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Hairy periostracal ornamentations on Galapagos land snail shells: S.E.M. comparative study of five species

(Pulmonata: Bulimulidae).*)

By

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With 1 plate.

A b s t r a c t: "Hairs" are observed on the shell's periostracum of five species of Galapagos Bulimulidae. This kind of ornamentation is reported for the first time for three of them. S.E.M. observations allow a detailed comparative description of the hairs. The hairy ornamentations and spiral punctuations of the shell's periostracum give additional elements to estimate phylogeny in this group of land snails.

Kurzfassung: Auf dem Periostrakum des Gehäuses von fünf Bulimuliden-Arten von den Galapagos-Inseln werden Haare beobachtet. Bei drei dieser Arten wird dieser Verzierungstyp erstmals nachgewiesen. REM-Untersuchungen erlauben eine genaue vergleichende Beschreibung der Haare, die ebenso wie punktierte Spirallinien auf dem Periostrakum zusätzliche Hinweise auf die Phylogenie dieser Gruppe geben.

Introduction.

85 taxa of Galapagos Bulimulids have been described until now (about 65 species, some subspecies and dubious cases of synonymy; taxonomy of the group still under study).

Periostracal hairs have been observed in only five species: Bulimulus (Naesiotus) eschariferus Sowerby 1833, B. (N.) unifasciatus Sowerby 1833, B. (N.) simrothi REIBISCH 1892, B. (N.) tortuganus DALL 1893, B. (N.) hirsutus VAGVOLGYI 1977.

Hairs are observed only on juveniles and are generally lost during growth due to abrasion and rubbing. In adults the shell's surface becomes either smooth or punctuated by hair remains. In only one species, *hirsutus*, the hairy ornamentation is still present in most adult specimens.

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S.E.M. examination of the shell's periostracum was made for *hirsutus*, *simrothi* and for three other species where "hairs" had never been mentioned before: *jacobi* SOWERBY 1833, *tanneri* DALL 1895, *ochsneri* DALL 1917.

Material and methods.

The material used for this study was collected in the Galapagos Islands. From Santa Cruz Island: *hirsutus* (southern slope, alt. 180 m, near the "Caseta", Tortoise Reserve, july 13th, 1974), *ochsneri* (Cerro Maternidad, alt. 630 m, Scalesia forest, may 29th, 1975), *tanneri* (western slope, "Las Palmas", arid zone, rec. André De Roy & Jean-Jacques Van Mol, oct. 31, 1965). — From Santiago Island: *jacobi* (near summit, alt 770 m, oct. 10th, 1974). — From Isabela Island: *simrothi* (volcan Cerro Azul, southern slope, estimated alt. 200 m, aug. 1974).

Live snails were collected in the field. Soft parts were removed mechanically. The shells were washed several times with water and ethanol 70% and air dried. For S.E.M. observations the shells were mounted on stubs with silver paint and sputter coated with gold. The electron micrographs were made with an I.S.I. DS. 130 scanning electron microscope at 30 KV.

Descriptions.

B. (N.) birsutus (Pl. 1: A):

Periostracal hairs are abundant and originate from the spiral lines on the teleoconch. In this species the spiral lines are numerous, almost regularly spaced on the whole surface of the whorl (14 lines on the 4th whorl). The bases of the hairs are slightly enlarged; the hairs themselves are elongated and roughly cylindrical with a thinned and often curved tip.

B. (N.) jacobi (Pl. 1: B):

Spiral punctuation or beading on the shells were reported by previous authors. Here we report for the first time the existence of hairy specimens. Morphological and biometrical variations seem to be important in this species which usually shows a rather smooth surface.

The teleoconch has discontinuous thin spiral lines from which numerous hairs originate. The growth lines exhibit a wavy pattern. Spiral lines are numerous (13 on the 4th whorl) and close to each other. They extend over the whole height of the whorls. The base of the hairs is enlarged, the stem is almost cylindrical or slightly flattened, with irregular surface. The tip of the hairs is thin and usually curved.

Thanks to the courtesy of Dr. R. JANSSEN, we have been able to examine type specimens of *jacobi* (Senckenberg Museum: SMF 9967/3). Hairs are seen on two of the syntypes observed with a binocular microscope at 10 x 50 magnification. On syntype n° 1, a few scattered hairs decorate the external surface of the last whorl, close to the aperture of the shell. On syntype n° 2, a few hairs are visible near the suture between whorls 3 and 4, and they are numerous inside the umbilicus. The third syntype has no hair visible and exhibits only the typical beading along spiral lines which was already described previously (SOWERBY 1833).

B. (N.) ochsneri (Pl. 1: C-D):

The presence of periostracal hairs is not usual for this species. They were observed on juveniles of one population only (Cerro Maternidad, Scalesia forest, alt. 600-640 m). In other populations the first whorls of the teleconch bear only naked spiral lines. B. (N.) ochsneri is widely distributed in the Transition and Scalesia forest on Santa Cruz Island. The fact that hairy and "glabrous" juveniles of this species are living as litter snails under similar conditions seems to argue that the presence of hairs is not of great "selective value"

Many inconspicuous spiral lines decorate the whorl's surface, giving a wavy aspect to the growth lines. A few of these spiral lines bear hairs (4 lines on the 4th whorl). The hairs are long, straight and slightly bent. The stem is about cylindrical and the tip of the hairs slightly budded.

B. (N.) simrothi (Pl. 1: E):

Hairs in this species have already been observed by PILSBRY (1897): "The youngs are more translucent and show projecting points of epidermis along the minute regular spiral lines" Our observations show that for *simrothi* the shape of the hairs is basically different from what is observed in other species.

The teleoconch has only 6 to 8 spiral lines bearing hairs on each whorl (7 on the 4th whorl). The hairs are widely spaced on the lines. They are flattened, ribbon like and strongly curved. The base of the hairs is widened along the spiral lines. Their tip is spatulated, with irregular surface. *B.* (N.) simrothi is related to tortuganus where hairs were observed on juveniles too.

B. (N.) tanneri (Pl. 1: F):

The presence of hairs in this species seems to be exceptional and not bound to environmental response: among the species mentioned in this paper it is the only "hairy" one living in an arid zone (North Santa Cruz). It is a ground dweller most often hidden under blocks of basalt where humidity is higher than in the open field. In this species, the presence of hairs has apparently no obvious or detectable role. One hypothesis could be an accidental expression of a genetically preserved potentiality to produce this kind of ornamentation.

On a few specimens hairs were observed inside the wide open umbilicus. The shell surface is smooth and lustrous and has few faint spiral lines sometimes marked by slight regular punctuations. The hairs are small, spine-like, slightly curved and lined on spiral lines inside the umbilicus. Growth lines split and deviate around their base.

Discussion and conclusions.

About B. (N.) hirsutus and jacobi:

B. (N.) jacobi which has been described as a non hairy species obviously contains hairy individuals (present paper). On the other hand, VAGVOLGYI (1977) has based the description of species *hirsutus* on several populations of shells including hairy and non hairy populations. These last non hairy populations coming from the "El Chato" area (South West Santa Cruz) have previously been identified as *jacobi*.

These populations could represent an intermediate type probably as close to the *jacobi* type as to the *hirsutus* type. The taxonomy of *jacobi* and related taxa such as *hirsutus* still need more investigations. S.E.M. as well as biometrical observations show that they are closely related (COPPOIS & GLOWACKI 1982). An extended biometrical study would probably show the existence of a cline between these species. Anatomical study should also be undertaken, although differences are often difficult to show for close related species (proportions of genitalia). Nevertheless, *hirsutus* is not questioned as a separate species.

In general:

In all studied species, hairs originate from the spiral lines (ridges). The morphology, disposition and abundance of hairs is quite similar in B. (N.) jacobi and *hirsutus*. Their base is swollen and often sculptured by the growth lines.

Although equally abundant in *simrothi*, hairs differ here in being ribbon like and curly. In *ochsneri* hairs are longer and slender and their base is almost not swollen. In *tanneri*, spine-like hairs are only found in the umbilicus of a few shells, and their base is not visible, being concealed by the splitting growth lines.

Punctuations observed on the spiral lines in other species of Galapagos Bulimulids could be interpreted in two opposite ways:

- as remains from one time hairy ancestor shells,

- as possible localisation of hairs.

Study of periostracal hairy ornamentation or punctuation gives more criteria to estimate the phylogeny of species in this group of land snails and informations on possible response to ecological conditions.

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Explanation of plate 1.

Periostracal hairs observed on the surface of the teleoconch.

- A) B. (N.) hirsutus, hairs near the suture between whorls 3-4.
- B) B. (N.) jacobi, hairs on the 4th whorl.
- C-D) B. (N.) ochsneri
 C) general aspect of the 4th whorl, spiral lines bearing hairs are sparse;
 D) detail of hair on the 3rd whorl.
- E) B. (N.) simrothi, two hairs in the mid-part of the 4th whorl.
- F) B. (N.) tanneri, hairs along a spiral line inside the umbilicus of the shell. Unless otherwise stated, bars are 25 μ m long.



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