

HATUMIA, A NEW GENUS FOR *OESTOPHORA RIFFENSIS* ORTIZ DE ZÁRATE, 1962, *OESTOPHORA COBOSI* ORTIZ DE ZÁRATE, 1962 AND *HATUMIA PSEUDOGASULLI* N. SP (PULMONATA: HELICOIDEA: TRISSEXODONTIDAE)

J.R. ARRÉBOLA¹, C.E. PRIETO², A.I. PUENTE² & A. RUIZ¹

¹ Dpto. de Fisiología y Biología Animal, Facultad de Biología, Universidad de Sevilla. Avda. Reina Mercedes, 6. E-41012 Sevilla Spain.
² Dpto. de Zoología y Dinámica Celular Animal, Facultad de Ciencia y Tecnología, UPV/EHU, Apdo.644. E-48080 Bilbao Spain.

Abstract A new genus, *Hatumia*, is designated for two species of *Oestophora*: *Hatumia riffensis* (Ortiz de Zárate, 1962) and *Hatumia cobosi* (Ortiz de Zárate, 1962) based on new anatomical evidence and a review of the literature. A third new species, *H. pseudogasulli*, is described from Andalusia (southern Iberia), and also belongs to this new genus. *H. gasulli* and *H. pseudogasulli* n. sp. have quite similar shells, occupy the same ecologic niche, but have different distributions with the exception of a small contact zone where they live together. The diagnosis of the genera *Oestophora* Hesse, *Gasulliella* Gittenberger, *Gasullia* Ortiz de Zárate & Ortiz de Zárate and *Suboestophora* Ortiz de Zárate is provided.

Key words Systematics, *Gasullia*, *Oestophora*, *Hatumia*, *pseudogasulli*.

INTRODUCTION

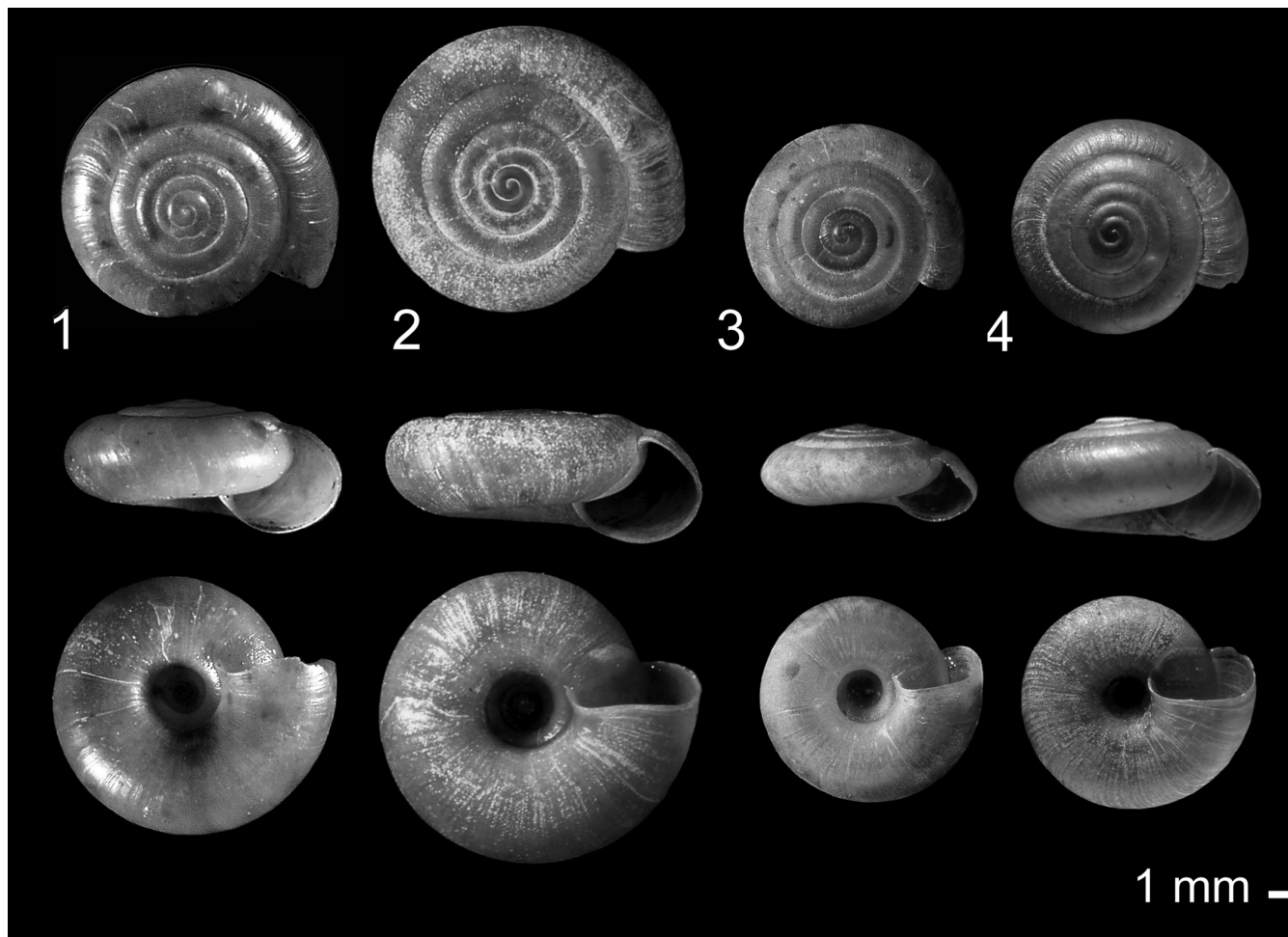
The family Trissexodontidae is represented in the Iberian peninsula by at least nine genera (Prieto, Puente, Altonaga & Gomez, 1993). While some of them are widespread (*Caracollina* Beck, *Oestophora* Hesse and *Suboestophora* Ortiz de Zárate), others are restricted to small geographical areas (*Gasulliella* Gittenberger, *Gittenbergeria* Schileyko, *Mastigophallus* Hesse, *Oestophorella* Pfeiffer, *Trissexodon* Pilsbry and *Gasullia* Ortiz de Zárate). Southern Iberia and North Africa represent the most probable nucleus of origin for the group, as well as the main distribution area for *Oestophora*, *Gasulliella*, *Gasullia* and *Gittenbergeria*.

Ortiz de Zárate (1962), following his earlier comments on the species within *Oestophora* (Ortiz de Zárate & Ortiz de Zárate, 1961), undertook a full revision of the genus. He improved the diagnosis of the three subgenera previously established in 1961, giving the following names: "*Oestophora* Ortiz de Zárate", "*Suboestophora* Ortiz de Zárate" and "*Gasullia* Ortiz de Zárate, 1961". When Ortiz de Zárate (1962) revised the subgenus *Gasullia*, he realized there were two different groups of shells. The first group from Huelva province, with a flat apex and longitudinal striae on the teleoconch, and the second with spiral striae on the protoconch and granulated surface on the teleoconch, as it was in the case of *Oestophora* (*Gasullia*) *riffensis* (Pallary) from Melilla. He therefore proposed to consider the last species as the type of *Gasullia*, although

he did not know where Pallary had described it. Finally, *Oestophora* (*Gasullia*) *cobosi* Ortiz de Zárate (1962) was described based on two shells that were believed to be from Moal (Asturias), Monte Muniellos, in N Spain.

Prieto (1986, p. 38) proposed that *Suboestophora* and *Gasullia* should be elevated to generic status. Muñoz (1992) and Muñoz & Parejo (1992) formally placed *gasulli* in the genus *Suboestophora* Ortiz de Zárate, 1962 as the type species of this genus. Their anatomical data showed the presence of two functional dart sacs in the stimulatory apparatus (according to Muñoz & Parejo, 1992, the dart is "present in any of the two sacs"). Further research by Parejo & Muñoz (1992) concluded that *Gasulliella simplicula* (Morelet, 1845) is a juvenile stage of *Suboestophora gasulli*, and that as such the oldest species name should take priority, namely, *Suboestophora simplicula* (Morelet, 1845). Their opinion is not accepted by other authors who judged that they are two different species on the base of anatomical, morphological and geographical distribution data (Puente, 1994; Arrébola, 1995; Puente, Altonaga, Prieto & Ruiz, 1998).

Puente (1994, 1996) re-described the genera *Oestophora* Hesse, 1907 and *Suboestophora*, which was referred to Ortiz de Zárate, 1962 because there was no specific designation of the type species in Ortiz de Zárate & Ortiz de Zárate (1961). This author proposed the same explanation to consider "*Gasullia* Ortiz de Zárate, 1962", an opinion later adopted by Arrébola (1995) and again by Puente (1996), supposedly with *G. riffensis* as type species of *Gasullia* since they



Figs 1-4 Shells of *Gasullia* and *Hatumia* species. 1 *Gasullia gasulli* (Ortiz de Zárate & Ortiz de Zárate, 1961). 2 *Hatumia riffensis* (Ortiz de Zárate, 1962). 3 *Hatumia cobosi* (Ortiz de Zárate, 1962). 4 *Hatumia pseudogasulli* n. sp.

placed *gasulli* in *Suboestophora*. According to Nordsieck (1993), the authorship of both *Gasullia* and *Suboestophora* is Ortiz de Zárate & Ortiz de Zárate, 1961, and according to Schileyko (1991) it is Ortiz de Zárate, 1961.

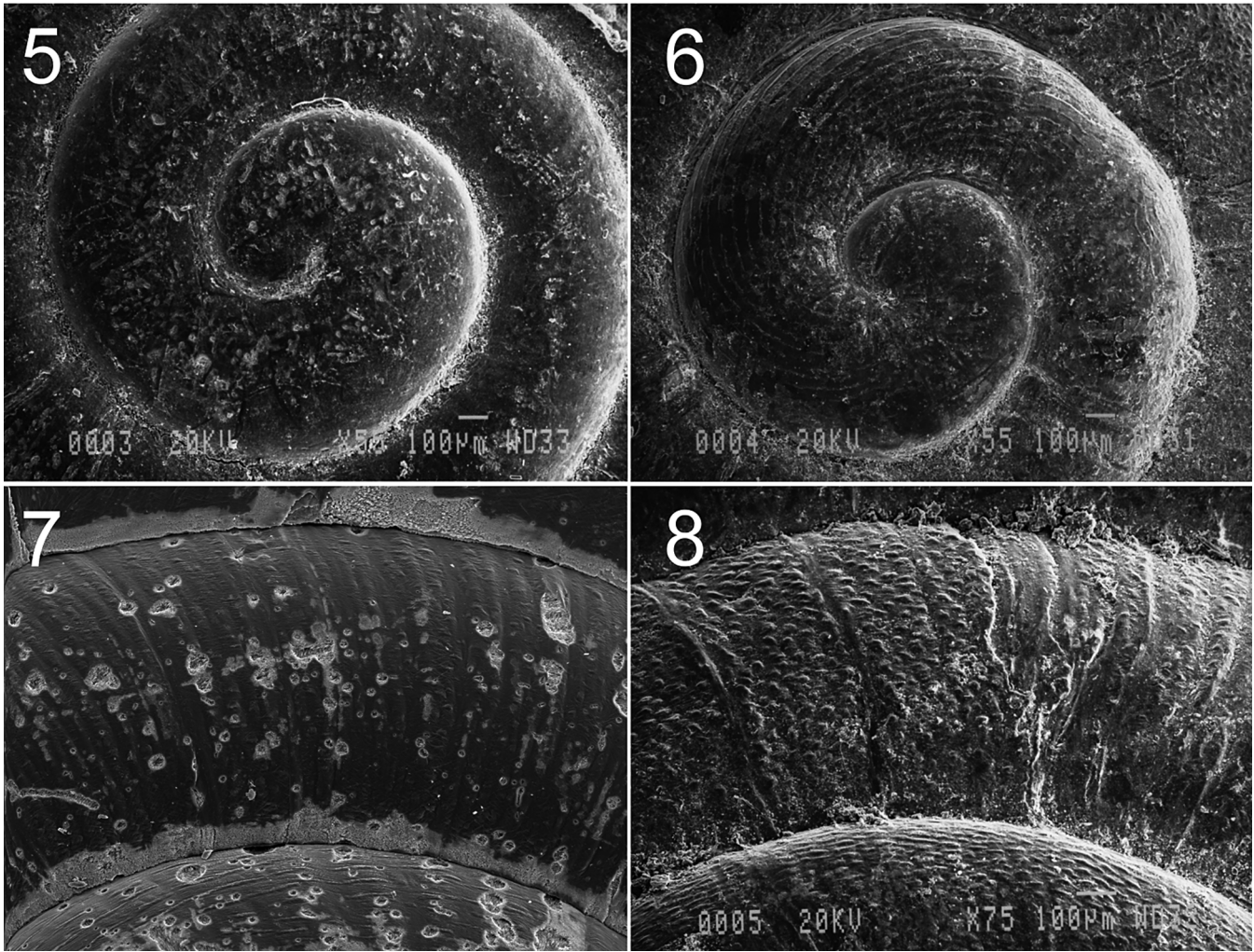
Corbellá & Guillén (2002) reviewed the status of *Gasullia cobosi* (Ortiz de Zárate, 1962), using topotype material sent by the original finder of the species, Dr Cobos, who provided the type specimens to Ortiz de Zárate. They believed that the type locality was wrongly designated, and the types actually came from "Barranco de la Molineta (Almería)" (South-eastern Iberia).

Material was collected of some of the forms of *gasulli*, identified as variable in Ortiz de Zárate's work, as well as species that were previously unknown anatomically. The current paper uses this material to review the diagnosis of *Oestophora* Hesse, 1907 and other related genera from the Iberian Peninsula. The supraspecific classifica-

tion follows Bank, Bouchet, Falkner, Gittenberger, Hausdorf, von Proschwitz & Ripken (2001)

MATERIALS AND METHODS

Specimens were drowned and then preserved in 70% ethanol. Most of the morphological and anatomical observations were made with an optical stereomicroscope (Leica MZ6). The protoconch, first whorls of the shell and radula, were mounted on copper blocks with electron-conductive glue and sputter-coated with gold and then studied and photographed using a Jeol-820 electronic microscope. Radulae were extracted from the bucal bulbs using KOH. Unless otherwise indicated, all the specimens are kept in Department of Physiology and Zoology, University of Seville (Spain).



Figs 5-8 Main taxonomical characters in the shell of *Gasullia gasulli* (Ortiz de Zárate & Ortiz de Zárate, 1961) and *Hatumia pseudogasulli* n. sp. **5** Protoconch of *G. gasulli*. **6** Protoconch of *H. pseudogasulli*. **7** Teleoconch of *G. gasulli*. **8** Teleoconch of *H. pseudogasulli*. See text for details.

RESULTS AND DISCUSSION

TAXONOMY

Gasullia gasulli (Ortiz de Zárate & Ortiz de Zárate, 1961)

Figs 1, 5, 7, 9-11, 13-16

Oestophora (*Gasullia*) *gasulli* Ortiz de Zárate & Ortiz de Zárate, 1961 (pp. 178-179, figs. 4-5): Puebla de Guzmán (PB56), Valverde del Camino (PB96).

Oestophora (*Gasullia*) *gasulli* Ortiz de Zárate, 1962 (pp. 101-102, fig. 12b): La Palma del Condado (QB14).

Oestophora (*Gasullia*) *gasulli* Gasull, 1985 (pag. 137): Puebla de Guzmán (PB56), Santa Ana la Real (QB09).

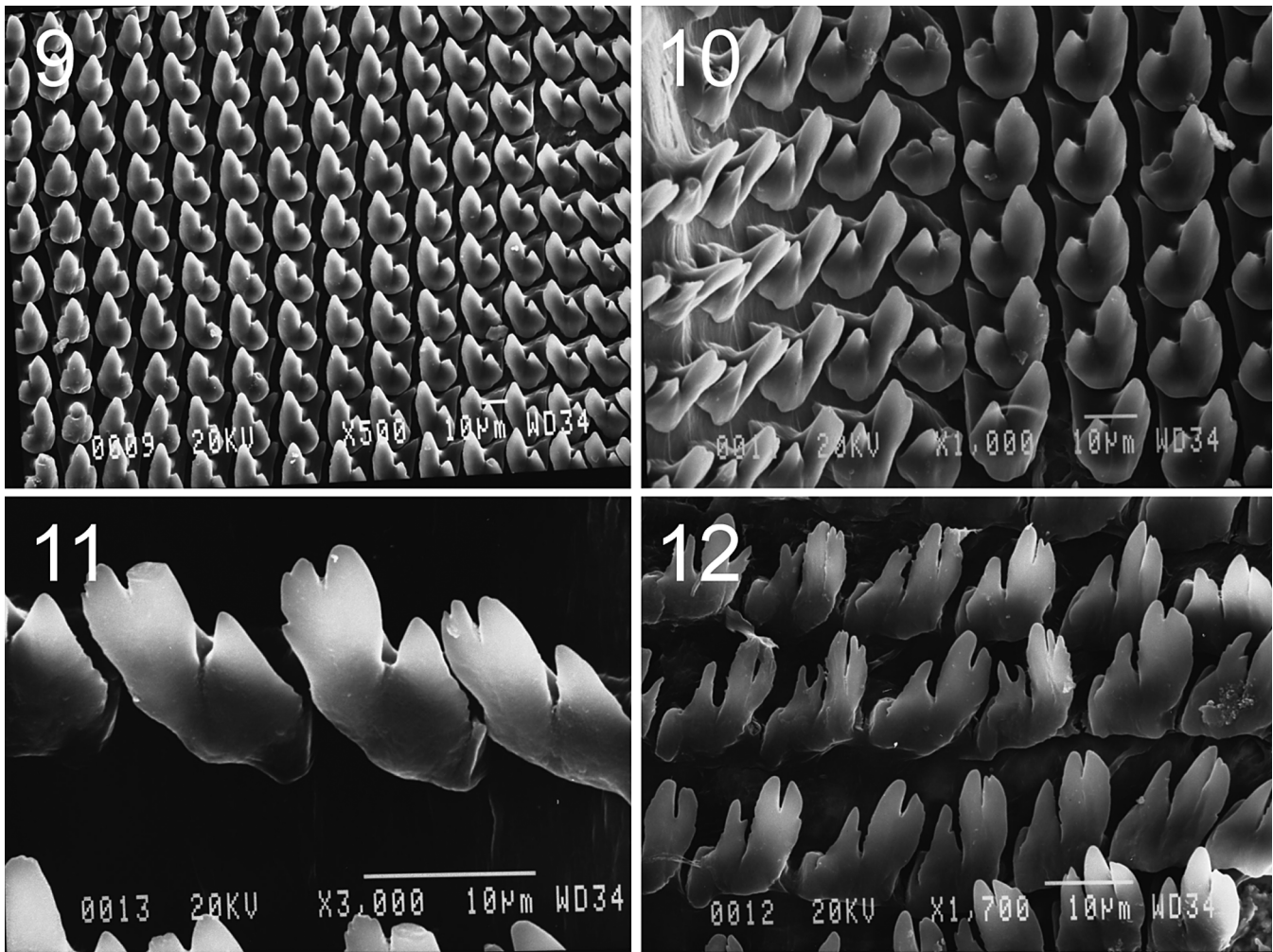
Oestophora (*Gasullia*) *gasulli* Muñoz, 1992 (pp. 138-153, lam. 1, figs. 36-44): Río Odiel (Valverde del Camino) (PB96), Casa Huerta del Sombrero (Cerro de Andévalo) (PB87), Río Matachel (Llera) (QC56). *Oestophora* (*Suboestophora*) *onubensis* Ortiz de Zárate, 1991 (nomen nudum) (pg. 170).

Suboestophora simplicula (non Morelet) Parejo & Muñoz, 1992 (pp. 65-69, fig. 2b-e): Valverde del Camino (PB96).

Suboestophora gasulli Muñoz & Parejo, 1992 (pp. 205-213; figs. 1-6): El Cerro del Andévalo (PB87), Llera (QC56).

Suboestophora gasulli Puente, 1994 (pp. 318-319; Láms. LI y CLXIX row 4): El Castillo de las Guardas (QB37).

Suboestophora gasulli Arrébola, 1995 (pp. 101-106, figs. 15-16, Lám. 3.2): see material.



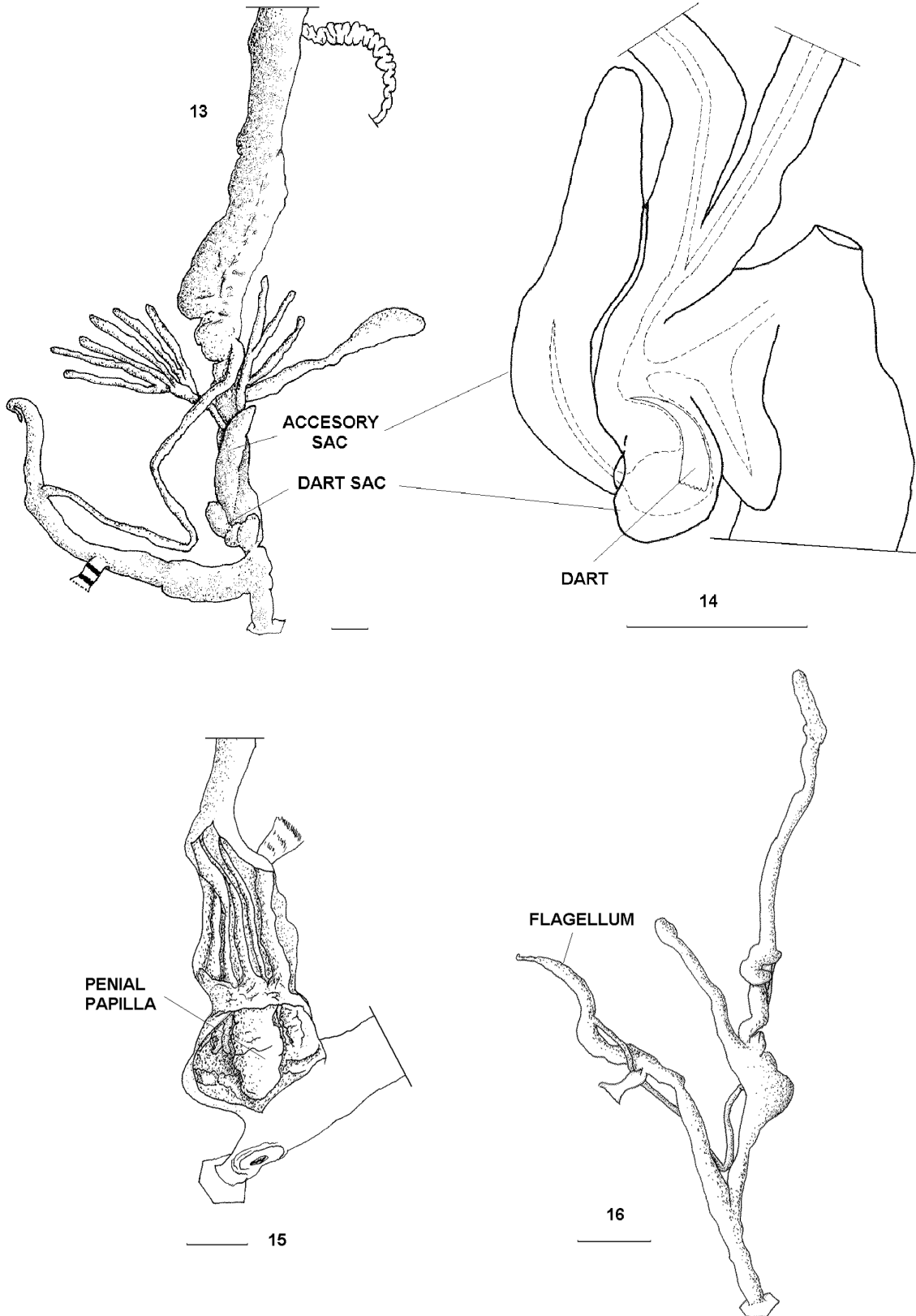
Figs 9-12 9-11 Radula of *Gasullia gasulli* (Ortiz de Zárate & Ortiz de Zárate, 1961) 9 General view of rows 1 to 13, with central and lateral teeth. 10 View of lateral and first marginal teeth. 11 Marginal teeth. 12 Marginal teeth of *Hatumia pseudogasulli* n. sp.

Type description *Oestophora* (*Gasullia*) *gasulli* Ortiz de Zárate & Ortiz de Zárate, 1961. Bol. R. Soc. Esp. Hist. Nat., 59: 178.

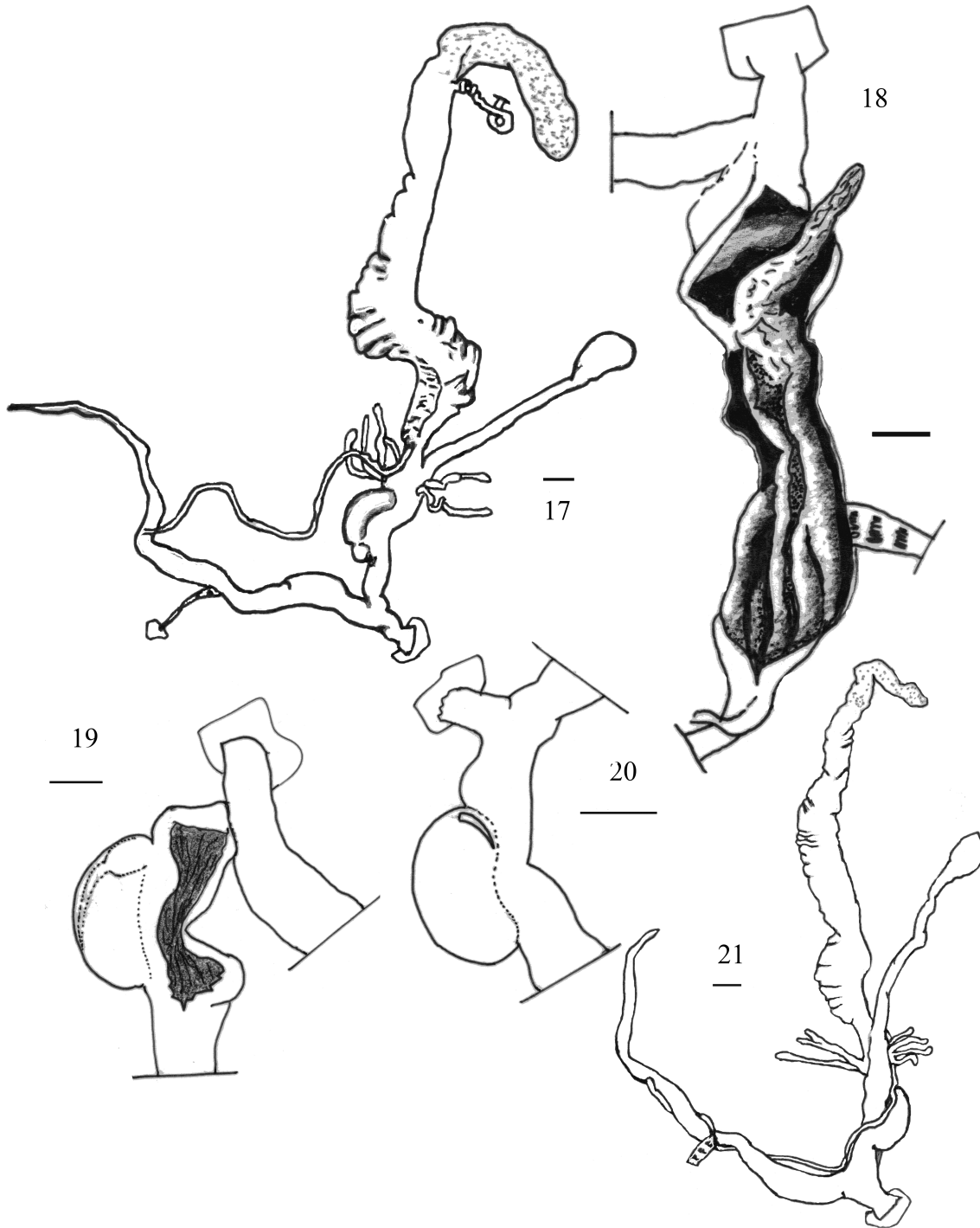
Type locality "Valverde del Camino" (Huelva - 29SPB96)

Material examined Valverde del Camino, 03.11.1989, 29SPB9557, 200-400 m (1a, 2j). Zalamea la Real-Calañas road: Odiel river, 03.11.1989, 29SPB9270, 0-200 m (7s, 12a, 2j). Calañas, 03.11.1989, 29SPB8770, 0-200 m (1a). El Real de la Jara-Santa Olalla del Cala road, 09.02.1991, 29SQC4803, 400-600 m (1s, 3a). El Castillo de las Guardas, 16.10.1991, 29SQB3774, 0-200 m (2a). Aznalcollar-El Castillo de las Guardas road: km 18, 16.10.1991, 29SQB3864, 200-400 m (4s, 4a). J.R. Arrébola leg (a: adults specimens, j: juveniles specimens, s: shells).

Shell (Figs 1, 5, 7) Depressed discoidal shell which is glossy, translucent and with pale brown uniform coloration, slightly paler on its lower surface. The protoconch has $1\frac{1}{2}$ - $1\frac{3}{4}$ whorls with a smooth surface (Fig. 5). It has fine and weak irregular transverse ribbing on the teleoconch and very small spiral crests on the periphery of some whorls (Fig. 7). The umbilicus is deep, rounded, somewhat opened at the last whorl, with the internal coil clearly visible and is $\frac{1}{4}$ of the shell's maximum diameter. The spire is very low conical. There are 5 to $5\frac{1}{4}$ convex whorls with a slow and regular growth and deep sutures. The last whorl is rounded at the periphery, non-decreasing at the end and less than a double width of the previous one. The aperture is simple and almost as tall as wide. The peristome is straight, thin, neither thickened nor reflected, and without internal lip.



Figs 13-16. Genitalia of *Gasullia gasulli* (Ortiz de Zárate & Ortiz de Zárate, 1961). **13** Adult genitalia (gonad and albumen gland). **14** Details of dart and accessory sacs. **15** Internal structure of distal penis with the penial papilla. **16** Juvenile genitalia.

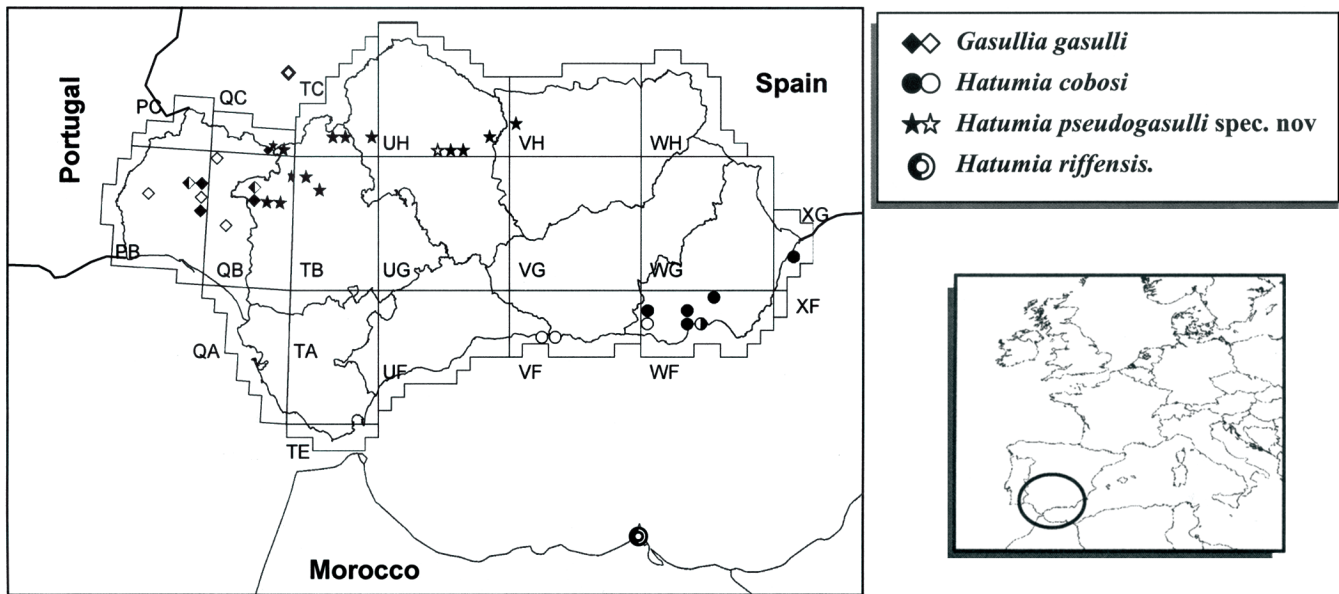


Figs 17-21 Genitalia of *Hatumia riffensis* (Ortiz de Zárate, 1962). **17, 21** Adult genitalia (gonad excluded). **18** Penis opened to show its internal structure and penial papilla. **19, 20** Details of dart and accessory sacs. Scale bar = 1mm.

Shell measurements 10.3-10.9 mm breadth and 4.9-5.3 mm in height.

Radula (Figs 9-11) 110-114 rows × 15M-12L-C in half row. The central tooth is tricuspid with a pointed and wide mesocone and two shorter

ectocones (Fig. 9). The lateral teeth (L) are bicuspid with mesocone and ectocone in a similar way to those of the central tooth (Fig. 10). Teeth of the 10th row may show a mesocone which is shorter than the rest of the rows. The marginal teeth (M), the mesocone have double apex (one



Map 1. Distribution of *Gasullia gasulli* (Ortiz de Zárate & Ortiz de Zárate, 1961), *Hatumia riffensis* (Ortiz de Zárate, 1962), *H. cobosi* (Ortiz de Zárate, 1962) and *H. pseudogasulli* n. sp. in Andalusia (southernmost part of the Iberian Peninsula) and Morocco (northern Africa) (open symbols: localities cited in literature, solid symbols: new localities).

of which is split in two or three points) and a simple ectocone (Fig. 11).

Genitalia (Figs 13-16) The penis is elongated, cylindrical, covered by a penial sheath and fusiform (Fig. 13). There are 4-5 internal and irregular ribs in the proximal part of the penis, with rings and subapically opened penial papilla that becomes thinner in the apex (Fig. 15). The penial retractor muscle is short. The epiphallus is shorter and thinner than the penis, with 3 internal folds (Fig. 15). The long flagellum is similar in width to the epiphallus in the whole extension except at the end, where it greatly narrows (Figs 13, 16). The vas deferens is enlarged at its origin. The stimulatory apparatus is composed of one accessory sac, one dart sac and two mucous glands. The accessory sac is partially separated from the vaginal walls (along about $\frac{1}{2}$ - $\frac{1}{3}$ of its total length), ends in the dart sac and is connected to the spermoviduct by a muscular ligament. The small dart sac is usually externally visible, adjacent to the accessory sac. The dart is small and hook-shaped. The two long mucous glands insert in the upper vagina and are divided close to the base with each gland having 2-6 digitations (Figs 13-14). The duct of the bursa copulatrix is short and similar in width to the flagellum. The bursa copulatrix is oval.

Geographic range (Map 1) and **habitat** The Iberian endemic *G. gasulli* is known from the mountains of Sierra Morena, in South-west Spain. It is more frequently found at lower altitude areas of the Sierra, in habitats dominated by rockrose (*Cistus* spp.) and cork oak (*Quercus suber*). Within the region the more favoured habitats are on riverbanks, areas with more anthropic influence, and even under pines and eucalyptus. The animals are found hidden under trunks or rocks.

Remarks The authorship of this species is Ortiz de Zárate & Ortiz de Zárate (1961) since it satisfies the monotypy requirement according to ICZN (1999) and because Pallary never described "*Oestophora (Gasullia) riffensis* Pallary", which means it was a nomen nudum in 1961. On the other hand, it is not possible to accept the validity of *Suboestophora simplicula* as Parejo & Muñoz (1992) have indicated. Anatomical, geographical, animal development and conchological features differentiate *Gasulliella simplicula* from *Gasullia gasulli*. They were all discussed by Arrébola (1995), Puente (1994) and Puente *et al.* (1998), except the last features.. In this case, the usual external appearance of the shells is darker but more brilliant, flatter and more transparent in *G. gasulli*; for the same diameter of shells *G. gasulli* shows a half whorl less than *G. simplicula*; the last

whorl is a little wider than the previous one in *G. gasulli* while this is not so evident in *G. simplicula*. Finally, there are comparatively deeper sutures and more swollen whorls in *G. simplicula*.

The occurrence of *G. gasulli* in Almería (South-eastern Iberia) with no specified location (Ortiz de Zárate & Ortiz de Zárate, 1961; Ortiz de Zárate, 1962; Gasull, 1985) is doubtful. Biogeographically this could refer to *H. pseudogasulli* n. sp., but we have not found this species there either.

Hatumia n. gen.

Type species *Oestophora (Gasullia) riffensis* Ortiz de Zárate, 1962.

Definition Shell with rounded or angulated whorls, straight and un-thickened peristome, weak irregular transverse ribbing and punctiform nodules on the teleoconch and protoconch sculptured by small spiral crests. Penial papilla and short or long flagellum. Stimulatory apparatus with two divided, or undivided, mucous glands inserted in the vaginal wall, a short and thick accessory sac completely attached to the vaginal walls and a small dart sac that is generally not externally visible.

Hatumia riffensis (Ortiz de Zárate, 1962)

Figs 2, 17-21

Helicodonta riffense Pallary, 1936 (nomen nudum) (pág. 5): environs of Melilla.

Type description *Oestophora (Gasullia) riffensis* Ortiz de Zárate, 1962. Bol. R. Soc. Esp. Hist. Nat., 60: 102.

Type locality "monte Gurugú, cercano a Melilla".

Material examined (a: adults specimens, j: juveniles specimens, s: shells): Environs of Zocohad (NW slope of Gurugu mount) 17.04.2004, VE9800, 303 m (1a, 2j, 32s). Farkhana, road 6249/21 12 Km to Nador, 17.04.2004, WE0202, 85 m, (11a, 1j, 11s). Gurugu mount, N slope, 17.04.2004, WE0200, 305 m, (2a, 1s). Gurugu mount, S slope. 17.04.2004, WD0198, 591 m, (5a, 4j, 1s). A. Ruiz & A. Cárcaba legs.

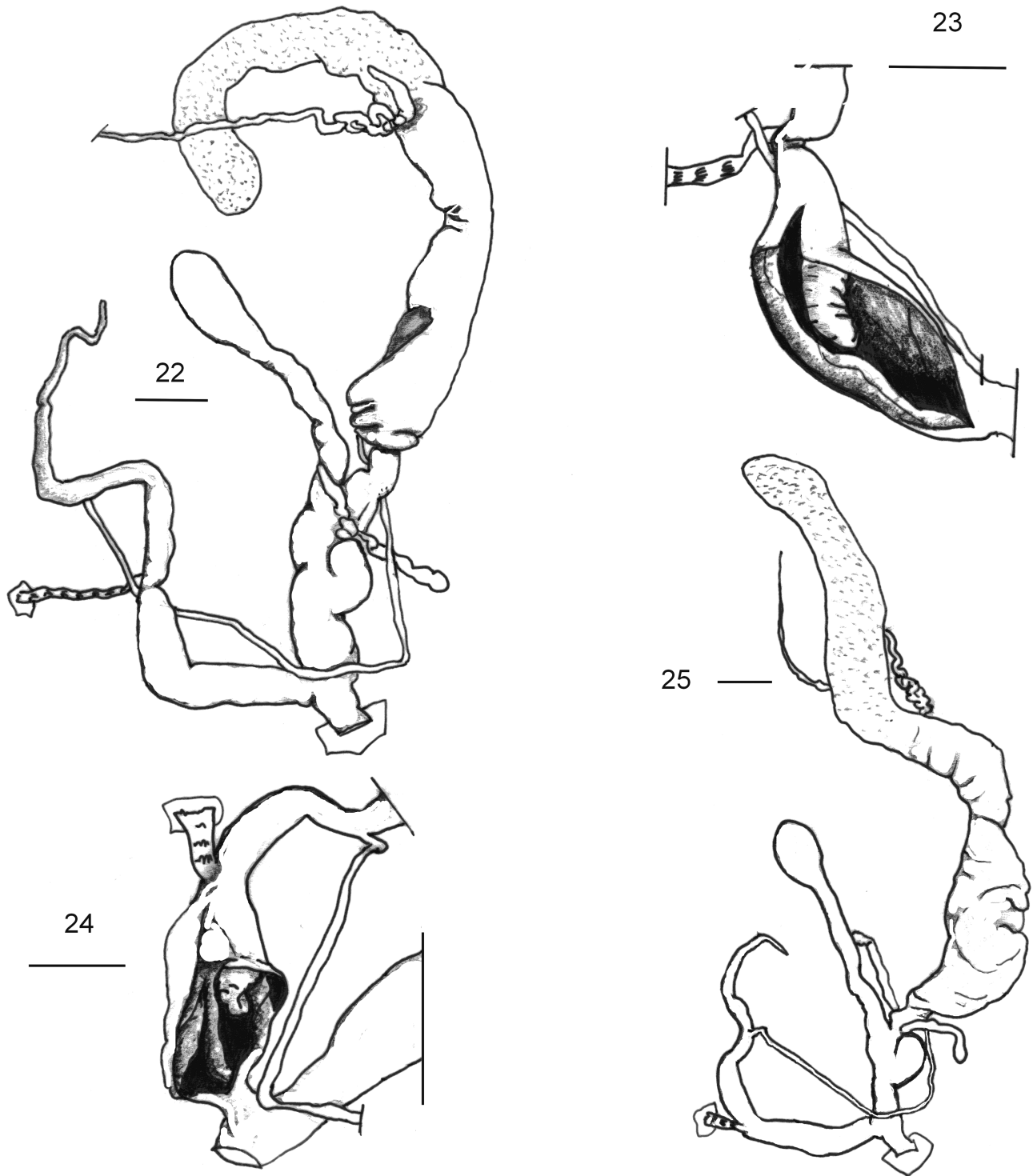
Shell (Fig. 2) Depressed shell which is dark

brown or even reddish, dull and slightly translucent, especially basally. It has fine and weak irregular transverse ribbing and a strongly granular surface on the teleoconch. This granular surface is composed of thousands of extremely small punctiform nodules, that are very densely distributed. This microsculpture can be observed on both sides of the shell, but is less apparent on the lower one. In the 1½ whorls of the protoconch, the nodules are also present, but they are shorter and less numerous than in teleoconch. In contrast, the sculpture consists of clearly visible spiral crests. The umbilicus is deep, rounded, with the internal coil well visible and ¼ of the shell's maximum diameter. The spire is very low conical. There are 4½ to 5 convex whorls with deep sutures and a slow and regular growth (slightly faster in the last two whorls). The last whorl is rounded at the periphery and non-decreasing at the end. The aperture is simple and almost as tall as wide. The peristome is straight, thin, neither thickened nor reflected, and without internal lip.

Shell measurements 9.5-13 mm in width and 3.7-5.1 mm in height

Genitalia (Figs 17-21) Right ommatophore muscle between penis and vagina. The penis is elongated, cylindrical and fusiform (Figs 17, 21). There is an elongated and slender penial papilla that becomes much thinner in the apex (Fig. 18). The penial retractor muscle is short. The epiphallus, shorter than the penis, has 3-5 internal folds (Fig. 18). The long flagellum is similar in width to the epiphallus only at the beginning, after which it becomes gradually thinner distally (Figs 17, 21). The stimulatory apparatus is composed of one accessory sac, one dart sac and two mucous glands. The accessory sac is short, thick and completely attached to the vagina walls (Figs 17, 19, 20, 21). It ends in a small dart sac that is generally not visible externally, containing a small and hook-shaped dart (Fig. 19, 20). The two long mucous glands, inserted in the vagina, are divided into 2-4 digitations each. The bursa copulatrix duct is of medium length and of similar width to the proximal flagellum. The bursa copulatrix is oval.

Geographical range and habitat According to Ortiz de Zárate (1962), *H. riffensis* is only known



Figs 22-25 Genitalia of *Hatumia cobosi* (Ortiz de Zárate, 1962). 22, 25 Adult genitalia (gonad excluded). 23, 24 Distal penis opened to show its internal structure and penial papilla. Scale bar = 1 mm.

from the type locality in Melilla (North Africa). Little data have been published on the distribution of this species since that time. The species is widely distributed, from disturbed habitats to natural habitats (pastures, uncultivated lands, Mediterranean scrub with cork oak trees and plantations). The habitats share a common feature, which is the high density of refuges within scree or walls, most of the samples having been collected in crevices or under large stones. The dominant substrate in the area was acidic metamorphic rocks. Species were found at a maximum altitude of 600 m on the south face, and 300 m on the north face of Gurugu mount.

Remarks The shell and anatomical features of the studied material of *H. riffensis*, from the type locality, agree with the original description (Ortiz de Zárate, 1962). The “extraordinary flagellum length” mentioned by Ortiz de Zárate (1962) was based on the species known anatomically at the time from the other subgenera. Ortiz de Zárate (1962) viewed the stimulatory apparatus as only having a single dart sac.

Hatumia cobosi (Ortiz de Zárate, 1962)

Figs 3, 22-25

Oestophora (*Gasullia*) *cobosi* (Ortiz de Zárate, 1962): erroneously referred to “Moal (Asturias), Monte Muniellos” (see remarks).

Synonymy: *Gasullia cobosi*.- Corbellá & Guillén, 2002 (pp. 33-37, figs. 1-3): el Barranco de la Molineta (Almería) (WF47), Ermita de Nuestra Señora de Gador, en el término municipal de Berja (WF07), afueras de la ciudad de Almería, hacia el este (WF47), alrededores de la playa de Burriana, Nerja (Málaga) (VF26), Cerro de San Antón, El Palo (Málaga) (VF26), acantilados de la playa de la Calaiza, en La Herradura, Almuñécar (Granada) (VF36).

Type description *Oestophora* (*Gasullia*) *cobosi* Ortiz de Zárate, 1962. Bol. R. Soc. Esp. Hist. Nat., 60: 103.

Type locality (emended) “el Barranco de la Molineta (Almería)” (30SWF4878). The original locality cited by Ortiz de Zárate (1962) is an error, as Corbellá & Guillén demonstrated (2002) (see Introduction and Remarks).

Material examined (a: adults specimens, j: juveniles specimens, s: shells): El Puntal (Tabernas), 29.06.2002, 30SWF5195, 524 m (4j, 7s). Peñón de la rata (Berja), 01.07.02, 30SWF0680, 548 m (1s). Km 10 A-391 road, Sierra de Gádor (Enix), 23.04.2003, 30SWF3477, 268 m (7s). Enix-Almería road, 6 km from Enix, 23.04.2003, 30SWF3979, 673 m (1a, 2j, 10s). Enix-Almería road, 2.5 km from Enix, 23.04.2003, 30SWF3780, 700 m (1a). Enix-Almería road, 1.2 Km. from Enix, 21.03.2004, 30SWF3681, 720 m (3a, 3j, 19s). 600 m W to Guzmaná, Sierra Almagrera (Cuevas de Almanzora), 24.03.2004, 30SXG1028, 205 m (1j, 1s). A. Ruiz leg.

Shell (Fig. 3) Depressed shell with pale brown coloration, dull and slightly translucent, especially basally. It has fine and weak irregular transverse ribbing and a granular surface on the teleoconch. This granular surface is composed of thousands of extremely small punctiform nodules, very densely distributed. This microsculpture is present on both sides of the shell, but it is less marked on the lower one. The nodules are also on the 1½ whorls of the protoconch but are shorter and less numerous than on the teleoconch. In contrast, it has sculpture of clearly visible spiral crests. The umbilicus is deep, rounded, with the internal coil well visible and ⅓-¼ of the shell's maximum diameter. The spire is very low conical. There are 4¼ to 5 convex whorls with deep sutures and a slow and regular growth (slightly faster in the last two whorls). The last whorl is angulated at the periphery and non-decreasing at the end. The aperture is simple and wider than tall. The peristome is straight, thin, neither thickened nor reflected, and without internal lip. The slightly waved upper border of the peristome is consequence of the depression existing between the peripheral angle and the suture.

Shell measurements 7.3-10.1 mm in width and 3.4-4.1 mm in height.

Genitalia (Figs 22-25): Right ommatophore muscle between penis and vagina. The penis is elongated, cylindrical and almost uniform in width (both extremes become more narrow) (Figs 22, 25). There is a short penial papilla with a more or less rounded apex (Figs 23-24). The penial retractor muscle is short. The epiphallus is shorter than the penis and has 1-3 internal folds. The long flagellum is similar in width to the epiphallus at

the beginning, and then becomes gradually thinner distally. The stimulatory apparatus is composed by one accessory sac, one dart sac and two mucous glands. The accessory sac is short, thick and completely attached to the vaginal walls. It finishes in a dart sac that is generally not visible externally. The two single mucous glands are inserted in the vagina. The bursa copulatrix duct is short and similar in width to the epiphallus. The bursa copulatrix is oval.

Geographic range and habitat (Map 1) This Iberian endemic is distributed in the eastern half of Andalusia. The species inhabits low altitude and human influenced places (i.e. ruderal) in xeric and argillaceous ground, on limestones and dolomites and within vegetation zones that correspond to regression stages of the climax forest (Corbellá & Guillén, 2002). Like other closely related species, it is frequently found under rocks and trunks or hidden in the crevices of stone walls.

Remarks The type locality proposed by Corbellá & Guillén (2002) for *H. cobosi* is also problematic. The material studied by Corbellá & Guillén (2002), received from D. Antonio Cobos, was labelled as "el Barranco de la Molineta, Almería. Topotypes". After an exhaustive search (J. Corbellá, personal communication), these authors decided the most probable location is an outlying area of the Almerian town named "La Molineta" (30SWF4878). This area had two small crags close to the institution (C.S.I.C) where D. A. Cobos worked which have now been lost through development ("Barranco" is a small precipice in Spanish). According to Corbellá & Guillén (2002), the supposed habitat characteristics of this place in 1962 would have been similar to those where they recently found the species, close by the same UTM square (WF47). Our observations support this conclusion.

H. cobosi can easily be differentiated from *H. riffensis* on conchological and anatomical features. In the first species, the shell is smaller in size, more transparent with pale brown colouration (darker or reddish in *H. riffensis*), a granular surface of the teleoconch less developed and with less densely distributed punctiform nodules, an angulated periphery (rounded in *H. riffensis*) and a slightly waved upper border to the peristome.

The penial papilla is shorter and wider, the flagellum is comparatively shorter and the 2 mucous glands are simple (divided in *H. riffensis*).

Hatumia pseudogasulli n. sp.

Figs 4, 6, 8, 12, 26-29

Oestophora (Gasullia) gasulli (non Ortiz de Zárate & Ortiz de Zárate). Ortiz de Zárate & Ortiz de Zárate, 1961 (in part) (p. 179): "Las Ermitas, provincia de Córdoba", 30SUH4102. The shells from this locality were collected by Gasull in 1948 and later studied by Ortiz de Zárate & Ortiz de Zárate (1961), Ortiz de Zárate (1962), Gasull (1985) [cited as *Oestophora (Gasullia) gasulli* (Ortiz de Zárate & Ortiz de Zárate, 1961)], Muñoz & Parejo (1992) [cited as *Suboestophora gasulli* (Ortiz de Zárate & Ortiz de Zárate, 1961)] and Parejo & Muñoz (1992) [cited as *Suboestophora simplicula* (Morelet, 1845)]. All these authors found and mentioned only slight shell differences between the material from "Las Ermitas" and the typical *G. gasulli* shells. There are also uncertain data from Almería province (E of Andalusia) without identification of the origin localities names and its UTM coordinates (Ortiz de Zárate & Ortiz de Zárate, 1961; Gasull, 1985).

Holotype (Fig. 26) from "Sierra Padrona, road SE-179, km 10-11 (Sevilla province)", 29SQ5906, J.R. Arrébola leg, 16.11.1989, in the Museo de Ciencias Naturales de Madrid, (Spain) N° 15.05/46655. N° 1478 in the Museo Valenciano de Historia Natural.

Paratypes (a: adult specimens, j: juvenile specimens, s: shells) Gerena-El Garrobo road: Cerrete Rompezapatos, 05.04.1989, 29SQB5161, 0-200 m (5s). Cala reservoir: Dehesa de Tena, 28.04.1989, 29SQB6082, 200-400 m (1a, 2s). Arenillas: Mulva Castle, 06.12.1988, 30STG5877, 0-200 m (1a). Sierra Padrona, road SE-179, km 10-11, 16.11.1989, 29SQ5906, 600-800 m (3a). Castilblanco de los Arroyos-Almadén de la Plata road, 09.02.1991, 29SQB6180, 200-400 m (1a, 1s). El Real de la Jara-Santa Olalla del Cala road, 09.02.1991, 29SQ4803, 400-600 m (2a, 1j). Las Jarillas, 25.03.1991, 30STG4986, 200-400 m (3a, 1s). San Nicolás del Puerto, 06.04.1991, 30STH6610, 600-800 m (1a). Alanís-Fuente Obejuna road, 06.04.1991, 30STH7218, 400-600 m (2a, 2s).

Aznalcollar-El Castillo de las Guardas road: km 11, 16.10.1991, 29SQB4061, 200-400 m (2a, 4s). All these specimens: Arrébola leg. J-500, km 1 to 2 (PN Sierra de Andujar, Andujar), 05.11.2002, 30SVH0928, 630 m (2s). San Rafael de Navallana reservoir (Córdoba), 18.03.2003, 30SUH5602, 115 m (1s). CO 412 road (Pedro Abad-Adamuz), 1.5 km W to the Salto reservoir, 19.03.2003, 30SUH6804, 170 m (1s). Yegua reservoir (PN Sierra de Cardeña y Montoro), 20.03.2003, 30SUH8917, 278 m (1j). 900 m. N to the Nava hill (Bembézar reservoir, Hornachuelos), 30STH9212, 23.03.2003, 233 m (1a, 1j, 1s). CO-142 road, Olivo hill (PN Sierra de Hornachuelos), 23.03.2003, 30STH9010, 354m (1a, 8j, 4s). A. Ruiz leg.

Type locality Sierra Padrona, road SE-179, km 10-11 (Sevilla province) 29SQC5906.

Diagnosis Shell pale brown and glossy with rounded periphery and weak granular surface on teleoconch. Genital system with short flagellum, small and wide penial papilla, becoming thinner in the apex, two mucous glands with digitations and short and wide bursa copulatrix duct.

Shell (Figs 4, 6, 8) Depressed shell. Glossy, translucent, pale brown uniform coloration which is slightly paler on the lower surface. The $1\frac{1}{4}$ whorls of the protoconch have sculpture with spiral crests (Fig. 6). It has fine, weak irregular transverse ribbing and a granular surface on the teleoconch (Fig. 8). This granular surface is composed of extremely small punctiform nodules, that is less evident than in the other two species of the genus. The umbilicus is deep, cylindrical, wide and approximately $\frac{1}{4}$ of the maximum shell diameter. The $4\frac{3}{4}$ to 5 convex whorls of the shell are slowly and regularly growing. The spire is very low conical. The last whorl is well rounded at the periphery and non-decreasing at the end. The sutures are deep. The aperture is simple and almost as tall as wide. The peristome is straight, thin, neither thickened nor reflected, and without internal lip.

Shell measurements 6.7-9.3 mm in diameter and 5 mm in height

Radula (Fig. 12) Only a small fragment of the radula containing some lateral teeth could be examined. The radula consists of 115-120 rows of teeth. The central tooth is tricuspid with a

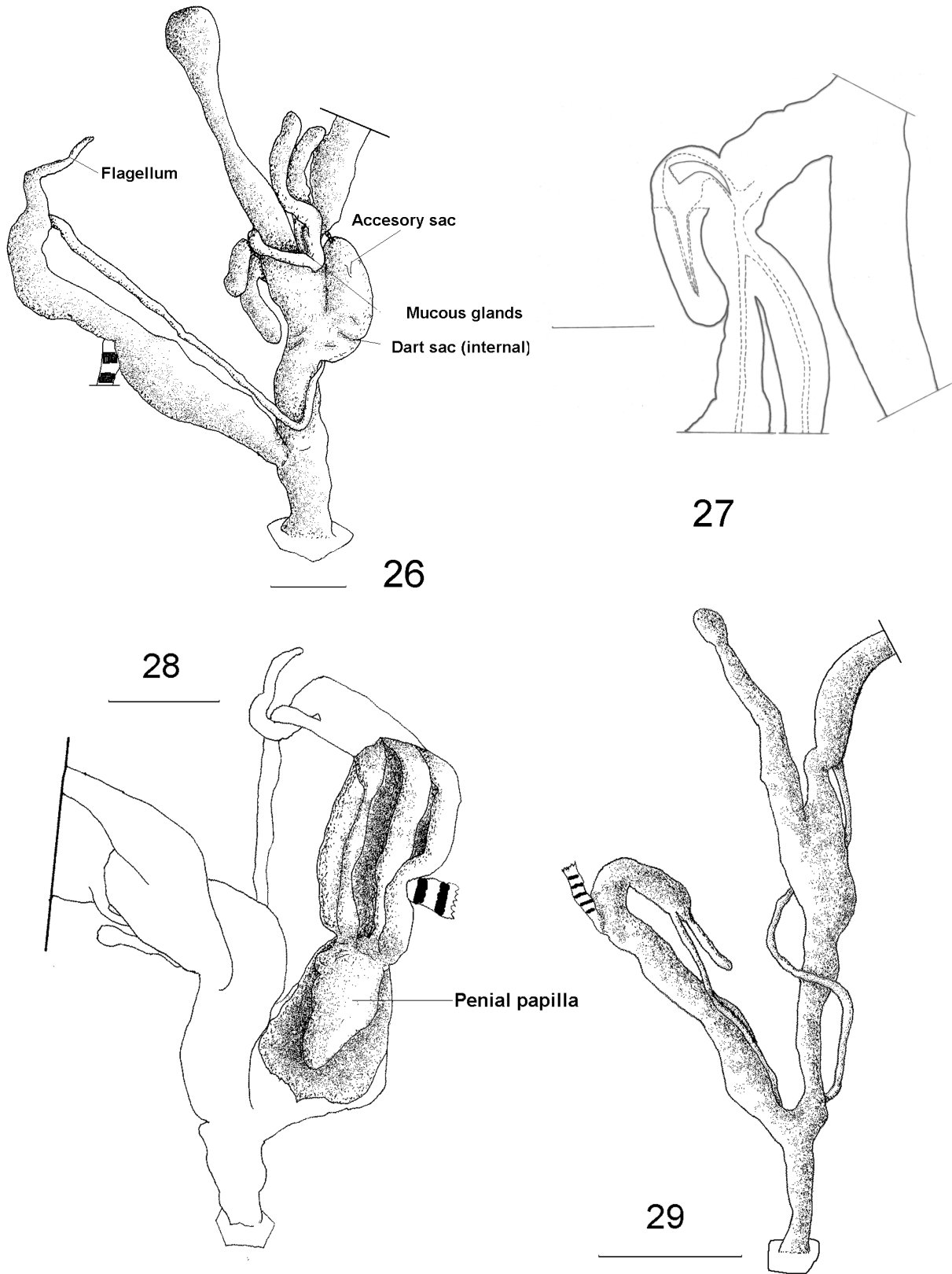
pointed and wide mesocone and two shorter ectocones. The lateral teeth are bicuspid. The marginal teeth show a variable mesocone and ectocone. The mesocone has two apices, the external at times subdivided in two points. The ectocones have one or, less frequently, two apices (Fig. 12).

Genitalia (Figs 26-29) The right ommatophore muscle passes between penis and vagina. The penis shows an enlarged central section internally occupied by a small and wide penial papilla, becoming thinner in the apex (Fig. 28). The epiphallus is similar in length but narrower than the penis and has three internal folds (Fig. 28). The flagellum is short, enlarged at the origin but decreasing gradually distally (Fig. 26). The stimulatory apparatus is composed of one accessory sac, one dart sac and two mucous glands. The thick accessory sac is totally attached to the vaginal walls and connected to the spermoviduct by a muscular ligament (Figs 26-27). The dart sac, smaller and normally not externally visible, contains a very small and hook-shaped dart (Fig. 27). There are two mucous glands inserted in the vagina, each with two, sometimes three, digitations. The bursa copulatrix duct is short and wide, similar to the epiphallus. The bursa copulatrix is rounded.

Derivation of name "*pseudogasulli*" refers to the conchological similarity existing between the new species and *G. gasulli*.

Geographic range and habitat (Map 1) The endemic *H. pseudogasulli* occurs in the Sierra Morena mountain chain in the North of Sevilla, Córdoba and Jaén provinces. Like *G. gasulli*, it lives in lower places of Sierra Morena in areas dominated by *Cistus* spp. (especially *C. ladanifer*) associated with *Quercus suber* and *Q. rotundifolia*. Specific microhabitats are under stones, below, and at base of trunks, and other refuges in humid and shaded places.

Remarks As Ortiz de Zárate (1962) predicted, the '*gasulli*' populations coming from "Las Ermitas (Córdoba)", that showed differences in the microsculpture of the protoconch compared to those of Huelva, are found to belong to a different species. The similarity of the shells is so great that, although the shell of *G. gasulli* would



Figs 26-29 Genitalia of *Hatumia pseudogasulli* n. sp. **26** Adult distal genitalia (holotype). **27** Details of dart and accessory sacs. **28** Penis opened to show its internal structure and penial papilla. **29** Juvenile genitalia. Scale bar = 1 mm.

be about 2 mm wider than *H. pseudogasulli*, only the presence of slight spiral striae on the protoconch and the fine granulation scattered along the rest of the shell in *H. pseudogasulli* (Fig. 8), can differentiate them using shell characters. Although some differences were observed in the formation of the radula, namely the lateral teeth (Figs 11 and 12), the distinct genital system allows their separation and places them in different genera. The main anatomical differentiation is the structure of the stimulatory apparatus. Some differences between the two species can be also observed even in immature specimens (i.e. external appearance of flagellum: Fig. 16, in comparison with Fig. 29).

G. gasulli and *H. pseudogasulli* n. sp. (Map 1) have separate distributions, except in a small contact zone on the border between the provinces of Huelva and Sevilla; at one site (El Real de la Jara-Santa Olalla de Cala road) they were found living together. As these two species appear to occupy very similar ecological niches, we suggest that they must strongly limit each other by inter-specific competition.

H. pseudogasulli can also be differentiated from the other two species of the genus using both conchological and anatomical characters. *H. pseudogasulli* is smaller, more glossy and paler brown than *H. riffensis*, with less pronounced granularity on the surface of the teleoconch, and with less densely distributed punctiform nodules. The penial papilla is shorter and wider and the flagellum is much less developed in *H. pseudogasulli* than *H. riffensis*. *H. pseudogasulli* has a more glossy shell than *H. cobosi*, less developed granular surface on the teleoconch, less densely distributed punctiform nodules with a more rounded periphery. Anatomical differences include a shorter flagellum and two divided mucous glands.

ABOUT THE TRISSEXODONTIDAE

The largely Iberian genera *Gasulliella*, *Oestophora*, *Suboestophora* and *Gasullia* are 4 of the 9 Iberian genera classified in Helicoidea: Trissexodontinae (Prieto *et al.*, 1993; Puente, 1994, 1996 and Puente *et al.*, 1998), elevated to Family status by Bouchet & Rocroi (2005). These authors proposed a new systematic interpretation of this group based on morphological and anatomical studies of most of the genera and species. These revisions differed from the earlier proposals of Nordsieck (1987,

1993) and Schileyko (1991).

The conchological and anatomical features shared by the three *Hatumia* species, especially those related with the stimulatory apparatus, as well as its close phylogenetical position to *Gasullia*, *Suboestophora* and *Oestophora*, support the creation of a new genus in the Trissexodontidae. Neither *Hatumia*, nor *Gasullia* were considered in the general pattern described to this family by Prieto *et al.* (1993) and Puente (1994). The only significant differences observed between *Gasullia/Hatumia* and most of the other Trissexodontidae concern the mucous glands: they do not end in the accessory sac and they are not bifurcated (may or may not be subdivided in *H. cobosi*, with up to 5-6 digitations each in *G. gasulli*). However, the simple structure of the mucus glands and their position of insertion to the vagina would not be sinapomorphies of these two genera because they also appear in the genus *Oestophora*. Consequently, the great genital uniformity emphasized by Prieto *et al.* (1993) in Trissexodontidae (Trissexodontinae) is not altered by *Gasullia* and *Hatumia*.

The diagnoses of *Oestophora*, *Suboestophora*, *Gasulliella* and *Hatumia* genera, refined from those provided by Puente *et al.* (1998), are as follows.

Oestophora Hesse, 1907

Type species Helix Lusitanica Pfeiffer, 1841. *Symb. ad Hist. Heliceorum*, 1: 40. *Locus typicus*: Porto (Douro).

Composition barbula (Rossmässler, 1838); *lusitanica* (Pfeiffer, 1841); *calpeana* (Morelet, 1854); *tarnieri* (Morelet, 1854); *dorotheae* Hesse, 1930; *silvae* Ortiz de Zárate, 1962; *ortizi* De Winter & Ripken, 1991; *granease* Arrébola, 1998. Other uncertain species, most of them from North Africa, such as *gougeti* (Terver, 1839), *tlemcenensis* (Bourguignat, 1868), *marocana* (Morelet, 1876), or *columnae* (Kobelt, 1889), are dealt with in another paper (in preparation).

Diagnosis shell with rounded, angulated or keeled whorls, reflected and thickened peristome and costulated teleoconch. No flagellum nor penial papilla. Stimulatory apparatus consists of one small dart sac barely visible externally, one longer accessory sac totally separated from the

vaginal walls and three simple and long mucous glands connected to the vagina.

Gasullia Ortiz de Zárate & Ortiz de Zárate,
1961

Type species *Oestophora* (*Gasullia*) *gasulli* Ortiz de Zárate & Ortiz de Zárate, 1961.

Composition *gasulli* (Ortiz de Zárate & Ortiz de Zárate, 1961).

Diagnosis Shell with rounded whorls, straight and un-thickened peristome, smooth-surfaced protoconch and weak irregular transverse ribbing on the teleoconch. Penial papilla and long and wide flagellum. Stimulatory apparatus with two mucous glands connected to the vagina and split up into 1-6 branches per gland, a long accessory sac partially separate from the vaginal walls and a smaller and generally externally visible dart sac.

Gasulliella Gittenberger, 1980

Type species *Helix simplicula* Morelet, 1845. Descr. Moll. terr. & fluv. Portugal: 56. *Locus typicus*: "Sur les hauts plateaux qui séparent Mertola de Castro Verde" (Alentejo).

Gasulliella (Morelet)

Diagnosis Lenticular shell with wide umbilicus, rounded whorls and simple peristome. Protoconch with elongated regularly spaced spiral crests. Penial papilla and short flagellum. Stimulatory apparatus absent.

Suboestophora Ortiz de Zárate, 1962

Type species *Helicodonta hispanica* Gude, 1910. Proc. Malac. Soc. London, 9: 124. *Locus typicus*: Tabernes de Valldigna (Valencia).

Composition *boscae* (Hidalgo, 1869); *hispanica* (Gude, 1910); *tarraconensis* (Aguilar-Amat, 1935); *altamirai* (Ortiz de Zárate, 1962); *jeresae* (Ortiz de Zárate, 1962).

Diagnosis Shell with rounded, angulated or keeled whorls, reflected and thickened or simple peristome, costulated teleoconch with

punctiform nodules, also visible on protoconch. Penial papilla and short flagellum. Stimulatory apparatus with two bifurcated mucous glands at the base of the accessory sac. A rounded and externally visible dart sac and a long accessory sac completely separated from the vagina.

ACKNOWLEDGEMENTS

Thanks are due to Alex Menez from Gibraltar Museum who corrected the last English version. This research was partially supported by the Regional Ministry of the Environment (Junta de Andalucía) as part of the "Program for Conservation and Sustainable Snail Exploitation in Andalucía". It also forms part of the project "Molecular systematic, taxonomy and phylogeny of the Helicodontidae (Gastropoda: Pulmonata: Helicoidea) - Ref CGL2005-01966/BOS".

REFERENCES

- ALTONAGA K, GÓMEZ B, MARTÍN R, PRIETO CE, PUENTE AI & RALLO A 1994 *Estudio faunístico y biogeográfico de los moluscos terrestres del norte de la Península Ibérica*. Ed. Parlamento Vasco. 503 pp.
- ARRÉBOLA JR 1995 *Caracoles terrestres (Gastropoda Stylommatophora) de Andalucía, con especial referencia a las provincias de Sevilla y Cádiz*. Tesis Doctoral. Universidad de Sevilla. 589 pp + 16 lám.
- BANK RA, BOUCHET PH, FALKNER G, GITTENBERGER G, HAUSDORF B, VON PROSCHWITZ T & RIPKEN THEJ 2001 Supraspecific classification of European non-marine Mollusca (CLECOM Sections I+II). *Heldia* 4 (1/2): 77-128.
- BOUCHET P & ROCROI JP (Ed.) 2005 Classification and nomenclature of gastropod families. *Malacologia* 47(1-2): 397 pp.
- CORBELLA J & GUILLEN MG 2002 Acerca de *Gasullia cobosi* (Ortiz de Zárate López, 1962) (Gastropoda: Hygromiidae: Trissexodontinae). *Spira* 1 (2): 33-37.
- GASULL L 1985 Fauna malacológica continental de la provincia de Huelva. *Miscelanea Zoologica* 9: 127-143.
- ICZN 1999 International Code on Zoological Nomenclature. 4th ed. International Trust for Zoological Nomenclature. London pp. i-xxix, 1-306.
- MUÑOZ B 1992 *Gasterópodos terrestres (Mollusca, Gastropoda, Pulmonata) de Cáceres, Badajoz y Huelva*. Tesis Doctoral. Universidad Complutense de Madrid, 304 pp.
- MUÑOZ B & PAREJO C 1992 Redescription of *Suboestophora gasulli* nov. comb. for *Oestophora* (*Gasullia*) *gasulli* (Gastropoda: Pulmonata). *Journal of Conchology* 34: 205-213.

- NORDSIECK H 1987 Revision des systems der Helicoidea. *Archiv fur Molluskenkunde* **118** (1/3): 9-50.
- NORDSIECK H 1993 Das System der paläarktischen Hygromiidae (Gastropoda: Pulmonata: Helicoidea). *Archiv fur Molluskenkunde* **122**: 1-23.
- ORTIZ DE ZÁRATE A 1962 Observaciones anatómicas y posición sistemática de varios helícidos españoles. V. Género *Oestophora* Hesse, 1907. *Boletín de la Real Sociedad española de Historia natural (Biología)* **60**: 81-104.
- ORTIZ DE ZÁRATE A 1991 *Descripción de los moluscos terrestres del valle del Najerilla*. Ed. Gobierno de La Rioja. Logroño. 400 pp.
- ORTIZ DE ZÁRATE A & ORTIZ DE ZÁRATE A 1961 Moluscos terrestres recogidos en la provincia de Huelva. *Boletín de la Real Sociedad española de Historia natural (Biología)* **59**: 169-190.
- PAREJO C & MUÑOZ B 1992 *Suboestophora simplicula* nueva denominación para *Gasulliella simplicula* (Morelet, 1845) y *Suboestophora gasulli* (Ortiz de Zárate Rocandio y Ortiz de Zárate Lopez, 1961) (Mollusca: Gastropoda: Pulmonata). *Graellsia* **48**: 65-69.
- PRIETO CE 1986 *Estudio sistemático y biogeográfico de los Helicidae sensu Zilch, 1959-60 (Gastropoda: Pulmonata: Stylommatophora) del País Vasco y regiones adyacentes*. Tesis Doctoral. Universidad del País Vasco. 393 pp + 10 lám.
- PRIETO CE, PUENTE AI, ALTONAGA K & GÓMEZ BJ 1993 Genital morphology of *Caracollina lenticula* (Michaud, 1831), with a new proposal of classification of Helicodontoid genera (Pulmonata: Hygromioidea). *Malacologia* **35**(1): 63-77.
- PUENTE AI 1994 *Estudio taxonómico y biogeográfico de la superfamilia Helicoidea Rafinesque, 1815 (Gastropoda: Pulmonata: Stylommatophora) de la Península Ibérica e Islas Baleares*. Tesis Doctoral. Universidad del País Vasco. 970 pp + lám 159-192.
- PUENTE AI 1996 El género *Oestophora* Hesse 1907 en la Península Ibérica e Islas Baleares (Gastropoda: Pulmonata: Hygromiidae: Trissexodontinae). *Archiv fur Molluskenkunde* **126** (1/2): 81-107.
- PUENTE AI, ALTONAGA K, PRIETO CA & RUIZ JC 1998 Los géneros *Gasulliella* Gittenberger 1980, *Mastigophallus* Hesse 1918, *Oestophorella* Pfeiffer 1929 y *Tressexodon* Pilsbry 1894 en la Península Ibérica. *Archiv fur Molluskenkunde* **127** (1/2): 43-55.
- PUENTE AI & PRIETO CE 1992 La Superfamilia Helicoidea (Pulmonata: Stylommatophora) en el norte de la Península Ibérica: corología y sectoización malacogeográfica. *Graellsia* **48**: 133-169.
- SCHILEYKO AA 1991 Taxonomic status, phylogenetic relations and system of the Helicoidea sensu lato (Pulmonata). *Archiv fur Molluskenkunde* **120** (4/6): 187-236.