broad region with no regular sculpturing (Fig. 6). Low, irregular concentric ridges appear at about one quarter to one third of the distance from the centre of the pit to the edge of the protoconch; numerous small pits appear between

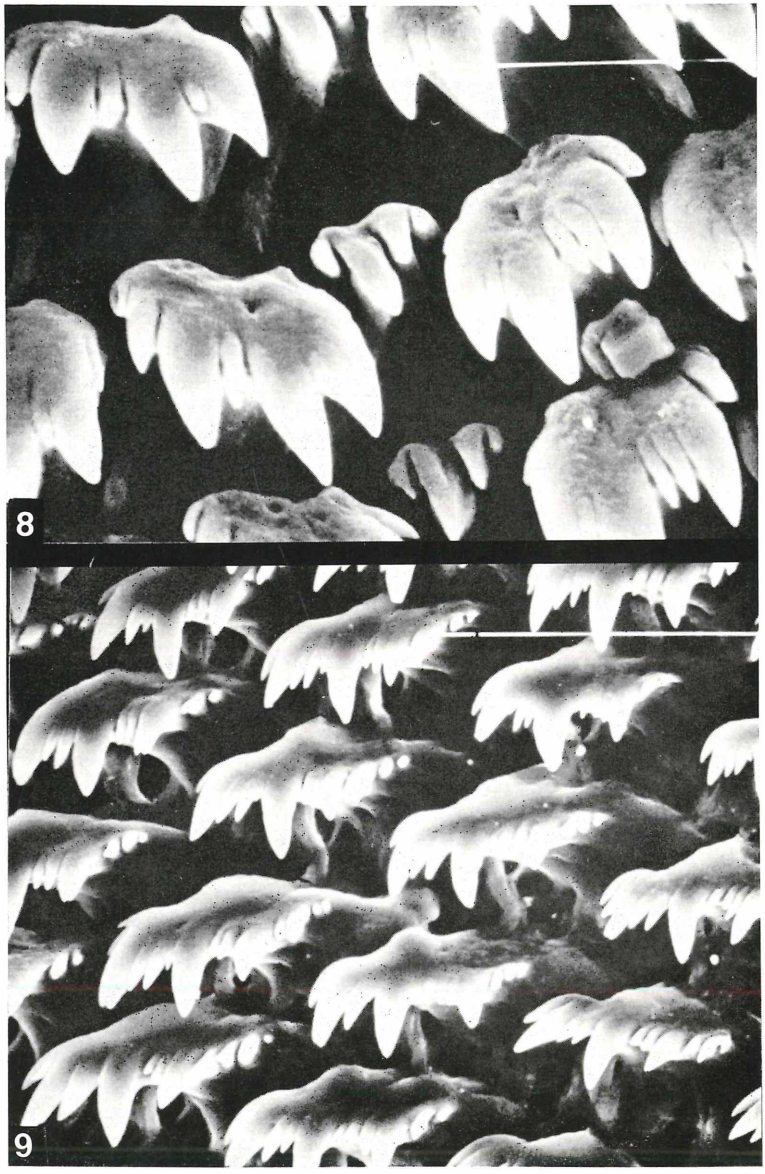

Fig. 8-9. *Gundlachia radiata.* — 8) central portion of radula showing rachidian and mesolateral teeth, 9) lateral radular teeth.

these ridges at one third to one half of the distance from the pit to the edge of the protoconch. As noted by GUILDING (1828) the post-embryonic shell bears both concentric and radial markings; the concentric markings are revealed by the SEM to be mainly grooves and the radial markings are raised ridges, sometimes interrupted by the grooves (Fig. 7). The radial ridges are absent or weakly developed on the early post-embryonic shell but are very obvious on newer portions of a large shell (Fig. 7).

The head-foot is not pigmented but there is irregular pigmentation on the mantle. The mantle cavity is large with two pseudobranchs, the ventral one large and strongly fluted and the dorsal one small and less strongly fluted. The pseudobranchs have a common base through which runs the rectum. Figure 3A shows the dorsal appearance of the three parts of the adductor muscle, in particular the chevron shape of the right anterior part.

The jaw consists of two lateral portions of 20 or more overlapping scales and a bar-like dorsal portion consisting of numerous, overlapping scales. All scales bear minute ridges which appear to be on exposed edges.

The radular formula is 17-1-17, the rachidian tooth (Fig. 9) being quadricuspid and somewhat asymmetrical with the left median cusp being much larger than the right. Rarely, the lateral cusps may be split into two (see top of Fig. 8). The mesolateral teeth (Fig. 8) have 4 main cusps with a number of sub-cusps; right mesolaterals have 1 sub-cusp internal to cusp one, 1 between cusps one and two, 1 between cusps two and three, and 1 external to four. The left mesolaterals are similar but have 2 subcusps between cusps two and three. This asymmetry was seen on all individuals examined, including one from St. Lucia. The sub-cusps increase in number and size towards the edge of the radula (Fig. 9), but the teeth in the last marginal row are smaller with fewer sub-cusps.

The copulatory organ, buccal bulb, radular sac, oesophagus and salivary glands are similar in general plan to those described from Puerto Rican *Gundlachia* by HUBENDICK (1964) and HARRY & HUBENDICK (1964).

Material and localities Material was collected mostly by the author. St. Vincent (station numbers taken from HARRISON & RANKIN 1976): 8 from flood pool beside Yambou River, Mesopotamia (PSS 66B), 23 May 1970; 5 from same site, 14 April 1971; 8 (collected by S. CORBET) from same site, 8 April 1979; 5 from South Rivers (PSS 33), 28 May 1970; 2 from Evesham Stream (PSS 67), 16 April 1971. Grenada: 2 from Chemin River, 21 July 1973. St. Lucia (collected by W. B. MCKILLOP): 4 from headwater of Ravin Chassin, 1972, 10 from a banana drain in the Riche Fond Valley, 9 August 1972; 1 from the headwaters of the Canaries River, 23 February 1973; 1 from marsh near the upper Roseau River, 4 February 1973. Guatemala (collected by H. B. N. HYNES): 2 from El Salto, March 1970.

Six shells from St. Vincent and six from St. Lucia were studied under the SEM.

Comments: The St. Vincent specimens resemble those from Puerto Rico described by HUBENDICK (1964) and HARRY & HUBENDICK (1964), except that in the latter description the right lateral cusp of the rachidian tooth is not always visible under the light microscope and therefore must be proportionately smaller than in the St. Vincent and St. Lucian specimens.

The pitted sculpturing of the protoconch resembles that of the Brazilian *Uncancylus concentricus* (BOURGUIGNAT) illustrated by BURCH (1974), but in

contrast *U. concentricus* has clear radial grooves in the region between the apical pit and the pitted sculpturing. There was no trace of these radial grooves in any of the shells of *G. radiata* examined.

Some of the material used for this paper has been deposited in the Department of Malacology, The Academy of Natural Sciences, Philadelphia.

Acknowledgements.

I wish to thank Dr. W. E. B. McKillop for specimens from St. Lucia, Dr. Sarah Corbet for additional specimens collected from St. Vincent, Mr. Dale Weber for assistance with the S.E.M. photography and my wife Dr. Jessie J. Rankin for help in preparing the manuscript. Most of the field work on the three islands was financed by a grant from the Rockefeller Foundation.

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Address of the author: Prof. Dr. Arthur D. Harrison, University of Waterloo, Faculty of Science, Department of Biology, Waterloo, Ontario, Canada N2L 3G1.