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Anatomy and taxonomic composition of the genus *Latisipho* Dall (Gastropoda: Buccinidae) from the Russian waters

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ABSTRACT. Based on the shell structure, anatomical and radular characters of seven species recorded from the Russian marine fauna and attributed to genera *Latisipho* and *Helicofusus*, *L. pharcidus* is reduced to the junior synonym of *L. hypolispus*, whereas *L. errones, L. jordani, L. georgianus*, and *H. luridus* – to the synonyms of *L. hallii*.

In 1916, Dall described subgenus *Latisipho* within the genus *Colus* Röding, 1799, with the type species *Chrysodomus (Sipho) hypolispus*. He noted that numerous species of *Latisipho* exist in the Bering Sea region, and are strongly contrasted with typical *Colus* by their buccinoid form and strongly recurved short canal [Dall, 1918]. In the list of shell-bearing mollusks of the Northwest coast of America, Dall [1921] attributed ten species to *Latisipho*: *Latispho hypolispus* (Dall, 1891), *L. hallii* (Dall, 1873), *L. jordani* (Dall, 1913), *L. errones* (Dall, 1919), *L. georgianus* (Dall, 1921), *L. pharcidus* (Dall, 1919), *L. aphelus* (Dall, 1890), *L. halibrectus* (Dall, 1919), *L. clementinus* (Dall, 1919), and *L. dalmasius* (Dall, 1919). Some authors [Turgeon et al., 1998] considered *L. hypolispus* as the junior synonym of *L. aphelus.* The photograph of the type specimen of *L. aphelus* given in Dall [1925] is too small, and unsatisfactory for making a conclusion about its similarity with *L. hypolispus*. That is why we prefer not to accept this synonymy until the examination of the type of *L. aphelus* is possible. *L. halibrectus* is usually included in *Colus* [Kantor, Sysoev, 2005]. *L. clementinus*, due to its small-sized, long-fusiform shell, is now attributed to *Retimohnia* [McLean, 1995]. *L. dalmasius* was not referred to in the literature since Dall's description [1919]. Based on the photograph of the type (by courtesy of USNM) we include it into the synonymy of *L. hallii* (see below). The rest six species, namely *Latispho hypolispus*, *L. pharcidus*, *L. hallii*, *L. jordani*, *L. errones*, and *L. georgianus,* were recorded in the recent most complete checklist of the Russian marine mollusks [Kantor, Sysoev, 2005]. The authors noted that the latter four species could probably be synonyms because of the similarity of the shell sculpture.

The purpose of this paper was to revise the taxonomic composition of the genus *Latisipho* from the Russian seas, based on anatomical and conchological characters of six mentioned species and the species, described within the other genus, but found being closer to *Latisipho, Helicofusus luridus* Golikov in Golikov et Scarlato [1985]. There is a number of works containing descriptions of shells and sometimes radulae of *Latisipho* [Golikov, Gulbin, 1977; Bouchet, Warén, 1985; Kosuge, 1991; Okutani, 2000], and the data on their ecology and distribution [Golikov, Sirenko, 1998; Golikov et al., 2001; Kantor, Sysoev, 2005]. Nevertheless, there are no data on the head-foot and mantle morphology, as well as the anatomy of digestive and reproductive systems.

The species of the genus appeared to be very variable both conchologically and anatomically, and after examination of a large number of specimens I came to the conclusion that there are only two valid species. The synonymy and descriptions of these two species, namely *L. hypolispus* and *L. hallii*, are given below. I found it useful to include morphological descriptions of specimens, selected as conchologically most similar to types of synonymized nominal species recorded from Russian fauna [Kantor, Sysoev, 2005].

Materials and methods

The preserved material was obtained from the Zoological Institute of Russian Academy of Sciences (RAS) – ZIN, Saint-Petersburg, Russia, P. P. Shirshov Institute of Oceanology of RAS – IO, Moscow, Russia, and the Zoological Museum of the Moscow State University – ZMMU, Moscow, Russia. Parts of proboscises were serially sectioned at 8 μm after embedding in paraplast, and stained with Masson triple stain. The radulae were removed by gross dissection, cleaned using diluted bleach (NaOCl), air-dried, coated with gold and examined with a Tescan Scanning Electron Microscope. Some radulae were embedded in glycerol and examined using light microscopy.

Terminology of the stomach morphology is given after Kantor [2003].

Abbreviations: **adg**, opening of anterior duct of digestive gland; **agl**, ampule of gland of Leiblein; **ao**, anterior aorta; **aoe**, anterior oesophagus; **ba**, buccal artery; **bc**, bursa copulatrix; **bh**, body haemocoel; **bm**, buccal mass; **cep.t**, cephalic tentacles; **cf**, circular fold of skin around seminal papilla; **cg**, capsular gland; **cm**, columellar muscle; **cm1**, outer layer of circular muscle fibers; **cm2**, inner layer of circular muscle fibers; **cnt,** connective tissue; **ct**, ctenidium; **cte**, transverse folds on the outer stomach wall; **dg**, digestive gland; **dgl**, duct of gland of Leiblein; **eye,** eye; **ep**, epithelium; **ft**, foot; **gl**, gland of Leiblein; **hd**, head; **int**, intestine; **kd**, kidney; **lm1**, outer layer of longitudinal muscle fibers; **lm2**, inner layer of longitudinal muscle fibers; **lti**, longitudinal folds on the inner stomach wall; **mo**, mouth opening; **mrr**, medial radular retractor muscle; **n**, nerves; **nd**, nephridial duct; **nr**, nerve ring; **odr**, odontophoral retractor muscles; **oeo**, oesophageal opening; **op**, operculum; **os**, osphradium; **ot**, oesophageal tensors; **oti**, oblique folds on the inner stomach wall; **p**, penis; **pdg**, opening of posterior duct of digestive gland; **pma**, posterior mixing area; **poe**, posterior oesophagus; **pr**, proboscis; **prp**, propodium; **prpg**, propodial groove; **prr,** proboscis retractors; **pw**, proboscis wall; **r**, radula; **rd,** rhynchodaeum; **re**, rectum; **s**, siphon; **sd**, salivary duct; **sg**, salivary gland; **so,** genital orifice; **sp**, seminal papilla; **st**, stomach; **vd**, vas deferens; **vl**, valve of Leiblein.

Abbreviations of the shell parameters in morphological descriptions: **AL**, aperture length, **H**, height of the shell, **h**, height of the last whorl.

Other abbreviations: USNM – National Museum of Natural History, Smithsonian Institution, Washington DC.

Results

Order Neogastropoda
Family Buccinidae Rafinesque, 1815
Subfamily Colinae Gray, 1857
Genus *Latisipho* Dall, 1916

Type species: *Chrysodomus (Sipho) hypolispus* Dall, 1891 (OD)

Latisipho hypolispus (Dall, 1891)
(Figs. 1, 2–6)

Chrysodomus (Sipho) hypolispus Dall, 1891: 188. – Dall, 1895: 708, pl. 27, fig. 1.
Colus (Latisipho) hypolispus. – Dall, 1916: 7. – Dall, 1921: 96.
Colus (Latifusus) pharcidus Dall, 1919: 314-315.
Colus hypolispus. – Abbot, 1974: 211, fig. 2330. – Tiba, Kosuge, 1981: 15.
Latisipho jordani. – Matsukuma *et al.*, 1991: 83, pl. LXXXI, fig. 8 (sensu auct., non Dall, 1913).
Plicifusus (Latisipho) hypolispus. – Okutani, 2000: 466, pl. 232, fig. 68.

Type locality of *Chrysodomus (Sipho) hypolispus*: Bering Sea, Alaska, between Bristol Bay and Pribiloff Islands, 56°50.00'N, 164°27.50'W, *Albatross* sta. 3254, 46 fms.

Type locality of *Colus (Latifusus) pharcidus*: Okhotsk Sea, Sakhalin Island, east of Aniva Cape, 46°44'N, 144°02'E, USBF sta. 5015, 510 fms.

Distribution: Okhotsk, Bering and Chukchi seas, Alaska; 40-930 m (Fig. 1).

Material examined anatomically: No. 1 – ZIN 52050/30, Bering Sea, "Pelamida" sta. 3, 65 m, coll. V. Goryachev, 30.08.1972; **No. 2, No. 7** – ZIN 58219/2, Bering Sea, 65°13.8'N 169°21.2'W, 45 m, coll. V. Koltun, B. Sirenko, 20.08.1988; **No. 4, No. 5** – ZIN 52050/41, 64°22.55'N 169°10.9'W, 38 m, 22.08.1988; **No. 3, No. 6** – IO, Bering Sea, Anadyr Bay, 63°59.9'N 177°38.6'W, 87 m, 12.10.1951; **No. 8** – ZMMU 18587, Bering Sea, Anadyr Bay, DT 35, 90 m, 22.06.1986.

Description.

Shell. More than 70 specimens were examined. The shell is large or medium-sized, from moderately thick and solid to thin and fragile; the shape changes from widely fusiform to oval. The shell is covered with dark-brown, brownish or light-olive smooth periostracum, tight-fitting to the shell. The siphonal canal is from strongly curved to the left to straight. The spiral sculpture is represented by irregular oblique spiral ridges, up to 10 on the penultimate whorl, separated by wide smooth interspaces without any spiral striation. Weak spiral ribs may be observed only near the siphonal canal. The axial sculpture is represented by incremental lines. The shell outline is very variable (Figs. 2, 3).

Morphology. Description of specimen No. 1 (Fig. 2 B), having the shell most similar to that of the type specimen of *L. hypolispus* (Fig. 2 A):

H 35 mm, h 25.5 mm, AL 18.5 mm.

External anatomy. The soft body consists of 3.5 whorls. The mantle occupies one whorl, the kidney – 0.2, the digestive gland and the gonad – 2.5 (Fig. 4 A-B). The head (Fig. 4 B, **hd**) is rather large, with the length slightly exceeding the width. Cephalic tentacles are very long and thick, bearing well-noticeable black eyes on small lobes at the base. The **foot** is folded transversally. The wide propodium (**prp**) is separated by the deep propodial groove (**prpg**). The operculum (**op**) is oval, with terminal nucleus.

The **mantle** length is twice the width (Fig. 4 C). The siphon (**s**) is moderately long, slightly protruding beyond the mantle edge. The ctenidium (**ct**) is long, occupying 5/6 of the length and 1/3 of the width of the mantle. The osphradium (**os**) is as wide

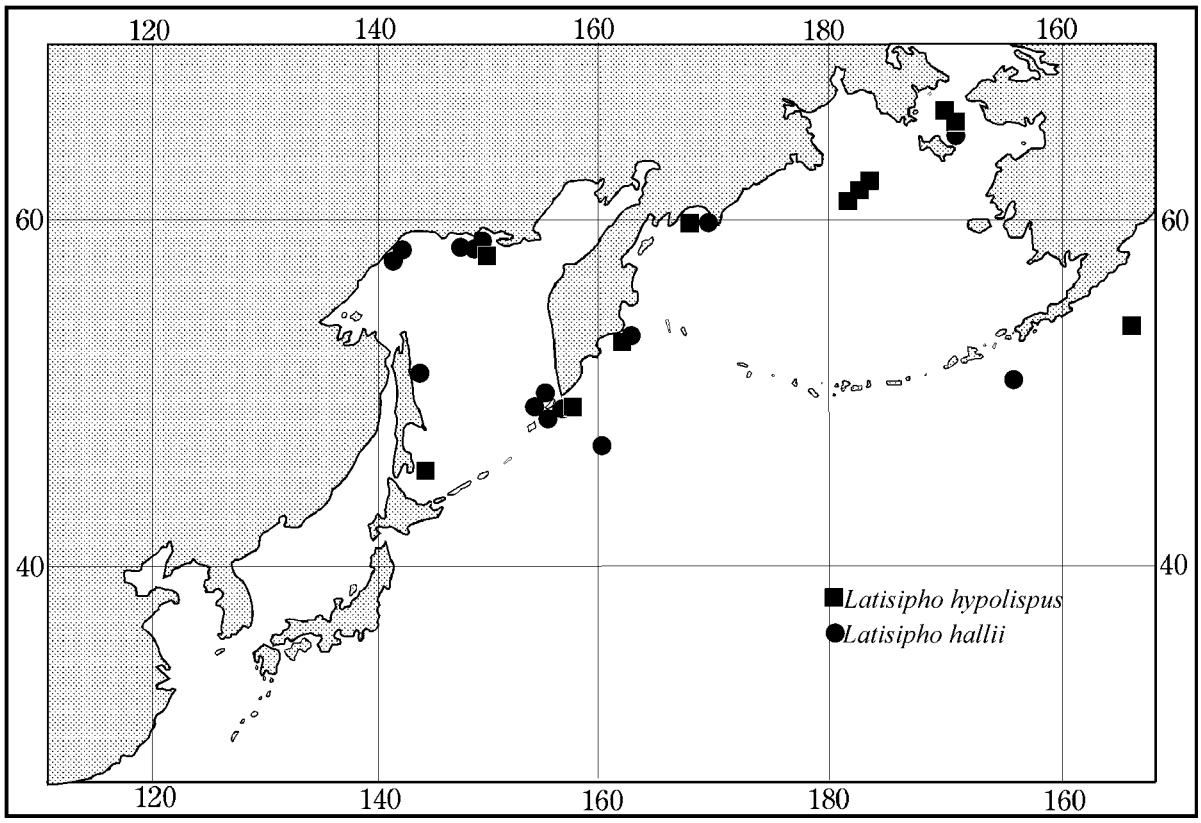

FIG. 1. Distribution of *L. hypolispus* and *L. hallii* in the North and North-western Pacific.

РИС. 1. Распространение *L. hypolispus* и *L. hallii* в северной и северо-западной части Тихого океана.

as the ctenidium, but twice shorter. Folds of the hypobranchial gland are not expressed. The rectum (**re**) opens approximately in the middle of the mantle length, the anal papilla is absent.

Reproductive system. The penis is flattened, contracted, bearing a cone-shaped seminal papilla with a small round opening on the top. The papilla is surrounded by a deep groove produced by a circular fold of skin.

The pallial oviduct was studied in the specimen No. 8 (Figs. 2 D, 4 G, Table 1). The pallial oviduct is strongly developed, occupying 2/3 of mantle length and 1/3 of its width. (Fig. 4 G, **cg**). It consists of two lobes with a slit-like canal between them. Bursa copulatrix is short and thick-walled, opened laterally. The female opening (**so)** is long and slit-like, surrounded by a thick bolster of glandular epithelium.

Digestive system. The proboscis is completely inverted into the rhynchodaeum (Fig. 4 D-E). Proboscis retractors (**prr**) originate at the level of posteriormost part of the radular sac, pass along the rhynchodaeum (**rd**) and split into several muscles, fastening onto the lateral walls of the body haemocoel. The buccal mass (**bm**) – cylindrical muscular bar – in dissected proboscis occupies its whole length. It is represented by two flexible cartilages (**crt**), fusing together in their anterior part, a circular muscular sheet binding the cartilages, and radular protractor and odontophoral retractor muscles (**odr**). The radula (**r**) in the radular sac is shorter than the odontophore (3/4 of its length), and lies in the middle of its dorsal side. Aside the base of the radular sac goes strong medial retractor of radula (**mrr**), with its other end joining the proboscis wall (**pw**) at the base of the proboscis.

The radula (Fig. 6 A) is 8.5 mm long and 360 μm wide, comprising 1.95% of AL, consisting of 101 transverse rows of teeth, 15 of which are forming and semi-translucent. The rachidian bears three cusps, with the median one being the longest. The laterals have three crescent-curved cusps on both sides, with the median one being the shortest.

Multiple retractors of odontophore and radula are attached to the proboscis wall at the base of the buccal mass. From outside proboscis is covered with high columnar epithelium (Fig. 5 H, **ep**). Under the basal membrane there is a thick layer of circular muscles (**cm1**), which is followed by a thicker layer of longitudinal fibers (**lm1**). Further there is the second layer of circular fibers (**cm2**), twice thinner

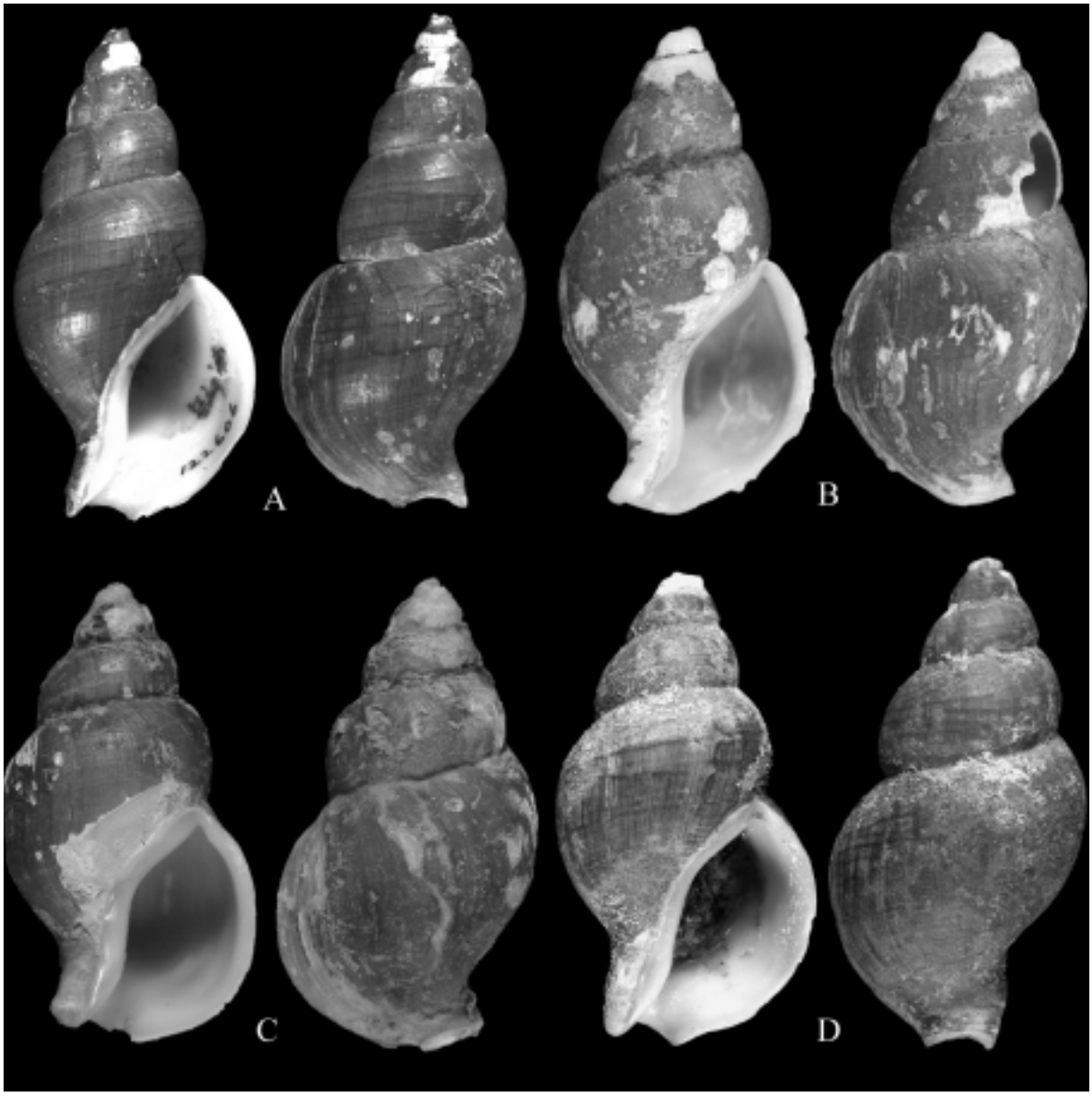

FIG. 2. *Latisipho hypolispus*. A – type specimen, by courtesy of USNM (lectotype, USNM 122606, H – 51 mm), B – specimen **No. 1**, H – 35 mm; C – specimen **No. 5**, H – 44.8 mm; D – specimen **No. 8**, H – 49 mm**.**

РИС. 2. *Latisipho hypolispus*. A – типовой экземпляр (лектотип, USNM 122606, H – 51 мм), B – экземпляр **№ 1**, H – 35 мм; C – экземпляр **№ 5**, H – 44,8 мм; D – экземпляр **№ 8**, H – 49 мм.

than the first one; the deepest is the thick layer of longitudinal muscles (**lm2**).

The anterior oesophagus (Fig. 4 F, **aoe**) is fixed inside the proboscis by multiple tensors (**ot**). It represents a wide flattened tube, passing along ventral side of the rhynchodaeum and then turning into the elongated pear-shaped valve of Leiblein (Fig. 4 D, **vl**). The massive and broad nerve ring (**nr**) is situated immediately posterior to the valve. The gland of Leiblein (**gl**) is small, lying under salivary glands in form of a horse-shoe. The duct of the gland (**dgl**) opens immediately posterior to the nerve ring. Large and long salivary glands (**sg**), accrete ventrally of the nerve ring. Strongly coiled salivary ducts (**sd**), pass along the anterior oesophagus, opening into the buccal cavity.

The **stomach** (Fig. 4 H-I) spans 0.2 of the whorl and is situated at an angle of 45° to the longitudinal axis of the whorl. The posterior oesophagus (**poe**) is very wide, tapering before entering the stomach ventrally. The posterior mixing area (**pma**) is not large, lined with transverse folds. The opening of

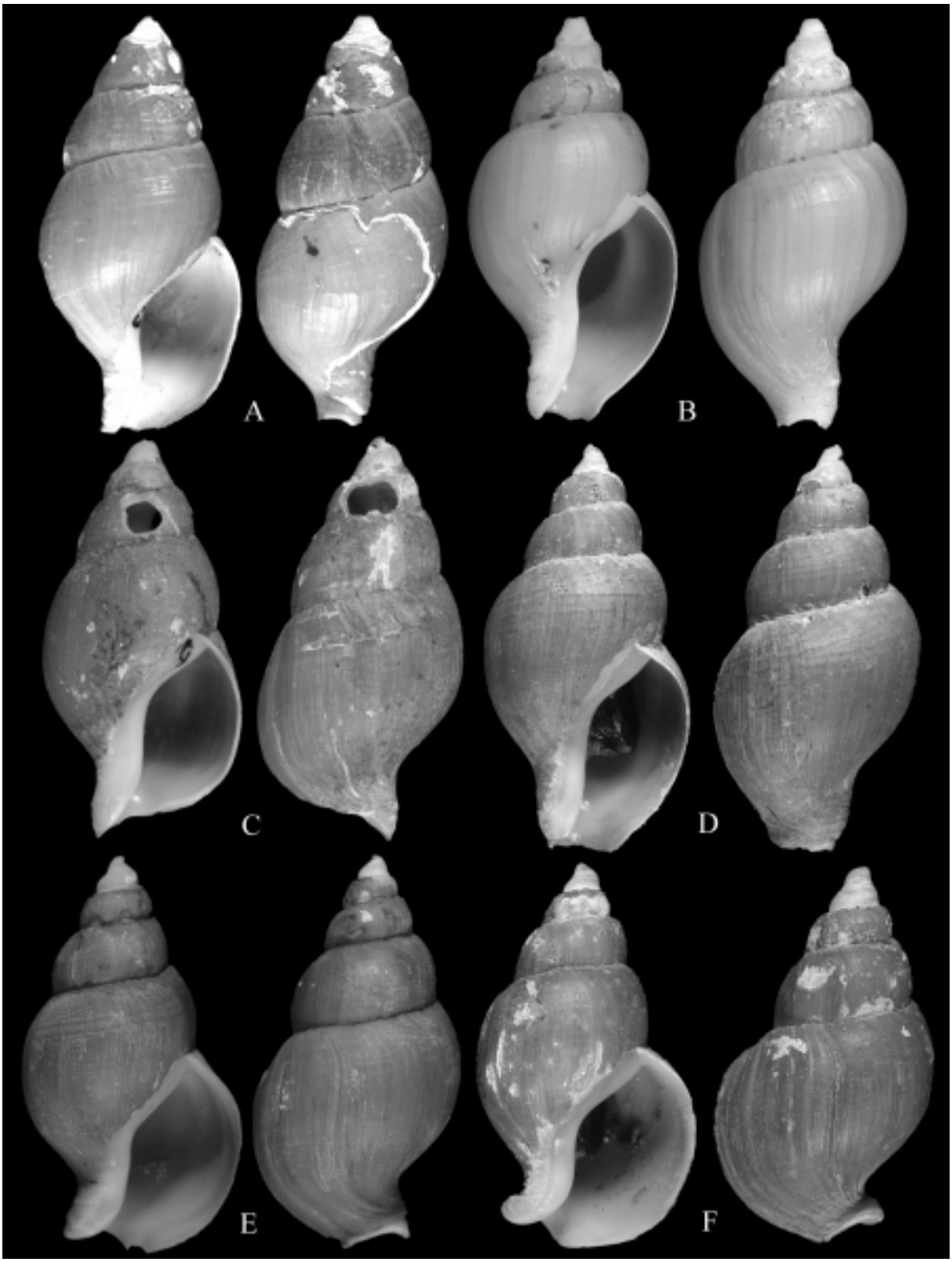

FIG. 3. *Latisipho hypolispus.* A – type specimen of *Latisipho pharcidus*, by courtesy of USNM (syntype, USNM 205243, H – 29 mm); B – specimen **No. 2**, H – 33 mm; C – specimen **No. 3**, H – 40.2 mm; D – ZMMU 18587, Bering Sea, Anadyr Bay, 90 m, H – 49 mm; E – specimen **No. 4**, H – 48.7 mm; F – specimen **No. 5**, H – 44.8 mm.

РИС. 3. *Latisipho hypolispus.* A – типовой экземпляр *Latisipho pharcidus* (синтип, USNM 205243, H – 29 мм), B – экземпляр **№ 2**, H – 33 мм; C – экземпляр **№ 3**, H – 40,2 мм; D – ЗМ МГУ 18587, Берингово море, Анадырский зал., 90 м, H – 49 мм; E – экземпляр **№ 4**, H – 48,7 мм; F – экземпляр **№ 5**, H – 44,8 мм.

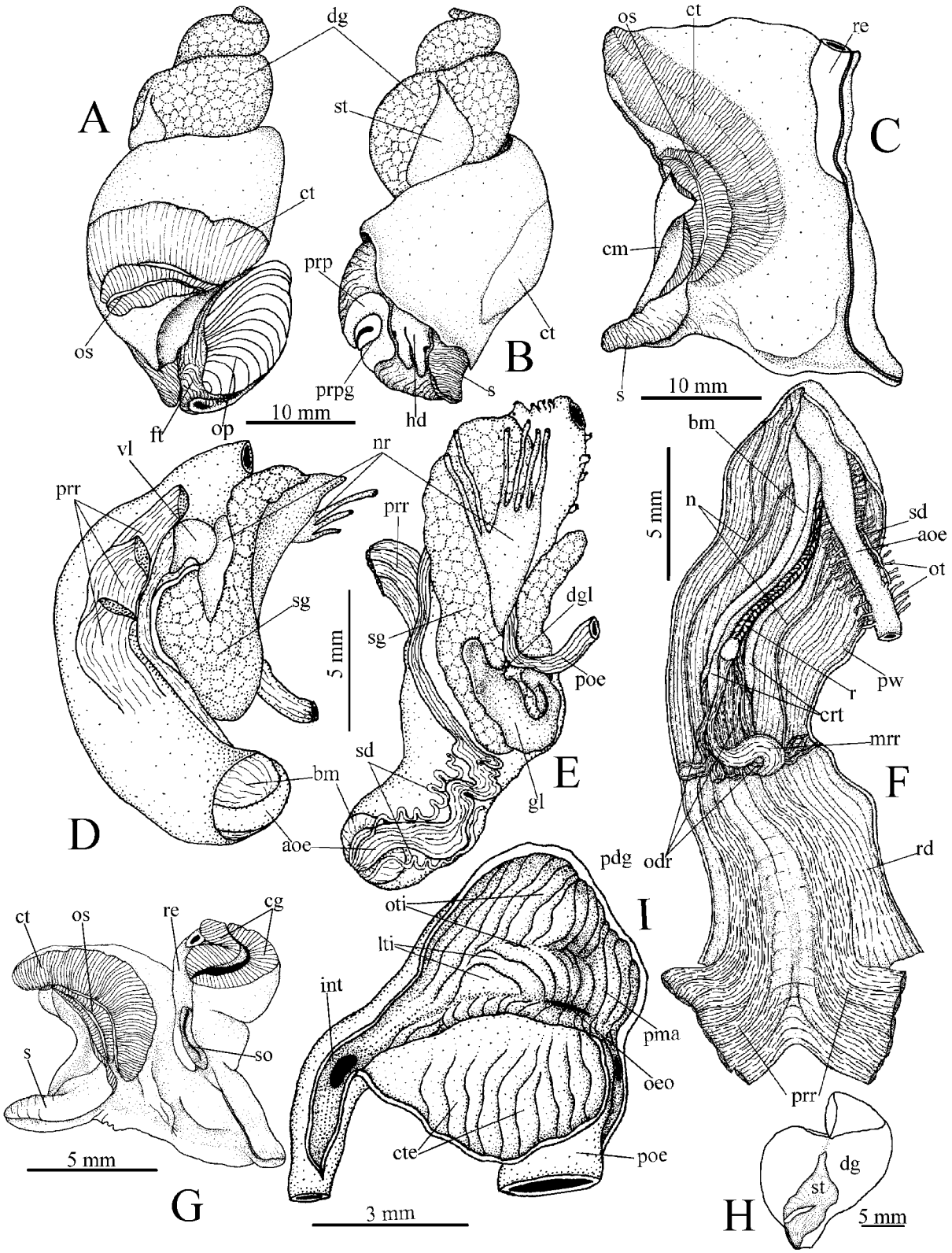

FIG. 4. Anatomy of *Latisipho hypolispus* **No. 1**. A–B – body, removed from the shell, C – mantle, D–E – organs of the body haemocoel (D – lateral view, E – ventral view), F – proboscis, opened dorsally, rhynchodaeum is turned aside, G – mantle of the female **No. 8**, H – stomach, general view, I – stomach, opened dorsally.

РИС. 4. Анатомия *Latisipho hypolispus* **№ 1**. A–B – мягкое тело, C – мантия, D–E – органы туловищного гемоцеля (D – латеральный вид, E – вентральный вид), F – хобот, вскрытый дорзально, G – мантия самки **№ 8**. H – желудок, общий вид, I – желудок, вскрытый дорзально.

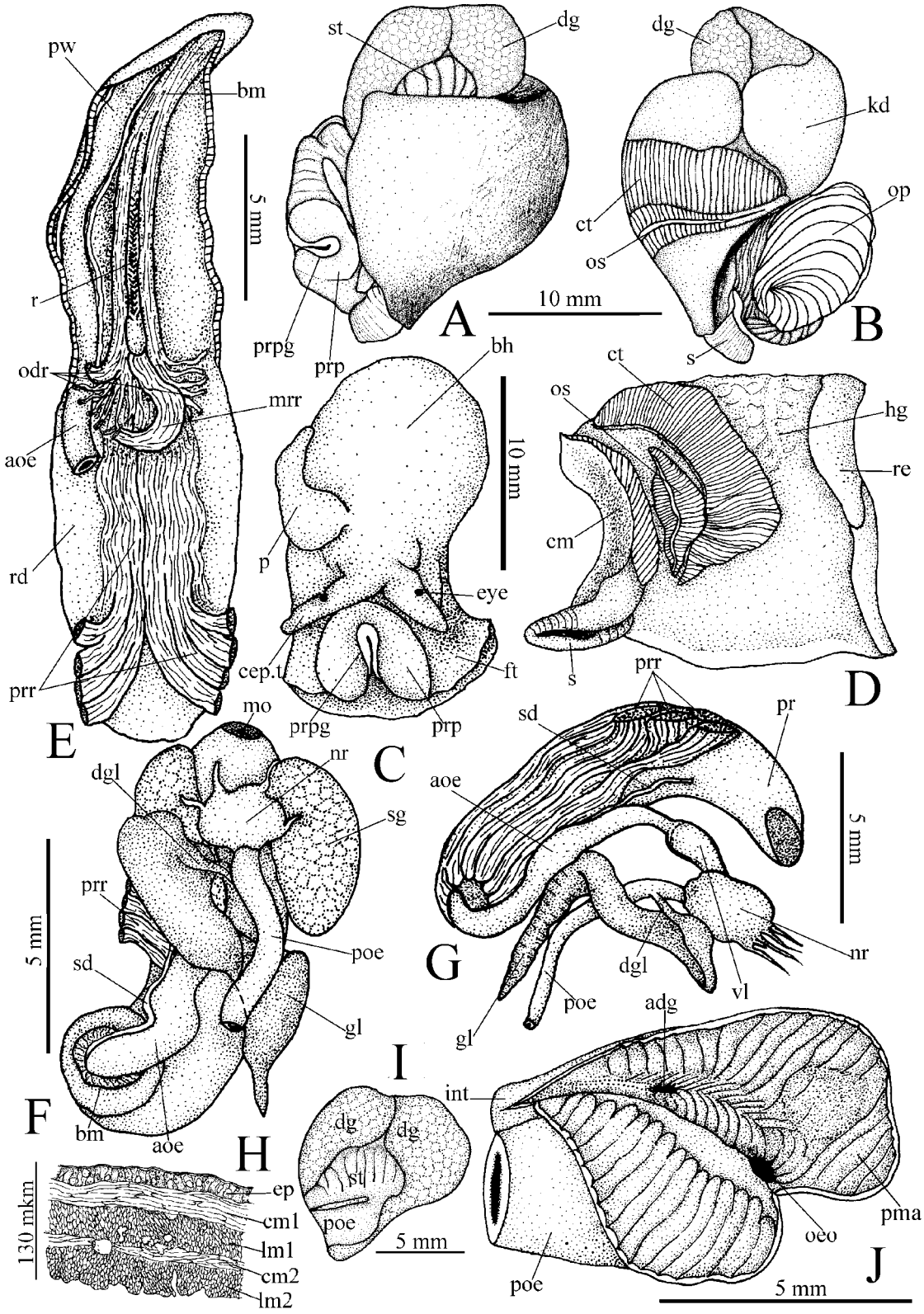

FIG. 5. Anatomy of *Latisipho hypolispus* **No. 2**. A–B – body, removed from the shell, C – head-foot from the front, mantle removed, D – mantle, E – proboscis, opened dorsally, F–G – organs of the body haemocoel (F – ventral view, G – lateral view), H – cross-section of the proboscis wall of **No. 1**, I – stomach, general view, J – stomach, opened dorsally.

РИС. 5. Анатомия *Latisipho hypolispus* **№ 2**. A–B – мягкое тело, C – цефалоподиум, вид спереди, мантия удалена, D – мантия, E – хобот, вскрытый дорзально, F–G – органы туловищного гемоцеля (F – вид с вентральной стороны, G – вид с латеральной стороны), H – поперечный срез стенки хобота экземпляра **№ 1**, I – желудок, общий вид, J – желудок, вскрытый дорзально.

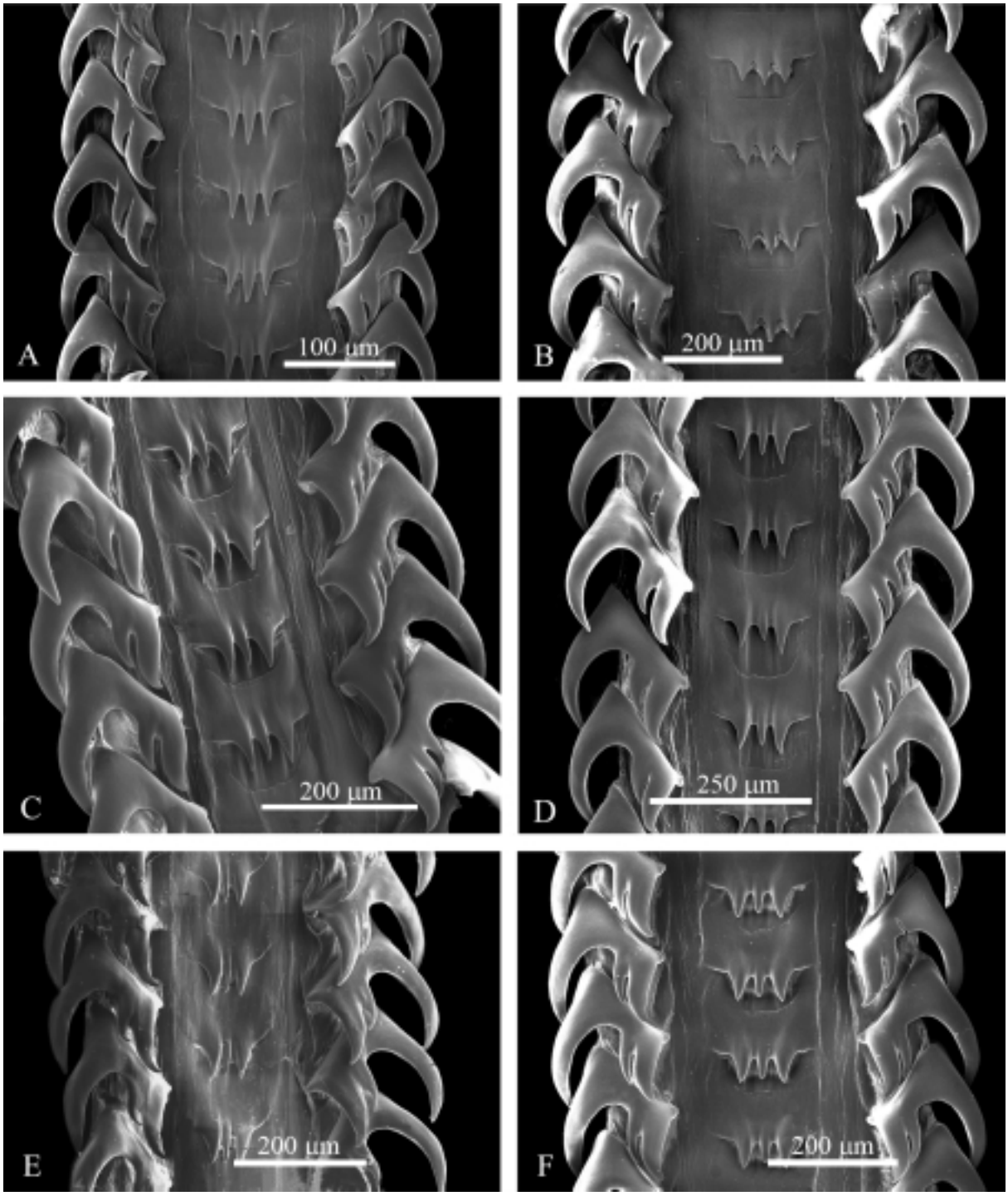

FIG. 6. Radulae of *Latisipho hypolispus*.A – **No. 1**, B – **No. 5**, C – D – **No. 3**, E – **No. 2**, F – **No. 4**.

РИС. 6. Радулы *Latisipho hypolispus*. A – **№ 1**, B – **№ 5**, C – D – **№ 3**, E – **№ 2**, F – **№ 4**.

the posterior duct of digestive gland (**pdg**) is rather small, situated at some distance above the oesophageal opening (**oeo**). The inner stomach wall is lined with divergent high oblique folds (**oti**), the lower of which are very large (**lti**). The small rounded opening of the anterior duct of the digestive gland (**adg**) is located close to the region where the intestine (**int**) is entering the stomach. The lateral sulcus is absent. The outer stomach wall is lined with large deep transversal folds (**cte**).

Specimen No. 2 (Fig. 3 B) has thin shell with straight siphonal canal and light-olive periostracum,

Table 1. Conchological and radular characters of investigated specimens of *L. hypolispus*

No	H/h/AL, mm	Periostracum color	Siphonal canal	Length of radula, mm	Width of radula, μm	Ratio of radular width to AL,%	No. of tooth rows (forming)	No. of tooth cusps	Median cusp of rachidian
1	35/25.5/18.5	dark-brown	curved	8.5	360	1.95	101(15)	3:3:3	the largest
2	33/25/17.7	light-beige	straight	10	600	3.39	85	3:3:3	the smallest
3	40.2/31.3/21.7	light-olive	straight	11	630	2.9	80(10)	3:3:4	the smallest
4	48.7/35.7/26.6	light-olive	curved	—	550	2.07	—	3:3:3	the smallest
5	44.8/33.6/23.6	dark-brown	curved	—	530	2.25	—	3:3:3	a bit larger
6	43.2/32.5/22.7	light-olive	straight	11.5	900	3.96	76(14)	3:3:3	the largest
7	34.5/25/18	light-beige	straight	—	650	3.61	—	3:3:3	the largest
8	49/37/27	dark-brown	weakly curved	—	1000	3.7	—	4:3:4	all cusps are equal

and conhologically is similar to the type specimen of *L. pharcidus* (Fig. 3 A). Its description is given below.

H 33 mm, h 25 mm, AL 17.7 mm; immature male:

External anatomy. Posterior coils of the body above the stomach were torn off during extraction from the shell. The remaining part consists of 1.5 whorls, the mantle occupies one whorl, the kidney – 0.2, and remaining parts are the digestive gland and the gonad (Fig. 5 A-B). The head (**hd**) is nearly square in form (the length without tentacles is equal to the width). The length of the thick contracted tentacles is twice that of the head. The eyes sit on the small lobes of the tentacles at the distance of one third of their length from the base. The foot (**ft**) is folded transversally. The wide propodium (**prp**) is separated by a deep propodial groove. The operculum (**op**) is leaf-shaped, with terminal nucleus dislodged to the left.

The **mantle** length, unlike the previous specimen, is equal to its width (Fig. 5 D). The siphon (**s**) is moderately long, protruding beyond the incrassate mantle edge. The ctenidium (**ct**) is long, crescent-curved, occupying 3/4 of mantle length. The osphradium (**os**) is 2/3 of ctenidium length. Folds of the hypobranchial gland (**hg**) are weakly expressed. The rectum (**re**) opens in the middle of the mantle length, the anal papilla is absent.

Reproductive system. The penis (Fig. 5 C, **p**) is small, structured in the same way as in the previous specimen.

Digestive system. The proboscis is completely inverted into the rhynchodaeum (Fig. 5 F-G, **pr**). Proboscis retractors (**prr**) originate at the proboscis base as a wide ventral band, pass along the rhynchodaeum, and then split into several muscles, fastening onto the lateral walls of the body haemocoel. The buccal mass (Fig. 5 E, **bm**) occupies the whole proboscis length. The radula (**r**) is 10 mm long and 600 μm wide, bearing 85 transverse rows of teeth, and comprising 3.39% of AL (Fig. 6 E). The rachidian is tricuspidate, with the median cusp being much smaller and narrower than the others. The laterals are tricuspidate, with median cusp the shortest. Multiple retractors of odontophore (**odr**) and radula are attached to the proboscis wall at the base of the buccal mass. The composition of the proboscis wall is similar to that of above described specimen (Fig. 5 H).

The anterior oesophagus, valve of Leiblein and the nerve ring are similar to those already described. The gland of Leiblein (**gl**) is large, with the long tapering duct (**dgl**) which opens slightly posterior to the nerve ring. Salivary glands (**sg**) are medium-sized, beanlike, separate. Slightly coiled salivary ducts (**sd**) open into the buccal cavity.

The **stomach** occupies 0.25 of the whorl and runs along longitudinal axis of the whorl (Fig. 5 I). The posterior oesophagus and stomach are filled with mud, and the internal structure (Fig. 5 J) is poorly recognizable. The posterior oesophagus is very wide, tapering before entering the stomach ventrally. The posterior mixing area (**pma**) is not large, lined with transverse folds. The opening of the anterior duct of digestive gland (**adg**) is rather large, situated ventrally not far from the beginning of the intestine (**int**). The posterior opening was not found because of the poor preservation of stomach tissues. The inner stomach wall is lined with divergent oblique folds. The intestine in the region of its falling into the stomach is lined with transverse folds. The lateral sulcus is absent. The outer stomach wall is lined with large high transverse folds.

Remarks. Radulae and morphology of the other six specimens were examined to reveal the range of intraspecific variability. The external anatomy differs in the degree of contraction of foot, tentacles and mantle, while the anatomy of the foregut is rather uniform and similar to that already described in specimens 1 and 2, except for radulae, which are very variable in different specimens. The data on conchological and radular characters (Figs. 2, 3, 6) are summarized in Table 1.

Latisipho hallii (Dall, 1873)

(Figs. 1, 7–17)

Sipho hallii Dall, 1873: 59, pl. 2, fig. 3.
Tritonofusus hallii. – Dall, 1902: 525, pl. 36, fig. 9.
Latisipho nallii. – Dall, 1921: 96, pl. 8, fig. 7 (misspelling of *L. hallii*).
Colus hallii. – Abbot, 1974: 211 fig. 2332. – Tiba, Kosuge, 1981: 11.
Colus (Latisipho) hallii. – Okutani, 2000: 464, pl. 232, fig. 59.
Tritonofusus jordani Dall, 1913: 588.
Colus (Latisipho) jordani. – Dall, 1921: 96.
Colus jordani. – Abbot, 1974: 211, fig. 2333.
Colus (*Latisipho*) *errones* Dall, 1919: 321. – Dall, 1925: 12, pl. 3, fig. 6.
Latisipho errones. – Golikov, Gulbin, 1977: 184.
Colus errones. – Tiba, Kosuge, 1981: 5.
Aulacofusus (Limatofusus) georgianus Dall, 1921: 95, pl. 8, fig. 3.
Colus georgianus. – Abbot, 1974: 211, fig. 2318. – Tiba, Kosuge, 1981: 9.
Aulacofusus georgianus. – Golikov, Gulbin, 1977: 182.
Colus (Aulacofusus) georgianus. – Golikov, Sirenko, 1998: 114, pl. 8, fig. F.
Latisipho georgianus. – Kantor, Sysoev, 2005: 132.
Helicofusus luridus Golikov in Golikov et Scarlato, 1985: 406, fig. 7.

Possible synonym:
Colus (Latisipho) dalmasius Dall, 1919: 322. – Dall, 1925: 12, pl. 1, fig. 9.

Type locality of *Sipho hallii*: Sanborn Harbor, Nagai, Alaska.

Type locality of *Tritonofusus jordani*: Puget Sound, Washington (for lectotype).

Type locality of *Colus* (*Latisipho*) *errones*: Bering Sea.

Type locality of *Aulacofusus (Limatofusus) georgianus*: Gulf of Georgia, 60-200 fms.

Type locality of *Helicofusus luridus*: Terpenija Bay, Sakhalin Island, 48°48.7'N, 143°55.3'E, 53 m.

Type locality of *Colus (Latisipho) dalmasius*: off the coast of British Columbia, 238 fms.

Distribution: Kurile Islands, Okhotsk Sea, Bering Sea, Alaska to northern California; 2-1112 m (Fig. 1).

Material examined anatomically: **No. 1, No. 2** – ZIN 28389/2, Paramushir Island, 50°07'N, 156°37'E, 552 m, 26.06.1988; **No. 3** – ZIN 28420/4, Kamchatka, off Lopatka Cape, 68 m, 31.07.1954; **No. 4** – ZIN 55992/3, Okhotsk Sea, 51°36'N, 156°09'E, 112 m, 24.06.1988; **No. 5** – ZMMU 18587, Bering Sea, Anadyr Bay, DT 35, 90 m, 22.06.1986; **No. 6** – ZIN 52050/41, Bering Sea, 64°22.55'N, 169°10.9'W, 38 m, 22.08.1988; **No. 7** – IO, Bering Sea, Anadyr Bay, 63°59.9'N, 177°38.6'W, 87 m, 12.10.1951; **No. 8, No. 9** – ZMMU 18186, Okhotsk Sea, 58°41'N, 150°00'E, 110 m, 28.08.1985; **No. 10** – IO, 53°25.3'N, 160°59.6'E, 58 m, 1952; **No. 11** – ZMMU 18214, Okhotsk Sea, 58°41'N, 150°E, 28.08.1985; **No. 12** – Sakhalin Island, 51°15'N, 143°51'E, 80 m, 18.10.04, coll. I.P. Smirnov; **No. 13** – ZMMU, Sakhalin Bay, 59°57.5'N 141°01.0'E, 95 m; **No. 14** – ZIN ?/3 58°57'N, 148°44'E, 28.06.1915; **No. 15** – IO, "Vityaz" 10th cruise, Kamchatka, 54°35'N, 162°02'E, 445 m, 22.05.1952; **No. 16** – IO, Okhotsk Sea, "Vityaz" 2d cruise, 59°10.0'N, 148°31.0'E, 71 m, 04.09.1949.

Description.

Shell. More than 50 specimens were examined. The shell is large or medium-sized, with slightly or strongly convex whorls, moderately thick and solid, or thin and fragile. The periostracum is dark-brown, olive, greenish-grey, or yellowish-olive, smooth, tight-fitting to the shell. The siphonal canal is usually straight, but sometimes slightly deflected to the left. The spiral sculpture is represented by multiple spiral ribs separated by interspaces usually narrower, or sometimes wider than the ribs. The spiral striation is uniform throughout the shell; on the penultimate whorl there are 20 to 30 ribs. The axial sculpture is represented by incremental lines (Figs. 7-8,).

Morphology. Several specimens with different shells similar to the type specimens of *L. hallii*, *L. jordani*, *L. georgianus, L. errones*, and *Helicofusus luridus* (see Table 2) were studied.

Description of specimens with shells most similar to those of the type specimens of *L. hallii* (Fig. 7 A) and *L. errones* (Fig. 8 A) is given below.

No. 1. H 35.3 mm, h 26 mm, AL 18.8 mm, mature female (Fig. 8 C); No. 2. H 34.3 mm, h 27.4 mm, AL 20 mm, mature female:

External anatomy. Posterior coils of the body above the stomach were torn off during extraction from the shell (Fig. 10 A). The remaining part consists of 1.5 whorls; the mantle occupies one whorl, the kidney (**kd**) – 0.3, the digestive gland and the gonad – the remainder. The head (Fig. 10 B, **hd**) is large, with long, half-contracted tentacles, pressed to each other. The eyes are black and small, sitting on minor lobes of the first third of cephalic tentacles. The propodium (**prp**) of the contracted foot (**ft**) is narrow, separated by a deep propodial groove (**prpg**). The operculum (**op**) is leaf-like, with terminal nucleus dislodged to the left.

The **mantle** is a bit longer than wide (Fig. 10 C). The siphon (**s**) is long and muscular. The ctenidium (**ct**) occupies 7/8 of the mantle length and 1/4 of its width. The osphradium (**os**) is twice shorter and a bit narrower than the ctenidium. The hypobranchial gland (**hg**) consists of a number of large deep glandular folds situated in the posterior right quadrant of the mantle. The rectum (**re**) has the form of a thin tube, half-covered by the capsular gland (**cg**), opening in the middle of the mantle length. The anal papilla is absent.

Reproductive system (Fig. 10 C). The capsular gland is thick, well-developed, consisting of two lobes separated by a slit-like canal. Bursa copulatrix (**bc**) has thin epithelial walls, which make the connection between the thick glandular lobes and long and narrow female orifice. The female genital opening (**so**) is surrounded by a thick bolster.

Digestive system. The proboscis is completely

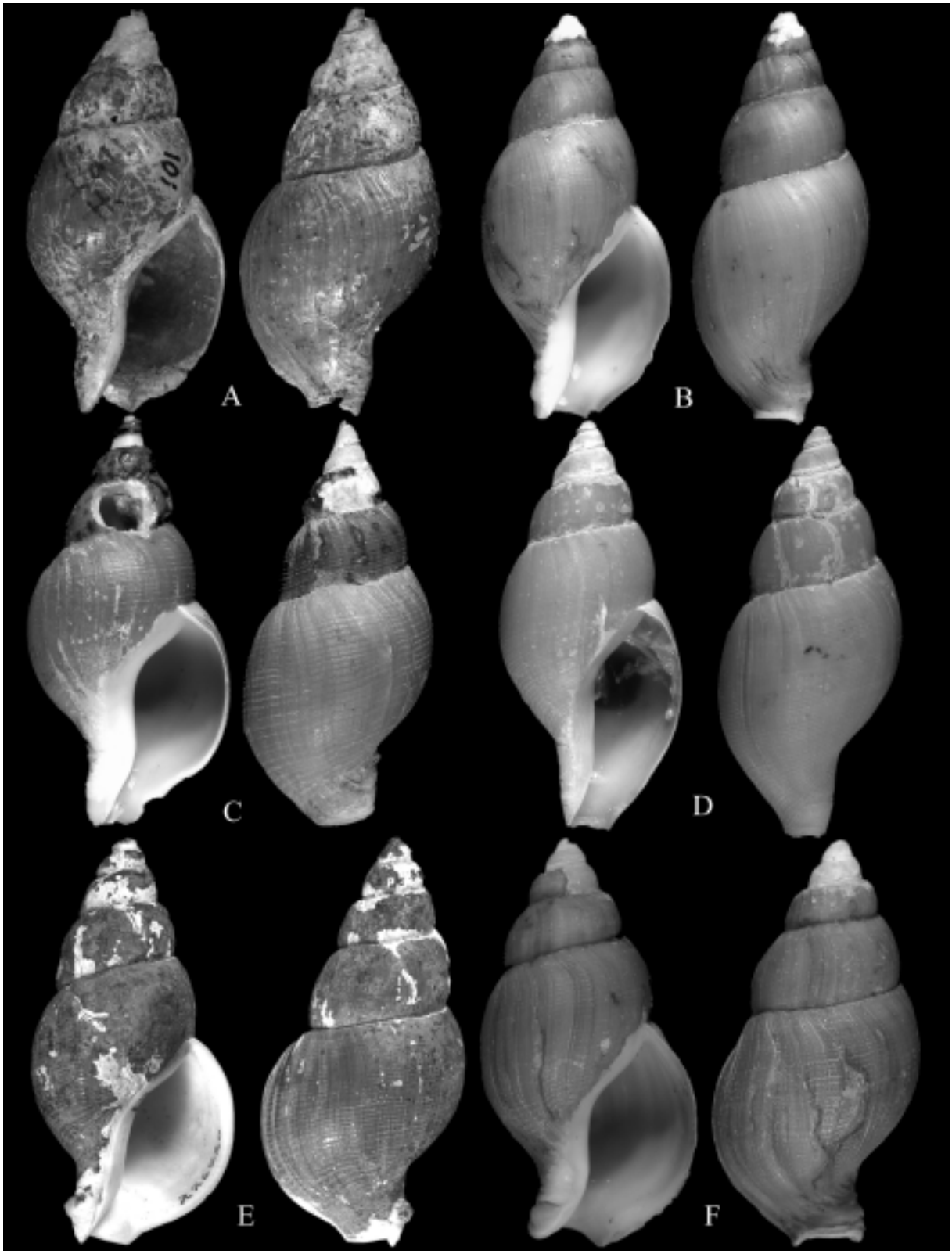

FIG. 7. *Latisipho hallii*. A – type specimen of *Latisipho hallii*, by courtesy of USNM (lectotype, USNM 108981, H – 40 mm); B – specimen **No. 5**, H – 42.2 mm; C – specimen **No. 4**, H – 37.4 mm; D – specimen **No. 7**, H – 40.4 mm; E – type specimen of *Latisipho jordani*, by courtesy of USNM (lectotype, USNM 226420, H – 41 mm); F – specimen **No 6**, H – 43.2 mm.

РИС. 7. *Latisipho hallii*. A – типовой экземпляр *Latisipho hallii* (лектотип, USNM 108981, H – 40 мм), B – экземпляр **№ 5**, H – 42,2 мм; C – экземпляр **№ 4**, H – 37,4 мм; D – экземпляр **№ 7**, H – 40,4 мм; E – типовой экземпляр *Latisipho jordani* (лектотип, USNM 226420, H – 41 мм); F – экземпляр **№ 6**, H – 43,2 мм.

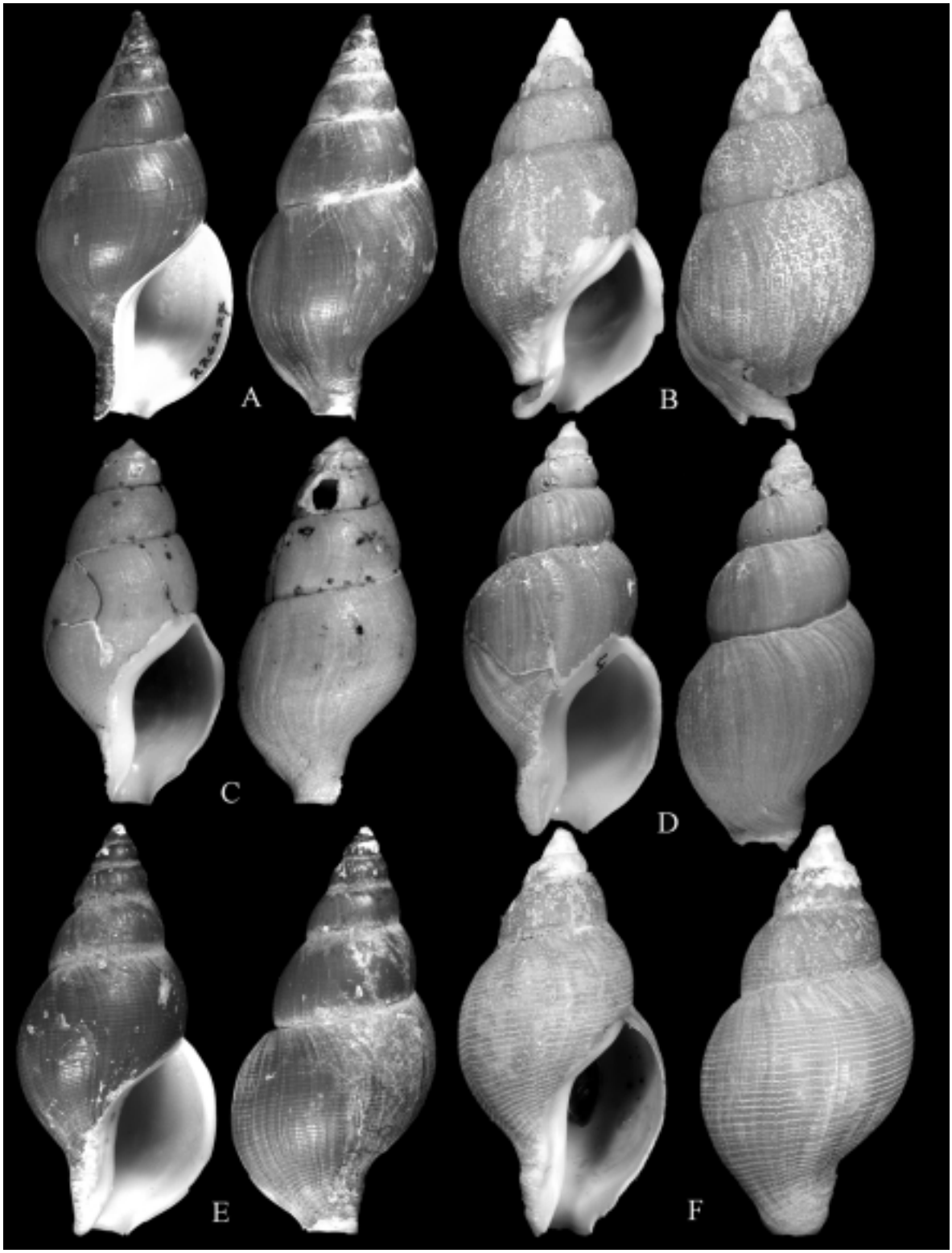

FIG. 8. *Latisipho hallii.* A – type specimen of *Latisipho errones*, by courtesy of USNM (holotype, USNM 226227, H – 46 mm); B – specimen **No. 3**, H – 52 mm; C – specimen **No. 1**, H – 35.3 mm; D – specimen **No. 10**, H – 47.1 mm. E – type specimen of *Latisipho georgianus*, by courtesy of USNM (holotype, USNM 122633, H – 48 mm); F – ZIN 28389/1, Northern Kurile Islands, 84 m, H – 48.4 mm.

РИС. 8. *Latisipho hallii.* A – типовой экземпляр *Latisipho errones* (голотип, USNM 226227, H – 46 мм); B – экземпляр **№ 3**, H – 52 мм; C – экземпляр **№ 1**, H – 35,3 мм; D – экземпляр **№ 10**, H – 47,1 мм. E – типовой экземпляр *Latisipho georgianus* (голотип, USNM 122633, H – 48 мм); F – ЗИН 28389/1, Северные Курильские о-ва, 84 м, H – 48,4 мм.

nverted into the rhynchodaeum (Fig. 10 E-F). Proboscis retractors (**prr**) originate at the level of posteriormost part of the radular sac, pass along the rhynchodaeum **(rd**) and split into several muscles, fastening onto the lateral walls of the body haemocoel. The buccal mass (**bm**) occupies 2/3 of the proboscis length. The radula (**r**) in the radular sac is of the same length as odontophore, and lies in the middle of its dorsal side. It is 9.8 mm long and 350 μm wide, consisting of 65 rows of teeth, comprising 1.86% of the aperture length (Fig. 11 E-F). The rachidian is tricuspid, with a bit longer median cusp. The laterals are less curved than in *L. hypolispus*, tricuspid, with the median cusp situated very close to the inner cusp, and having almost the same length. In general the radula looks more tuff and rude. Aside the base of the radular sac goes a strong medial retractor of radula (**mrr**), with its other end joining the fibers of one of proboscis retractors. Multiple retractors of odontophore (**odr**) and radula attach to the proboscis wall at the base of the buccal mass (Fig. 10 D). The proboscis wall from its inner side looks longitudinally striated by the muscle fibers.

Anterior oesophagus is a wide flattened tube (Fig. 10 D, **aoe**), passing along the ventral side of the rhynchodaeum till the beginning of the proboscis, and then turning into the medium-sized pear-shaped valve of Leiblein (Fig. 10 E, **vl**). The massive nerve ring (**nr**) is well-developed, situated immediately posterior to the valve. The gland of Leiblein (**gl**) is a long narrow brownish strip of glandular tissue. In the upper part it gradually tapers, turning into the duct of the gland (**dgl**), entering the posterior oesophagus at some distance posterior to the valve. The posterior part is also tapered. Oval, medium-sized, separate salivary glands (**sg**) are located on both sides of the nerve ring. Salivary ducts (**sd**) are thin and strongly coiled, running on both sides of the anterior oesophagus. The posterior oesophagus (**poe**) is a bit narrower than the anterior one. The large anterior aorta (**ao**) also comes out of the nerve ring; it has spongy walls impregnated with white spots of unknown origin.

The **stomach** (spm. No. 2) occupies 0.33 of the whorl (Fig. 10 G, H). The posterior oesophagus falls ventrally into the stomach. The posterior mixing area (**pma**) is not large, lined with high transverse folds. The opening of the anterior duct of digestive gland (**adg**) is rounded, situated approximately in the middle of the inner stomach wall. The opening of the posterior duct was not found. Three longitudinal folds on the inner wall (**lti**) run from the anterior opening towards the opening of the oesophagus (**oeo**); the remaining part of the stomach is lined with transverse folds, gradually decreasing towards the intestine. The outer wall is lined posteriorly with high and anteriorly – with low transverse folds.

Specimen No. 3 conhologically is similar to the type specimen of *L. errones* (Fig. 8 A);

H 52 mm, h 37 mm, AL 27 mm (Fig. 8 B), mature female:

External anatomy (Fig. 12 A – B) is similar to that of the previous specimens**.** Pale-yellowish body lacks pigmentation.

The **mantle** length is equal to its width (Fig. 12 C); organs of the mantle cavity have the same proportions as in the previous specimens. Folds of the hypobranchial gland are not expressed.

Reproductive system (Fig. 12 C). The pallial oviduct is strongly developed, occupying 2/3 of ctenidium length and 1/3 of its width (Fig. 12 C, **cg**). It consists of two lobes with a slit-like canal between them. The lobes abruptly terminate and turn into the curved thin-walled bursa copulatrix (**bcp**). The latter ends by the female opening (**so**), which is long and slit-like, with longitudinal folds seen on the inner side. The opening is surrounded by a thick bolster of glandular epithelium.

Digestive system. Organs of body haemocoel are compactly packed in a similar way as in the previous specimens (Fig. 12 E). The radula (**r**) is strong, containing the remnants of food in its very anterior part, 12.5 mm long and 430 μm wide, consisting of 88 rows of teeth (15 – forming), comprising 1.59% of AL (Fig. 11 A-B). The histological composition of the proboscis wall is the same as in *L. hypolispus* (Fig. 12 F). From the outside there are remnants of the covering columnar epithelium (**ep**). Under the epithelium there is a thick layer of circular muscles (**cm1**), which is followed by a layer of longitudinal fibers (**lm1**). The next is a very thin layer of circular fibers (**cm2**). The deepest is the thickest layer of longitudinal muscles (**lm2**); it looks heterogeneous, because muscle fibers in its upper and lower parts are oriented a bit differently.

The valve of Leiblein (**vl**) is thick and short. After passing through the nerve ring the anterior oesophagus strongly flattens. The gland of Leiblein (**gl**) is large, not tapered (obviously ragged in its posterior part), opening by a long broad duct (**dgl**) at a small distance posterior to the nerve ring. The anterior aorta (**ao**) comes out of the nerve ring and consists of whitish connective tissue, impregnated with white spots. Salivary glands (**sg**) are not large, beanlike, separate, situated on both sides of the anterior part of the proboscis.

The **stomach** occupies 0.33 of the whorl, being situated at an angle of 30° to the longitudinal axis of the whorl (Fig. 12 G, H). The posterior oesophagus is very wide, strongly narrowing prior to entering the stomach ventrally. The posterior mixing area (**pma**) is small, lined with poorly expressed transverse folds. The posterior opening of the duct of digestive gland (**pdg**) is rather large, situated above the oesophageal opening (**oeo**). The upper part of

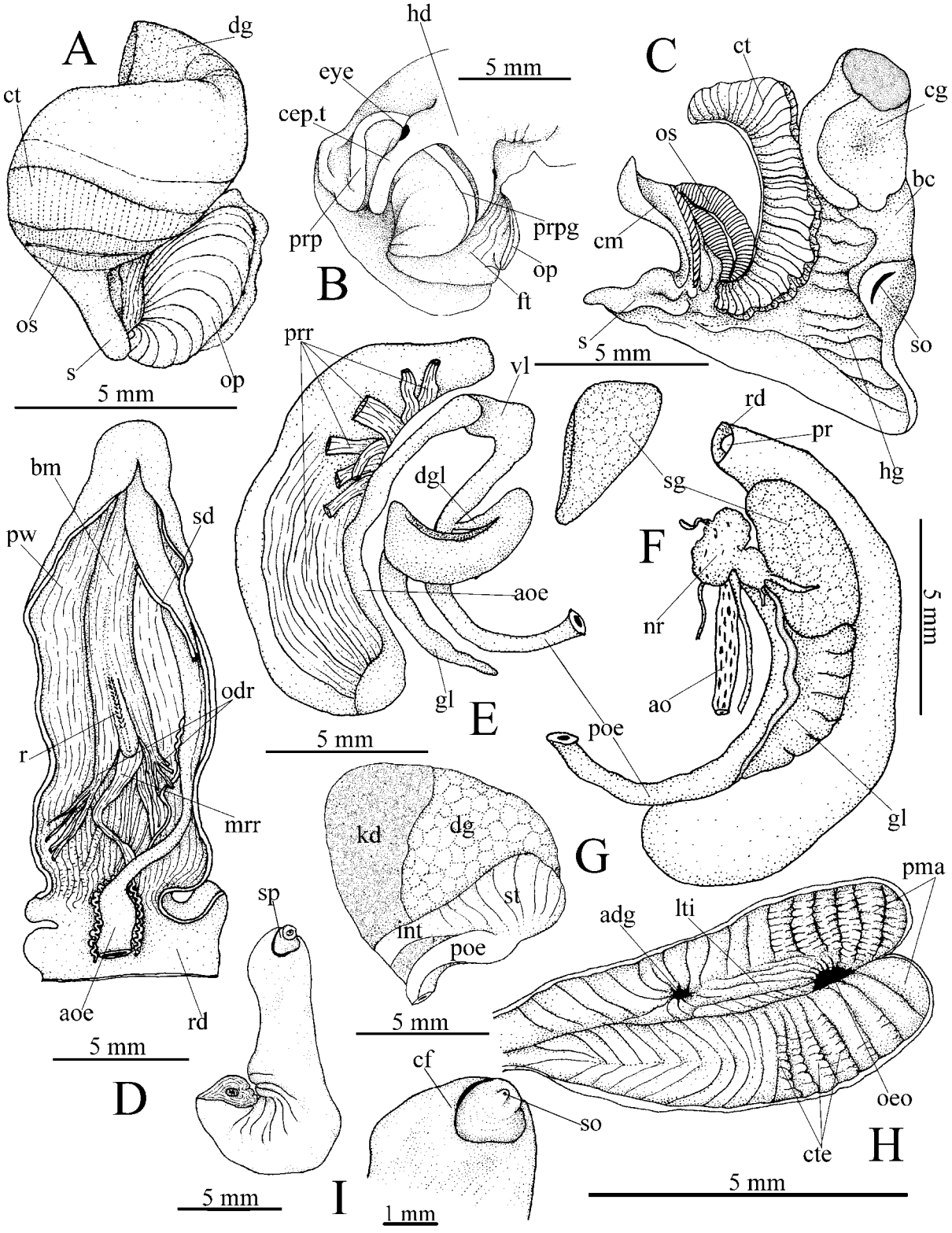

FIG. 9. Anatomy of *Latisipho hallii* **No. 1, 2**. A – body, removed from the shell, B – head-foot, dorsal view, C – mantle, D – proboscis, opened dorsally, E–F – organs of the body haemocoel (E – from the right, F – from the left), G – stomach, general view, H – stomach, opened dorsally, I – penis of the male **No. 5**, ventral view.

РИС. 9. Анатомия *Latisipho hallii* **№ 1, 2**. A – мягкое тело, B – цефалоподиум, вид с дорзальной стороны, C – мантия. D – хобот, вскрытый дорзально, E–F – органы туловищного гемоцеля (E – вид справа, F – вид слева), G – желудок, общий вид, H – желудок, вскрытый дорзально, I – вентральный вид пениса самца **№ 5**, вид с вентральной стороны.

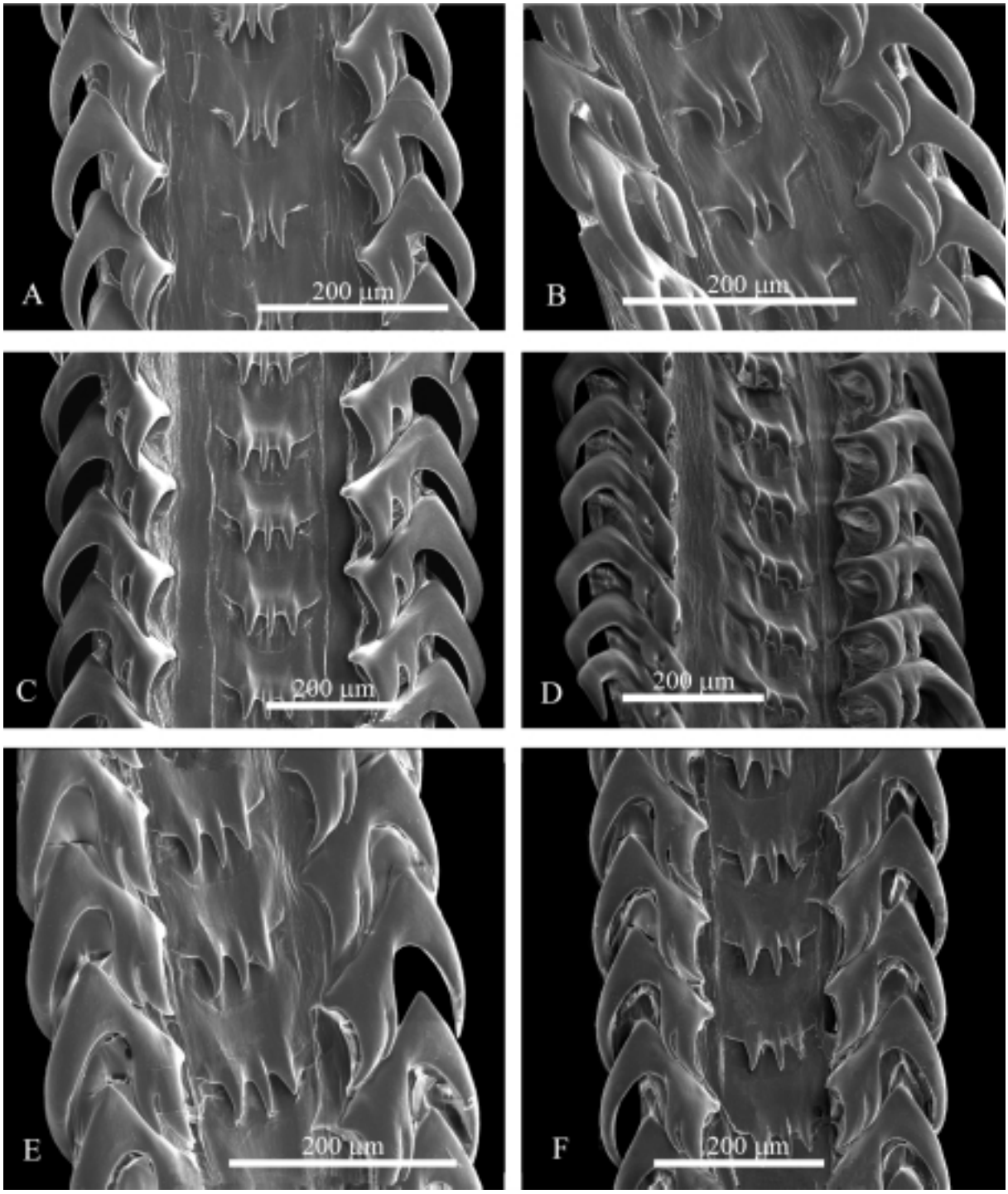

FIG. 10. Radulae of *Latisipho hallii*. A–B – **No. 3**, C–D – **No. 10**, E–F – **No. 1**.

РИС.10. Радулы *Latisipho hallii*. A–B – **№ 3**, C–D – **№ 10**, E–F – **№ 1**.

the inner stomach wall is lined with not high transverse folds, the lower – with minute oblique folds (**oti**). The large opening of the anterior duct of digestive gland (**adg**) is situated near the ventral channel, not far from the beginning of the intestine. The outer stomach wall is lined with multiple high transverse folds (**cte**).

Specimen No. 4 is conchologically similar to the type specimens of *L. georgianus* (Fig. 8 E) and *L. jordani* (Fig. 7 E); H 37.4 mm, h 27.5 mm, AL 20 mm (Fig. 7 C); immature female:

External anatomy. Posterior coils of the body above the stomach were torn off during extraction from the shell. The remaining part consists of 1.5

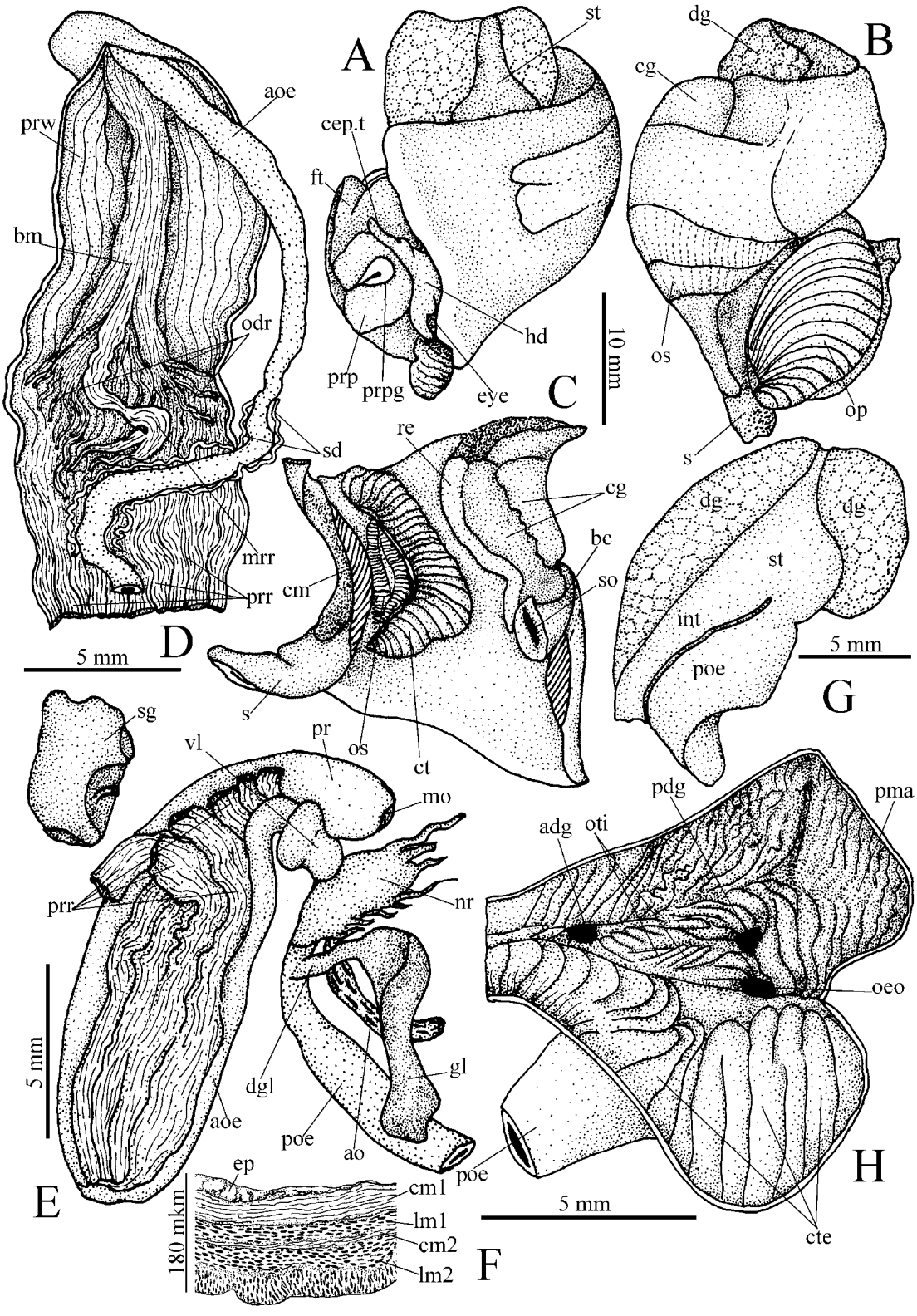

FIG. 11. Anatomy of *Latisipho hallii* **No. 3**. A–B – body, removed from the shell, C – mantle, D – proboscis, opened dorsally, E – organs of the body haemocoel, lateral view, F – cross-section of the proboscis wall, G – stomach, general view, H – stomach, opened dorsally.

РИС. 11. Анатомия *Latisipho hallii* **№ 3**. A–B – мягкое тело, C – мантия, D – хобот, вскрытый дорзально, E – органы туловищного гемоцеля, латеральный вид, F – поперечный срез стенки хобота, G – желудок, общий вид, H – желудок, вскрытый дорзально.

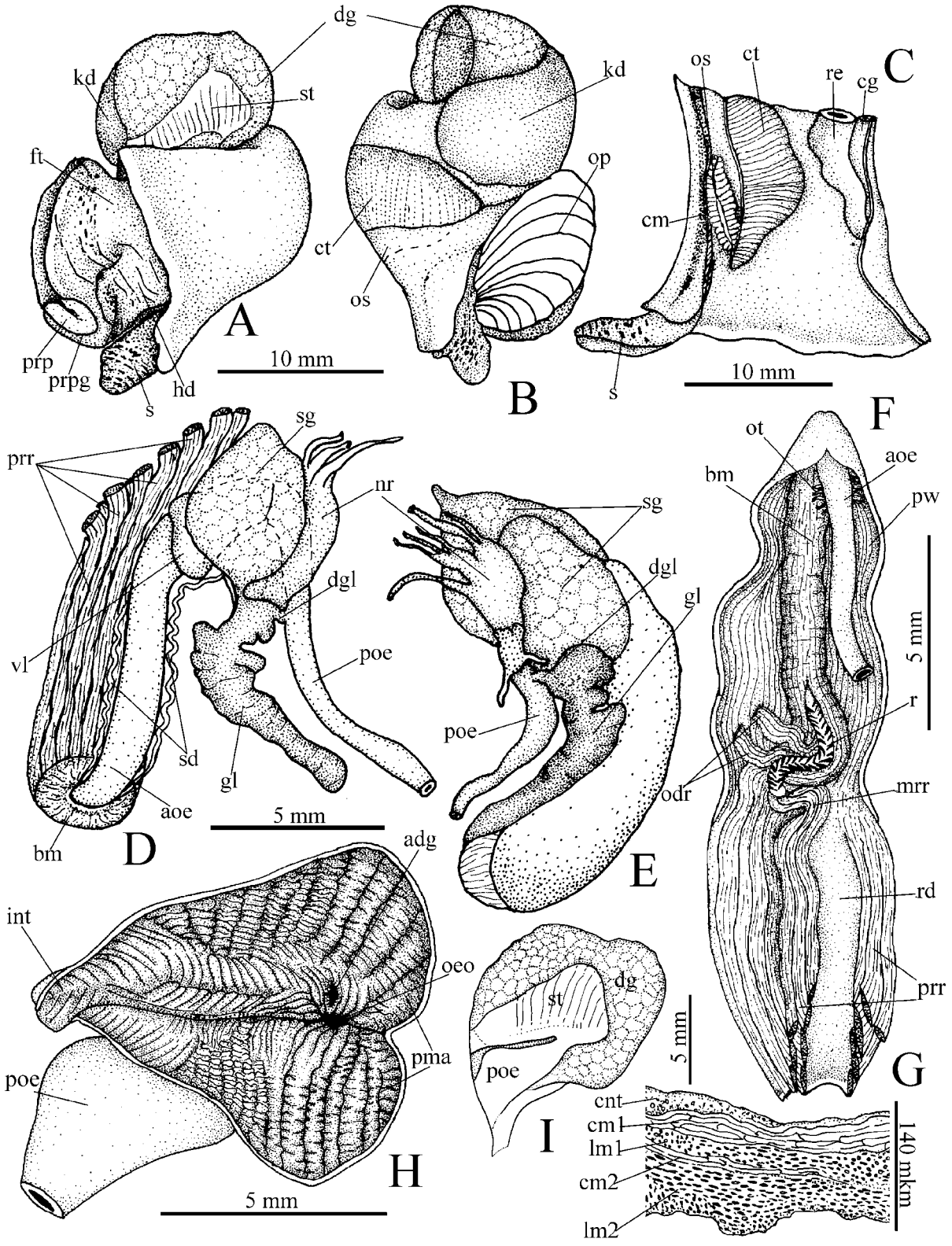

FIG. 12. Anatomy of *Latisipho hallii* **No. 4**. A–B – body, removed from the shell, C – mantle, D–E – organs of the body haemocoel (D – right-ventral view, E – lateral-left view), F – proboscis, opened dorsally, G – cross-section of the proboscis wall, H – stomach, opened dorsally, I – stomach, general view.

РИС. 12. Анатомия *Latisipho hallii* **№ 4**. A–B – мягкое тело, C – мантия, D–E – органы туловищного гемоцеля (D – вид вентрально справа, E – вид слева), F – хобот, вскрытый дорзально, G – поперечный срез стенки хобота, H – желудок, вскрытый дорзально, I – желудок, общий вид.

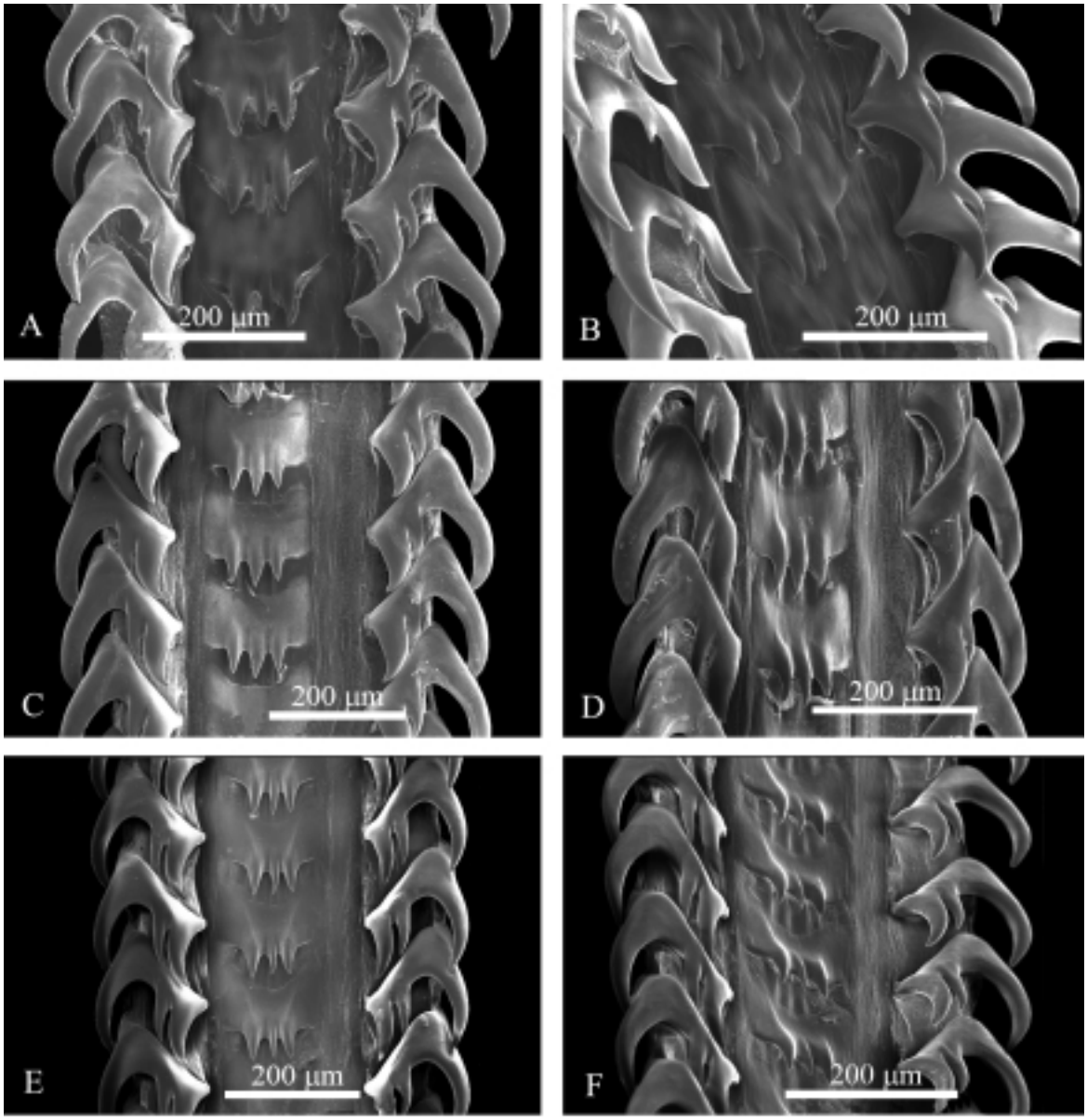

FIG. 13. Radulae of *Latisipho hallii*. A–B – **No. 4**, C–D – **No. 6,** E–F – **No. 7**, G – **No. 9**, H – **No. 8**.

РИС.13. Радулы *Latisipho hallii*. A–B – **№ 4**, C–D – **№ 6,** E–F – **№ 7**, G – **№ 9**, H – **№ 8**.

whorls, the mantle occupies one whorl, the kidney – 0.2, and remaining parts are the digestive gland and the gonad (Fig. 13 A–B). The body is pigmented with little black spots. The broad flattened head (**hd**) without tentacles is 1.5 times wider than long. The length of thick contracted tentacles is twice that of the head. The eyes sit on small lobes of the tentacles at the distance of one third of their length from the base. The **foot** (**ft**) is twice folded. The wide propodium (**prp**) is separated by a deep propodial groove. The operculum (**op**) is leaf-shaped, with terminal nucleus slightly dislodged to the left.

The **mantle** length is 1.5 times more than the width (Fig. 13 C). The siphon (**s**) is long and muscular, transgressing far off the bounds of the mantle edge. The ctenidium (**ct**) is moderately large, occupying 3/4 of the mantle length. The osphradium (**os**) is twice shorter and narrower than the ctenidium. Folds of the hypobranchial gland (**hg**) are not expressed. The rectum (**re**) opens in the middle of the mantle; the anal papilla is absent.

Reproductive system. The capsular gland (Fig. 13 C, **cg**) is poorly developed.

Digestive system. The proboscis is completely inverted into the rhynchodaeum(Fig. 13 D-E). The buccal mass (**bm**) occupies the whole length of the

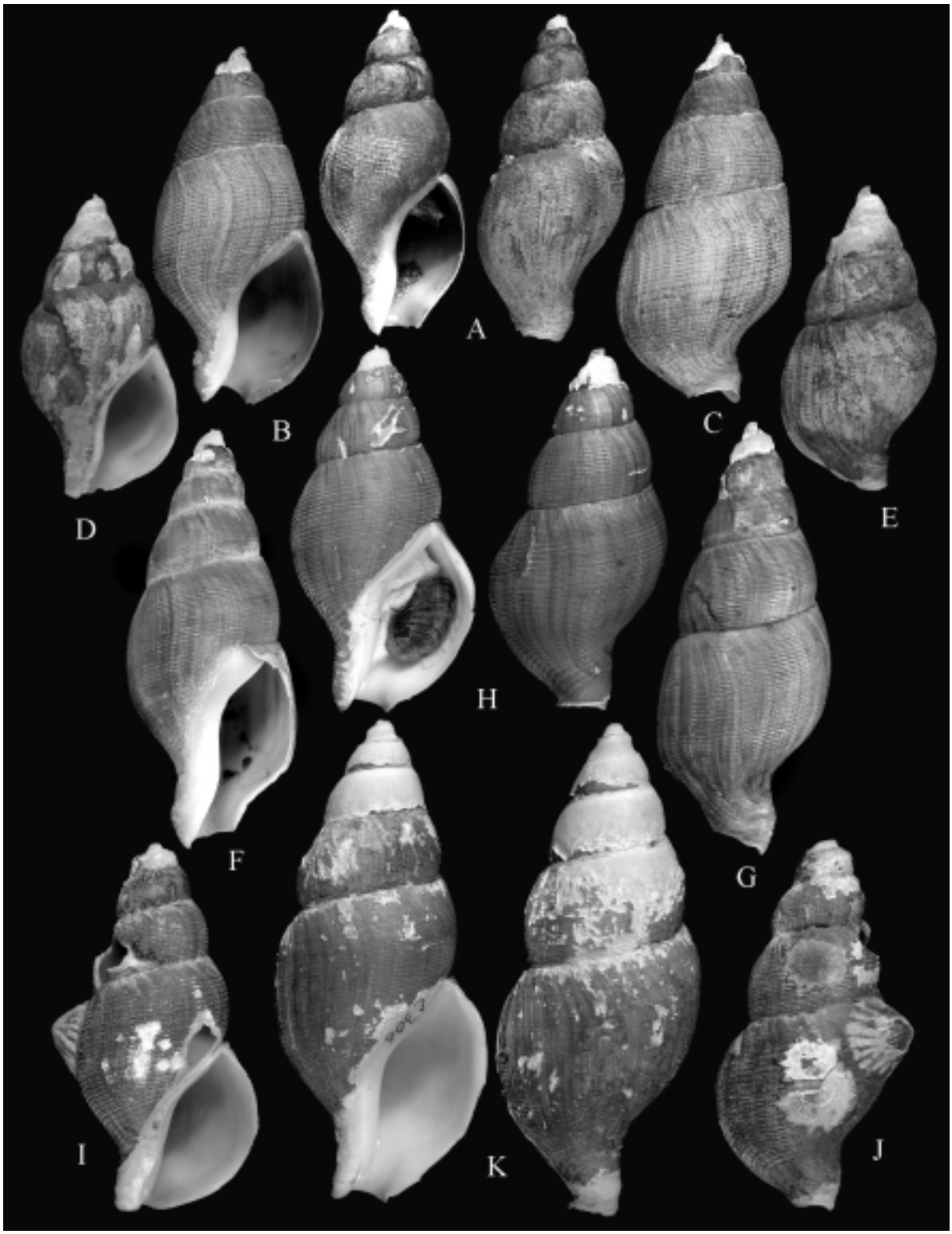

FIG. 14. *Latisipho hallii.* A – specimen **No. 9**, H – 49.2 mm; B-C – specimen **No. 12**, H – 53.2 mm; D-E – specimen **No. 16**, H – 47.6 mm; F-G – type specimen of *Helicofusus luridus* (holotype, ZIN 33739/1, H – 60.2 mm); H – specimen from the Okhotsk Sea, 151°50'-153°30'E, south off Alevin Cape, by courtesy of D.O. Alexeev, H – 53.3 mm; I-J – specimen from ZMMU 18186, Okhotsk Sea, 58°41'N, 150°00'E, H – 54 mm; K – specimen from Kamchatka, 600 m, by courtesy of D.O. Alexeev, H – 70.5 mm.

РИС. 14. *Latisipho hallii.* A – экземпляр **№ 9**, H – 49,2 мм. B-C – экземпляр **№ 12**, H – 53,2 mm; D-E – экземпляр **№ 16**, H – 47,6 мм; F-G – типовой экземпляр *Helicofusus luridus* (голотип, ЗИН 33739/1, H – 60,2 мм); H – экземпляр из Охотского моря, 151°50'-153°30'E, к югу от мыса Алевина, любезно предоставлен Д.О. Алексеевым, H – 53,3 мм; I-J – экземпляр из ЗМ МГУ 18186, Охотское море, 58°41'N, 150°00'E, H – 54 мм; K – экземпляр с Камчатки, 600 м, любезно предоставлен Д.О. Алексеевым, H – 70,5 мм.

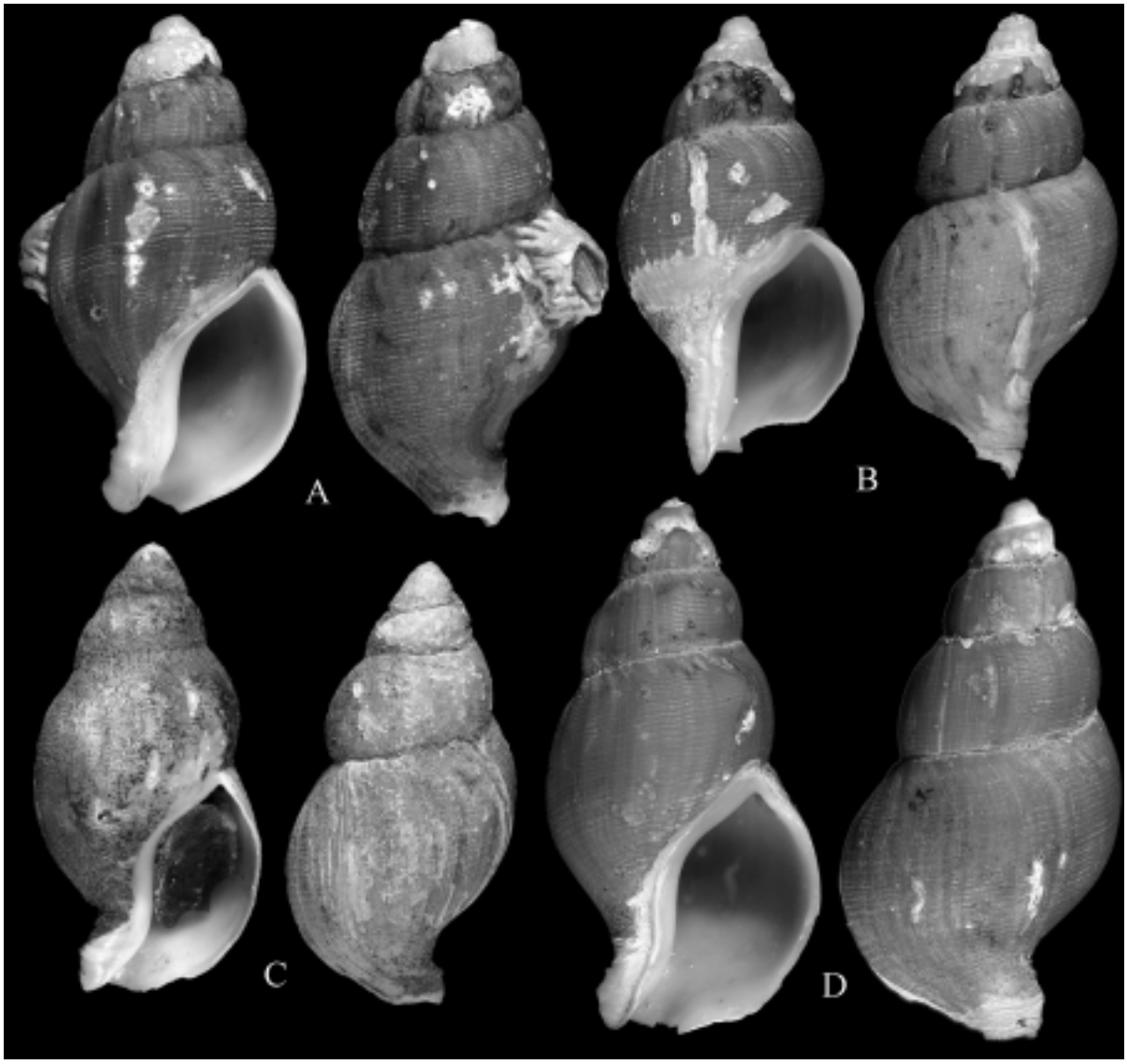

FIG. 15. *Latisipho hallii. A – specimen* **No. 11**, H – 44.8 mm; B – specimen **No. 14**, H – 42.0 mm; C – specimen **No. 15**, H – 40.0 mm; D – specimen **No. 13**, H – 47.5 mm.

РИС.15. *Latisipho hallii.* A – экземпляр **№ 11**, H – 44.8 мм; B – экземпляр **№ 14**, H – 42.0 мм; C – экземпляр **№ 15**, H – 40.0 mm; D – экземпляр **№ 13**, H – 47.5 mm.

rhynchocoel (Fig. 13 F). It is strongly contracted, making the radula (**r**) curved. The radula is 10 mm long and 530 μm wide, bearing 81 transverse rows of teeth (6 are forming) and comprising 2.65% of AL (Fig. 14 A-B). The composition of the proboscis wall (Fig. 13 G) is similar to that of *L. hypolispus*.

Anterior oesophagus (**aoe**) is a wide flattened tube (Fig. 13 D-E). The valve of Leiblein (**vl**) is very large (1/4 of the length of anterior oesophagus). The gland of Leiblein (**gl**) is also rather large. The short duct of the gland (**dgl**) opens immediately posterior to the nerve ring. Salivary glands (**sg**) are large, rounded, and separate. Salivary ducts are thin and coiled, opening into the buccal cavity.

The **stomach** occupies 0.33 of the whorl and runs along the longitudinal axis of the whorl (Fig.13 H–I). The posterior oesophagus is very wide, tapering before entering the stomach ventrally. The posterior mixing area (**pma**) is not large, lined with transverse folds. The opening of the posterior duct of digestive gland (**pdg**) is rather small, situated just above the opening of the oesophagus (**oeo**). The upper part of the inner stomach wall is lined with high transverse folds, the lower – with two rows of minute divergent oblique folds. The outer wall is lined with multiple transverse folds. The opening of the anterior duct of digestive gland was not found.

The penis was studied in specimen No. 5; H 42.2 mm, h 32.4 mm, AL 24.6 mm, adult male (Fig. 7 B). The penis is flattened, contracted, bearing a

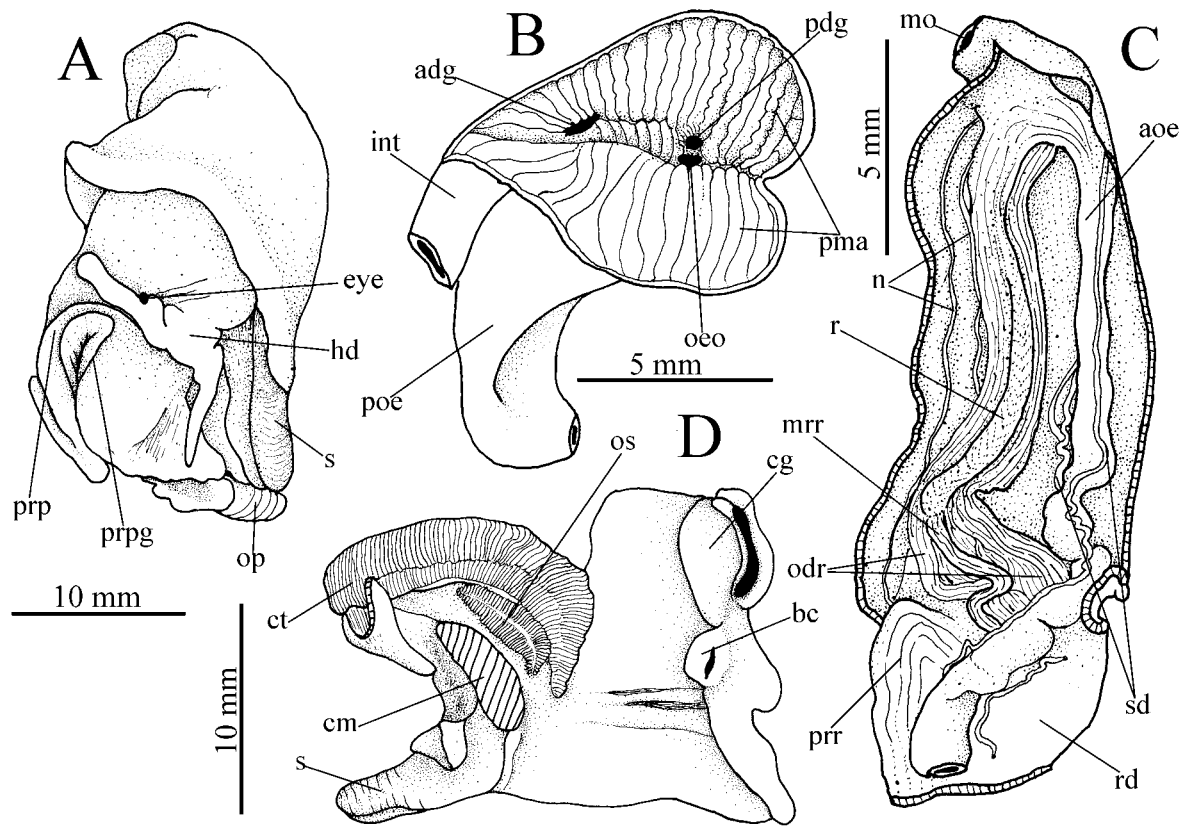

FIG. 16. Anatomy of *Latisipho hallii* **No. 12**. A – anterior view of the head-foot, B – stomach, opened dorsally, C – proboscis, opened dorsally (rhynchodaeum opened dorsally and pulled backwards), D – mantle.

РИС. 16. Анатомия *Latisipho hallii* **№ 12**. A – фронтальный вид головы и ноги, B – желудок, вскрытый дорзально, C – хобот, вскрытый дорзально (ринходеум отвернут назад), D – мантия.

cone-shaped seminal papilla with a small round opening on the top. The papilla is surrounded by a deep groove produced by a circular fold of skin (Fig. 10 I).

Specimens figured on the Fig. 14 have the spiral sculpture of sharp ribs separated by interspaces twice wider than the ribs. This kind of sculpture is characteristic for *Helicofusus luridus* (Fig. 14 F-G – holotype). There are several specimens representing the transition of the sculpture from sharp spiral ribs with wide interspaces (Fig. 15 A-B) to flattened spiral ribs with narrow interspaces (Fig. 15 C-D). Below the brief morphological description of specimen No. 12 (Fig. 16) with sharp spiral ribs is given, with the notes on radulae of the other figured specimens (Figs. 14, 15).

No. 12. H 53.2 mm, h 37.5 mm, AL 27 mm.

External anatomy (Fig. 16 A) is the same as in the previous described specimens.

The **mantle** length (Fig. 16 D) is approximately equal to its width; organs of the mantle cavity have usual proportions.

Reproductive system. The capsular gland is large and dorso-ventrally flattened (Fig. 16 D, **cg**). Bursa copulatrix is medium-sized, folded ventrally, with a slit-like female orifice.

Digestive system. Organs of the body haemocoel are compactly packed in a way described above for the other specimens of *L. hallii*. The buccal mass (**bm**) is of the same length as the proboscis (Fig. 16 C). The radula (**r**) in the radular sac is equal to odontophore length, lying in the middle of its dorsal side. It is 14 mm long and 900 μm wide, comprising 3.33% of AL, with 78 rows of teeth, 5 of which are forming. The rachidian is relatively broad, bearing three equal cusps. The laterals are tricuspid with the median cusp the shortest, similar to those of previous specimens.

The valve of Leiblein (**vl**) is medium-sized, elongated. Salivary ducts (**sd**) are narrow and strongly coiling, passing on the both sides of the anterior oesophagus, and separating from it in the beginning of the valve of Leiblein. The nerve ring and salivary glands are strongly fused with the connective tissue, so it is impossible to distinguish one from another. The gland of Leiblein (**gl**) is medium-sized, slightly tapering towards the end. The short broad duct of the gland (**dgl**) opens in a small distance posterior to the nerve ring.

Table 2. Conchological and radular characters of anatomically studied specimens of *L. hallii*

No.	H/h/AL, mm	Periostracum color	Siphonal canal	Length of radula, mm	Width of radula, μm	Ratio of radular width to AL,%	No. of tooth rows (forming)	No. of tooth cusps	Median cusp of rachidian
1	35.3/26/18.8	light-olive	straight	9.8	350	1.86	65	3:3:3	a bit larger
2	34.3/27.4/20	light-olive	straight	9.6	—	—	72(8)	—	—
3	52/37/27	yellowish	curved	12.5	430	1.59	88(15)	3:3:3	the smallest
4	37.4/27.5/20	dark-brown	curved	10	530	2.65	81(6)	3:3:3	a bit smaller
5	42.2/32.4/24.6	light-brown	straight	—	—	—	—	—	—
6	43.2/32.2/23.5	light-olive	curved	—	500	2.13	—	3:3:3	the largest
7	40.4/31.4/22.6	light-brown	straight	—	460	2.04	—	3:3:3	the smallest
8	55.2/39.2/28.8	brown	straight	—	560	1.94	77	3:3:4	the largest
9	49.2/35.6/24.5	dark-olive	straight	—	450	1.84	—	3:3:3	the same as other cusps
10	47.1/33.7/23	yellowish	curved		500	2.17		3:3:3	the smallest
11	44.8/34.3//24	reddish-brown	curved	12	400	1.67	86(6)	3:3:3	the largest
12	53.2/37.5/ /27	dark-olive	curved	14	900	3.33	78(5)	3:3:3	all cusps are equal
13	47.5/35.3/ /24	light-brown	curved	14	620	2.58	83(20)	3:3:3	all cusps are equal
14	42/34.3/ /24	reddish-brown	straight	14	500	2.08	84(22)	3:3:3	the smallest
15	40/31/21.2	brown	strongly recurved	9.6	400	1.89	74(12)	3:3:3	all cusps are equal
16	47.6/35//25.7	dark-brown	straight	13.2	500	1.95	104(20)	3:3:4	the largest

Stomach (Fig. 16 B) occupies one fourth of the whorl, being situated at an angle of 20° to the longitudinal axis of the whorl. The posterior mixing area (**pma**) is small, lined with several transverse folds. The posterior opening of the duct of digestive gland (**pdg**) is rather small, situated above the opening of the oesophagus. The anterior opening (**adg**) is larger, situating nearer to the beginning of the intestine. The space of the internal stomach wall between two openings is lined with low oblique folds, the upper part is lined with transverse folds. Outer stomach wall is lined with multiple high transverse folds.

The data on conchological and radular characters of investigated specimens are summarized in Table 2 (Figs. 7-8, 10, 13-15, 17).

Distinguishing conchological and anatomical characters of two species of *Latisipho* are summarized in the Table 3.

Table 3. Summary of conchological and anatomical characters of *L. hallii* and *L. hypolispus*

	Latisipho hallii	***Latisipho hypolispus***
Shell form and thickness	Fusiform, thin- or thick-walled	Fusiform, thick- or thin-walled
Siphonal canal	Straight to curved	Curved to straight
Periostracum	Light-olive to dark-brown	Light-olive to dark-brown
Spiral striation	Spiral ribs covering the whole shell, 20-30 in number on the penultimate whorl; oblique ridges usually absent	Always present oblique spiral ridges up to 10 on the penultimate whorl, inconspicuous spiral ribs only near siphonal canal; rest of the shell smooth
Salivary glands	Medium-sized, rounded, separated, with tendency to fusing in large specimens	Medium-sized, rounded, separated in juveniles, and large (2/3 of rhynchodaeum length), ventrally fused in adults
Gland of Leiblein	Large	Usually large
Stomach	Large, occupying 0.33 of the whorl, lined with multiple transverse folds (more than 16 on the outer wall)	Small, occupying up to 0.25 of the whorl, lined with little number of transverse folds (up to 16 on the outer wall)

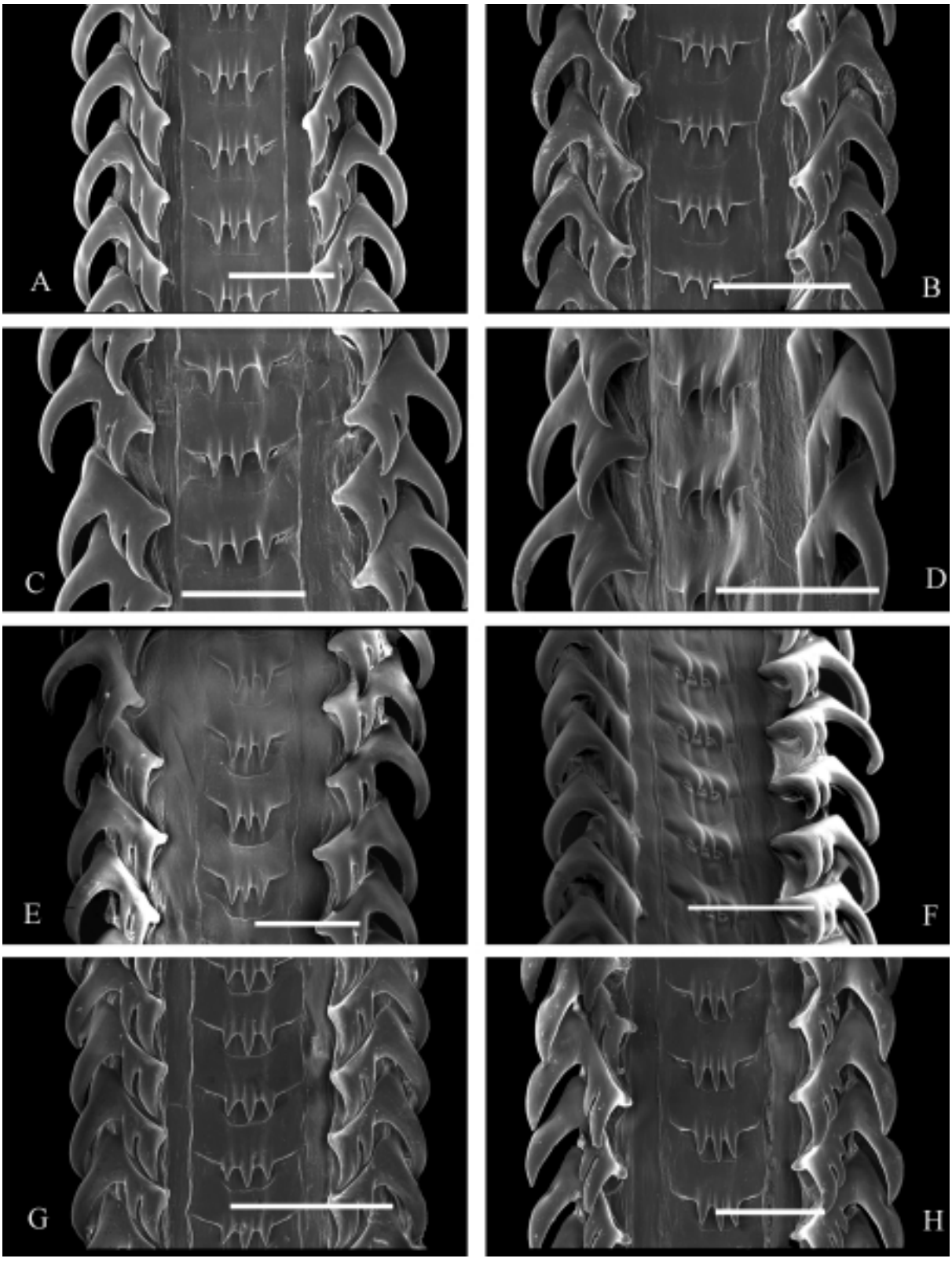

FIG. 17. Radulae of *Latisipho hallii.* A – **No. 14**, B – **No. 15**, C-D – **No. 13**, E-F – **No. 9**, G – **No. 11**, H – **No. 16.** Scale bar – 200 μm.

РИС. 17. Радулы *Latisipho hallii.* A – **№ 14**, B – **№ 15**, C-D – **№ 13**, E-F – **№ 9**, G – **№ 11**, H – **№ 16**. Масштабный отрезок – 200 мкм.

Discussion

It is well known that the shell in buccinids is extremely variable [Golikov, 1963, 1980; Goryachev, 1978]. Even without special anatomical investigation some authors [Foster, 1981; Kantor, Sysoev, 2005] noted the strong similarity in shells of *L. hallii, L. jordani, L. errones* and *L. georgianus*, and made a suggestion about their belonging to one widely distributed and variable species.

Based on spiral sculpture it is possible to divide seven studied species – six nominal species of *Latisipho* and *Helicofusus luridus* – into two groups. In *L. hallii, L. jordani, L. errones, L. georgianus* and *H. luridus* the spiral sculpture is "of numerous flattened threads with narrow channelled interspaces, coarser on the canal" [Dall, 1919: 322], while shells of *L. hypolispus* and *L. pharcidus* are sculptured "only by a few obsolete spirals" [Dall, 1891: 188].

The similarity of types of *L. hypolispus* and *L. pharcidus* is not obvious. Although the spiral sculpture is similar, the shell of the type specimen of *L. pharcidus* is thin and oval, with a straight siphonal canal and light-olive periostracum, while that of *L. hypolispus* – solid and more fusiform, with curved siphonal canal and dark-brown periostracum. After examining a large number of specimens having the spiral sculpture only of irregular spiral ridges, it was found that the thickness of the shell and the colour of the periostracum change significantly, producing a lot of transitions, and the siphonal canal can be curved to a variable extent. In Russian museums there is no material from the type locality of *L. pharcidus* (i.e. Sakhalin Island, east of Aniva Cape, 930 m), nevertheless, we consider that present samples from the Bering Sea and Kamchatka fall within the limits of intraspecific variability. Radulae also appear to be very variable, different even in two specimens from the same sample and similar conchologically (Table 1, No. 2 and No. 7). Varying features are the number of cusps on the lateral teeth and the length of the median cusp of the rachidian. The ratio of radula width to the aperture length varies from 1.95 to 3.96. It seems that the larger values (2.9-3.96) are those of shells with straight siphonal canals, while the smaller – of those with curved canals (1.95-2.25). Nevertheless, the specimen No. 8 with weakly curved siphon represents the transition between these two forms, having the ratio 3.7. The anatomy of the foregut is uniform, and does not reveal any distinctions between the specimens of different forms. Based on all above mentioned, it is possible to say that *L. hypolispus* and *L. pharcidus* represent forms of one extremely variable species.

Specimens with spiral ribs are also remarkably variable. Thus, shells can be thin and fragile, or thick and solid; with convex, or flattened whorls; with curved or straight siphon, and periostracum of different tint. The spiral sculpture itself varies greatly: the ribs can be sharp, separated by interspaces wider than the ribs themselves (Fig. 14 F-G – *Helicofusus luridus*), or, on the contrary, smooth and flattened, separated by grooves twice narrower than the rib (Figs. 7, 8, 15 C-D). The number of ribs is not constant, varying from 20 (Fig. 7) to 30 (Fig. 8 A-C) on the penultimate whorl. The radula is extremely variable, but without a correlation to the shell variability: it can be different in two similar specimens and similar in two different specimens (Fig. 14 C-D and H; Fig. 11 C-D and 14 E-F). The ratio of radular width to the aperture length varies from 1.59 to 3.33%, i.e. it is as variable as in *L. hypolispus*.

The anatomy of the foregut and reproductive system is similar within the group, and reveals very few differences between *L. hypolispus* and *L. hallii* (Table 3). The stomach of *L. hypolispus* is a bit smaller than that of *L. hallii*: it occupies up to 0.25 of the whorl, lined with little number of transverse folds (up to 16 on the outer wall), while the stomach of *L. hallii* occupies 0.33 of the whorl, and lined with multiple transverse folds (more than 16 on the outer wall). Salivary glands are usually fused in adults of *L. hypolispus* and separate in *L. hallii.* Fusing of glands is not uncommon and occurs in some other Buccinoidea: *Habevolutopsius* and *Lussivolutopsius* (Volutopsiinae, Buccinidae) [Kantor, 1990], *Germonea* (Prosiphiinae, Buccinulidae) [Harasewych, Kantor, 2004].

Based on all above mentioned, it is necessary to reduce *L. pharcidus* to the junior synonym of *L. hypolispus*, and *L. jordani, L. errones, L. georgianus* and *H. luridus* – to the junior synonyms of *L. hallii.*

As the morphology of both species is similar, and the radula is extremely variable, they can be clearly destinguished only conchologically by spiral sculpture. In *L. hypolispus* the spiral sculpture is not uniform, represented by irregular oblique spiral ridges (up to 10 on the penultimate whorl), and weak inconspicuous spiral ribs near siphonal canal. In *L. hallii* all the shell is covered with regular frequent spiral ribs, 20-30 in number on the penultimate whorl. The majority of samples containing *L. hypolispus* were from the Bering Sea region, and *L. hallii* – from the Okhotsk Sea (Fig. 1). Nevertheless, there were a number of samples containing both species.

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Анатомия и таксономический состав рода *Latisipho* Dall (Gastropoda: Buccinidae) из российских вод

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РЕЗЮМЕ. На основании анализа конхологических, анатомических и радулярных признаков шести номинальных видов рода *Latisipho* и вида *Helicofusus luridus*, отмеченных в морской фауне России, вид *L. pharcidus* сведен в младший синоним *L. hypolispus,* а виды *L. errones, L. jordani L. georgianus* и *Helicofusus luridus* – в синонимы *L. hallii*.