

TABLE S1 | Summary of specimens analyzed in this study, including species, catalogue number, collection locality, state/province, county, country, geographic coordinates (latitude and longitude), sex, standard length (SL; mm), and histological descriptions of the axillary gland and pectoral spine gland. No data available (N/D). *Specimen obtained through the aquarium trade.

Species	Catalogue number	Province/State	County	Country	Latitude	Longitude	Sex	SL (mm)	Axillary gland	Pectoral spine gland
<i>Aspidoras albater</i>	UFRGS 11196	Goiás	Cavalcante	Brazil	-13.755	-47.455555556	Female	33.3	Encapsulated, round-shaped, organized into lobules containing granular secretion. Septa separate the lobules, within which smaller or elongated nuclei are observed.	A thin spine with abundant club cells arranged in 3–4 layers adjacent to the bone along its entire length. The cells exhibit clear cytoplasm, a round shape, and centrally located nuclei, consistent with the characteristics of club cells. These cells are covered by the epidermis, including keratinocytes and goblet cells, and extend beyond the spine into other regions of the surrounding epidermis.
<i>Aspidoras albater</i>	UFRGS 9906	Goiás	Cavalcante	Brazil	-13.75444	-47.455	Female	35.9	N/D	The thin spine is populated by abundant club cells arranged in 3–4 layers adjacent to the bone along its entire length. These cells exhibit clear cytoplasm, a round shape, and centrally located nuclei, consistent with the characteristics of club cells. They are covered by the epidermis, comprising keratinocytes and goblet cells, and extend beyond the spine into other regions of the surrounding epidermis.
<i>Aspidoras albater</i>	UFRGS 9906	Goiás	Cavalcante	Brazil	-13.75444	-47.455	Male	31.7	N/D	The thin spine contains abundant club cells arranged in 3–4 layers adjacent to the bone along its entire length. These cells display clear cytoplasm, a round shape, and centrally located nuclei, consistent with the characteristics of club cells. They are covered by the epidermis, composed of keratinocytes and goblet cells, and extend beyond the spine into other regions of the surrounding epidermis.
<i>Aspidoras fuscoguttatus</i>	UFRGS 10522	N/D	N/D	Brazil	N/D	N/D	N/D	33.1	Present and observed during dissection (Figure 2H).	N/D
<i>Brochis agassizi</i>	ICN 14741	Putumayo	Puerto Leguizamo	Colombia	-0.106617	-74.962506	Male	42.3	Present but weakly stained; the lobular structure and granular secretion are discernible.	N/D
<i>Brochis ambiacus</i>	ICN 13836	Amazonas	N/D	Colombia	N/D	N/D	Female	40.9	Encapsulated, round-shaped, approximately 1 - 1.5 mm in size, organized into lobules containing granular eosinophilic secretion and cells (~30 - 50 µm) with large nuclei and eosinophilic granular cytoplasm. Septa separate the lobules, within which smaller or elongated nuclei are observed.	N/D
<i>Brochis arcuata</i>	ICN14256	Amazonas	Leticia	Colombia	-4.219386	-69.944818	N/D	20.8	Encapsulated, round-shaped, approximately 1 mm wide and 1.5 mm high, organized into lobules without granular secretory material but filled with large cells (50–70 µm) exhibiting round nuclei with peripheral location and uniform, pale, colloid-like cytoplasm.	N/D



TABLE S1 | (Continued)

Species	Catalogue number	Province/State	County	Country	Latitude	Longitude	Sex	SL (mm)	Axillary gland	Pectoral spine gland
<i>Brochis delphax</i>	ICN 13841	Amazonas	Leticia	Colombia	-4.218209	-69.940956	Female	44.5	Encapsulated, oval-shaped, approximately 0.8 mm high and 0.4 mm wide, organized into lobules with abundant granular eosinophilic secretion. Nuclei are located at the periphery of the lobules, some large and others short or elongated.	N/D
<i>Brochis delphax</i> *	ICN 26512	N/D	N/D	Colombia	N/D	N/D	N/D	39.5	Encapsulated, irregularly shaped, approximately 1 mm long and 0.5 mm high, consisting of a single lobule containing granular secretory material. The lobule contains 30 µm cells with large nuclei and uniform, pale, colloid-like cytoplasm, as well as other cells with granular cytoplasm. An apparent transition from colloid-like cells to granular cells is observed, with holocrine release of contents into the lobules.	N/D
<i>Brochis delphax</i> *	ICN 26512	N/D	N/D	Colombia	N/D	N/D	N/D	34.7	Not included in the histological section, but externally observed.	A small layer of round to oval cells with round nuclei and uniform eosinophilic cytoplasm is observed adjacent to the distal portion of the pectoral spine, not covered by epidermis.
<i>Brochis delphax</i> *	ICN 26512	N/D	N/D	Colombia	N/D	N/D	N/D	41.2	Encapsulated, round-shaped, approximately 1 - 1.5 mm in size, organized into lobules containing granular eosinophilic secretion and cells (~30 - 50 µm) with large nuclei and eosinophilic granular cytoplasm. Septa separate the lobules, within which smaller or elongated nuclei are observed.	A layer approximately 80 µm thick, composed of round (30 µm) to polygonal cells with central nuclei and uniform eosinophilic cytoplasm, more intensely stained than club cells in other regions of the epidermis. Covered by a thin layer of keratinocytes and located adjacent to the pectoral spine.
<i>Brochis reticulatus</i>	ICN 15225	Putumayo	Puerto Leguizamo	Colombia	-0.093344	-74.954437	Male	43.2	N/D	A layer approximately 50 µm thick, composed of oval to polygonal cells (30 µm) with uniform eosinophilic cytoplasm, adjacent to the posterior region of the pectoral spine and covered by a layer of keratinocytes.
<i>Brochis sodalis</i>	ICN 13843	Amazonas	Leticia	Colombia	-4.218209	-69.940956	Male	39.5	N/D	The pectoral spine is covered by a thin epidermal layer of keratinocytes. No glandular tissue is observed.
<i>Brochis splendens</i>	ICN 13839	N/D	N/D	Colombia	-4.224876	-69.946982	Female	61.2	N/D	A layer approximately 100 µm thick, composed of oval to polygonal cells with round nuclei measuring 30–40 µm and uniform eosinophilic cytoplasm, adjacent to the pectoral spine and covered by an epidermal layer containing keratinocytes and goblet cells. Club cells are observed in other regions of the epidermis, allowing differentiation from these cells.



TABLE S1 | (Continued)

Species	Catalogue number	Province/State	County	Country	Latitude	Longitude	Sex	SL (mm)	Axillary gland	Pectoral spine gland
<i>Brochis splendens</i> *	ICN 26511	N/D	N/D	Colombia	N/D	N/D	N/D	50.5	Heavily encapsulated, round in shape, approximately 1 mm wide and 1.5 mm high, composed of lobules with abundant granular secretion. Large cells (~50 µm) with large nuclei and granular basophilic cytoplasm are observed. Granular material is secreted into the lobules via an apparent holocrine mechanism. Septa between lobules contain cells with smaller or elongated nuclei.	N/D
<i>Brochis splendens</i> *	ICN 26511	N/D	N/D	Colombia	N/D	N/D	N/D	55.7	Present, but the structure is not clearly visible due to weak staining.	Present, but the structure is not clearly visible due to weak staining.
<i>Corydoras araguaiensis</i>	UFRGS 11592	Mato Grosso	Barra do Garças	Brazil	N/D	N/D	N/D	40.2	N/D	Thin pectoral spine with an epidermis containing club cells and another cell type lacking an evident nucleus, with darker, occasionally granular cytoplasm.
<i>Corydoras araguaiensis</i>	UFRGS 15867	Mato Grosso	Alto Boa Vista	Brazil	-11.50667	-51.4308333	N/D	30.6	N/D	N/D
<i>Corydoras nattereri</i>	UFRGS 15105	São Paulo	Bragança Paulista	Brazil	-22.98782	-46.6600583	N/D	39.3	N/D	The spine is covered by normal epidermis containing some club cells, along with goblet cells and keratinocytes.
<i>Corydoras pastazensis</i>	ICN 10311	Amazonas	Leticia	Colombia	-4.118715	-69.924234	Male	45.2	Encapsulated, irregular to round in shape, approximately 1–1.5 mm wide, organized into lobules with highly eosinophilic granular secretion. The lobules contain cells measuring 30–50 µm with large nuclei located at the periphery, whose cytoplasm appears to release the granular material. Lobules are separated by septa containing cells with smaller, elongated nuclei.	Pectoral spine with pronounced serrations, containing abundant epidermal tissue with club cells and goblet cells, as well as cells with eosinophilic granular secretion (~20 µm), similar to that observed in the axillary gland.
<i>Corydoras semiaquilus</i>	ICN 16865	Amazonas	Leticia	Colombia	-4.127723	-69.946146	Male	42.8	N/D	Pectoral spine with pronounced serrations, covered by abundant epidermis and containing cells with eosinophilic granular secretion, as observed in other <i>Corydoras</i> species.
<i>Corydoras septentrionalis</i>	ICN 26509	Meta	Acacias	Colombia	4.114079	-73.364937	Male	37.8	N/D	Pectoral spine with serrations covered by a well-developed epidermis containing club cells and keratinocytes, as well as abundant cells with eosinophilic granular secretion (30–50 µm) predominantly located in the middle and basal regions of the epidermis. These cells are similar to those observed in the axillary gland.
<i>Corydoras septentrionalis</i>	ICN 26509	Meta	Acacias	Colombia	4.114079	-73.364937	Female	40.1	Encapsulated, less than 1 mm wide, irregular in shape, organized into lobules containing eosinophilic granular secretory material. Within the septa, cells with varying nuclear morphology are observed—some small and round, others elongated. Some cells with large nuclei and granular cytoplasm are also present.	N/D



TABLE S1 | (Continued)

Species	Catalogue number	Province/State	County	Country	Latitude	Longitude	Sex	SL (mm)	Axillary gland	Pectoral spine gland
<i>Corydoras simulatus</i>	ICN 26509	Meta	Acacias	Colombia	3.241955	-73.45228	Female	33.7	N/D	Pectoral spine with pronounced serrations, covered by abundant epidermis and containing cells (~30 µm) with eosinophilic granular secretion, as observed in other <i>Corydoras</i> species.
<i>Corydoras simulatus</i>	ICN 26509	Meta	Acacias	Colombia	3.241955	-73.45228	Male	32.5	Encapsulated, 0.5 to 1 mm wide, round to oval, organized into lobules containing eosinophilic granular uniform and granular material. Within the septa, cells with varying nuclear morphology are observed. Some cells with large nuclei and granular cytoplasm are also present.	Pectoral spine with a well-developed epidermis containing some cells (~30 µm) with eosinophilic granular material, similar to that observed in the axillary gland. Other typical epidermal cell types are also present.
<i>Corydoras</i> sp.	ICN 9607	Amazonas	N/D	Colombia	-4.446931	-71.403988	Female	46.9	Not included in the histological section, but externally observed.	Pectoral spine covered by a well-developed epidermis containing cells with granular secretion.
<i>Gastrodermus elegans</i>	ICN 14252	Amazonas	N/D	Colombia	N/D	N/D	Male	26.2	Encapsulated, very round in shape, measuring approximately 1–1.2 mm in diameter, organized into lobules with abundant granular secretion that appears eosinophilic or pale in some areas. The lobules contain cells (approximately 30–40 µm) with large nuclei and granular cytoplasm releasing the granular secretion into the lobular lumen. The septa separating the lobules contain cells with smaller or elongated nuclei.	Pectoral spine bone tissue without epidermal tissue recovering it.
<i>Gastrodermus elegans</i>	ICN 13837	Amazonas	Leticia	Colombia	-4.218209	-69.940956	Female	43.4	Not included in the histological section, but externally observed.	Simple epidermis covering the pectoral spine.
<i>Gastrodermus napoensis</i>	ICN 14746	Putumayo	Puerto Leguizamo	Colombia	-0.194081	-74.779933	Female	32.4	Not included in the histological section, but externally observed.	N/D
<i>Gastrodermus</i> sp.	ICN 9602	Amazonas	Leticia	Colombia	-3.846962	-70.221831	Male	40.9	Tissue that could correspond to the axillary gland, but very weakly stained.	Pectoral spine with no visible epidermis or other associated structures.
<i>Hoplioma armatus</i>	ICN 15220	Putumayo	Puerto Leguizamo	Colombia	-0.194081	-74.779933	Female	35.8	Encapsulated, nearly 2 mm in diameter, round in shape, and organized into lobules. One portion of the gland contains predominantly granular secretory material, while another is composed mainly of large cells with centrally located round nuclei and uniform, colloid-like cytoplasm filling the lobules. In the granular region, cells with large nuclei (30–40 µm) and granular cytoplasm are observed, with septa separating the lobules containing cells of varying shapes and nuclear sizes.	N/D



TABLE S1 | (Continued)

Species	Catalogue number	Province/State	County	Country	Latitude	Longitude	Sex	SL (mm)	Axillary gland	Pectoral spine gland
<i>Hopli-soma axelrodi</i>	ICN 12099	Meta	Puerto Gaitán	Colombia	4.315283	-72.077531	N/D	25.5	Encapsulated, irregular shaped, composed of clusters of large cells (30 to 60 µm) with pale, colloid-like cytoplasmic content, lacking eosinophilic granules and showing apparent duct-like structures that require further examination. The gland is surrounded by connective and muscular tissue. Some of these colloid cells display large peripheral nuclei and, occasionally, binucleation.	Pectoral spine with round to oval cells exhibiting uniform eosinophilic cytoplasm adjacent to the spine, which is covered by normal epidermis.
<i>Hopli-soma axelrodi*</i>	ICN 26510	N/D	N/D	Colombia	N/D	N/D	N/D	30.2	Present but weakly stained; the lobular structure is discernible, as well as the presence of colloid-like cells. Granular secretion were not observed	N/D
<i>Hopli-soma concolor</i>	ICN 9554	Vichada	Puerto Carreño	Colombia	5.155134	-69.150253	N/D	48.4	Tissue with multiple lobules separated by connective tissue. Each lobule contains cells with large nuclei and clear cytoplasm, possibly due to tissue degradation. Apparent granular secretions and binucleated cells are observed. A possible axillary gland is present in transverse section.	Epidermis with abundant club cells, round in shape with central nuclei and clear cytoplasm. Some cells are granular, similar to those observed in other <i>Corydoras</i> , although no serrations are visible.
<i>Hopli-soma leu-comelas</i>	ICN 15840	Putumayo	Puerto Leguizamo	Colombia	-0.194081	-74.779933	Female	40.1	Encapsulated, nearly 1.5 mm in size, round-shaped, with abundant cells containing uniformly pale cytoplasm with colloid-like material, distinguishable from the surrounding muscle tissue. In some basal regions near the capsule, multinucleated cells are observed. Occasional septa separating the colloid material and cells with smaller nuclei are also present.	Pectoral spine with round cells (10 to 20 µm) possessing uniformly eosinophilic cytoplasm and centrally located round nuclei, located adjacent to the spine and toward its distal region. The spine is covered by an epidermis containing abundant keratinocytes.
<i>Hopli-soma leu-comelas</i>	ICN 13844	Amazonas	N/D	Colombia	N/D	N/D	Male	34.7	N/D	N/D
<i>Hopli-soma loxozonum</i>	ICN 25558	Meta	Acacias	Colombia	3.2767	-73.3547	Female	42.8	Encapsulated small round-shaped gland (<0.5 mm), composed of several small lobules filled with granular eosinophilic material. Cells with large nuclei are located at the periphery of these compartments. Smaller cells with round or elongated nuclei are present within the septa separating the compartments. Some additional compartments containing colloid-like material are also observed in other regions of the gland.	Pectoral spine with layers of round to oval cells (~10–20 µm) with uniformly and intensely eosinophilic cytoplasm located adjacent to the bone tissue of the spine. Not covered by epidermis.
<i>Hopli-soma melini</i>	ICN 25510	Meta	Acacias	Colombia	3.241955	-73.45228	Female	35.6	Encapsulated small round-shaped gland (<0.5 mm), composed of several small lobules filled with granular eosinophilic material. Cells with large nuclei are located at the periphery of these compartments. Smaller cells with round or elongated nuclei are present within the septa separating the compartments.	Pectoral spine with layers of round to oval cells (~10–20 µm) with uniformly and intensely eosinophilic cytoplasm located adjacent to the bone tissue of the spine. Covered by keratinocytes.

TABLE S1 | (Continued)

Species	Catalogue number	Province/State	County	Country	Latitude	Longitude	Sex	SL (mm)	Axillary gland	Pectoral spine gland
<i>Hopli-soma metae</i>	ICN 25464	Meta	Acacias	Colom-bia	3.890417	-73.677284	Male	31.2	N/D	Pectoral spine with layers of round to oval cells (~10–20 µm) with uniformly and intensely eosinophilic cytoplasm located adjacent to the bone tissue of the spine. Covered by keratinocytes and some cells with granular secretion content.
<i>Hopli-soma metae</i>	ICN 25479	Meta	Acacias	Colom-bia	3.921143	-73.682757	Female	35.7	N/D	Pectoral spine with layers of round to oval cells (~10–20 µm) with uniformly and intensely eosinophilic cytoplasm located adjacent to the bone tissue of the spine. Covered by keratinocytes and some cells with granular secretion content.
<i>Hopli-soma metae</i>	ICN 26508	Meta	Acacias	Colom-bia	4.114079	-73.364937	Male	32	Encapsulated, round, measuring 1–1.5 mm in diameter, composed of lobules predominantly containing large cells with uniform colloid-like cytoplasm, and some cells with granular cytoplasm and large nuclei.	N/D
<i>Hopli-soma metae</i>	ICN 26508	Meta	Acacias	Colom-bia	4.114079	-73.364937	Male	34.5	Present but weakly stained; the lobular structure and granular secretion are discernible, as well as the presence of colloid-like cells.	N/D
<i>Hopli-soma reynoldsi</i>	ICN 29071	N/D	N/D	Colom-bia	N/D	N/D	Male	37.9	Encapsulated gland surrounded by connective and muscular tissue, measuring over 1 mm in diameter. It is organized into multiple lobules containing abundant eosinophilic granular secretion, with some areas appearing paler. Large cells (~30–60 µm) with prominent nuclei are present within the lobules, while smaller or elongated nuclei are observed in the interlobular septa. Additionally, in the peripheral region of the gland, clusters of cells with pale, uniform, colloid-like cytoplasm and central nuclei are present, some of which are binucleated.	N/D
<i>Hopli-soma tri-lineatum</i>	ICN 7539	Caquetá	La Monta-ña	Colom-bia	1.372161	-75.256902	Female	36.7	Not included in the histological section, but externally observed.	In the middle to distal third of the spine, round cells with a well-defined central nucleus are observed, resembling club cells but with a much darker, strongly eosinophilic cytoplasm. In another region of the section, typical club cells with clear cytoplasm are present, allowing differentiation between both cell types.
<i>Osteo-gaster aeneus</i>	ICN 26507	Meta	Acacias	Colom-bia	4.114079	-73.364937	N/D	38.7	Not included in the histological section, but externally observed.	Not included in the histological section
<i>Osteogas-ter melano-taenia</i>	ICN 25443	Meta	Acacias	Colom-bia	3.903316	-73.632492	Male	40.1	Not included in the histological section	A layer of round cells with eosinophilic cytoplasm and centrally located round nuclei is observed adjacent to the distal portion of the pectoral spine, not covered by epidermis. Some cells display granular areas, although these are not predominant.
<i>Osteo-gaster rabauti</i>	ICN 14259	Amazonas	Leticia	Colom-bia	-4.219386	-69.944818	Male	46.2	Encapsulated, irregular in shape, approximately 1 mm in diameter, organized into lobules filled with granular secretory material. Large cells with prominent nuclei are observed at the periphery of the lobules, and connective septa between lobules contain cells with nuclei of varying sizes.	A layer of round cells with eosinophilic cytoplasm and centrally located round nuclei is observed adjacent to the distal portion of the pectoral spine, covered by epidermis.

TABLE S1 | (Continued)

Species	Catalogue number	Province/State	County	Country	Latitude	Longitude	Sex	SL (mm)	Axillary gland	Pectoral spine gland
<i>Scleromystax macrop-terus</i>	UFRGS 29647	Santa Ca-tarina	São Fran-cisco do Sul	Brazil	-26.33129	-48.59636	Male	37.4	Encapsulated,round to oval organized into lobules filled with granular secretory material.	Pectoral spine covered by epider-mis containing some club cells, goblet cells, and keratinocytes.
<i>Sclero-mystax macrop-terus</i>	UFRGS 29647	Santa Ca-tarina	São Fran-cisco do Sul	Brazil	-26.33129	-48.59636	Female	37.7	Not included in the histolog-ical section, but externally observed.	Pectoral spine covered by epider-mis with an abundant number of club cells. The serrations are distinguishable, but no evidence of granular secretory cells is ob-served. A pigmented layer is pres-ent at the base of the epidermis adjacent to the pectoral spine.
<i>Sclero-mystax virgula-tus</i>	UFRGS 11026	Bahia	Prado	Brazil	-17.28889	-39.2216667	Male	32.2	N/D	The spine is covered by normal epidermis containing a few club cells (much fewer than in A. al-bater), along with goblet cells and keratinocytes
<i>Sclero-mystax virgula-tus</i>	UFRGS 11026	Bahia	Prado	Brazil	-17.28889	-39.2216667	Female	37.2	N/D	The spine is covered by normal epidermis containing a few club cells (much fewer than in A. al-bater), along with goblet cells and keratinocytes

HOW TO CITE THIS ARTICLE

- Jiménez-Vergara CR, Thomaz AT, Garzón-Restrepo AJ, Malabarba LR, Monroy M. Morphological diversification of defensive glands in Corydoradinae catfishes indicates a mixed Müllerian-Batesian mimicry system. Neotrop Ichthyol. 2026; 24(4):e260051. <https://doi.org/10.1590/1982-0224-2026-0051>