Observations on the Nasolabial Groove of the Plethodontid Salamander

Eurycea quadridigitata

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Introduction

The nasolabial groove is diagnostic for metamorphosed salamanders of the family Plethodontidae. This groove is a narrow depression in the skin extending ventrally from either external naris to the upper lip. The nasolabial groove functions to carry water borne chemicals from the substrate through the nasal passages and over the sensory epithelium of Jacobsen's organ (2).

Associated with the nasolabial groove are the nasolabial glands, a group of subdermal exocrine glands that secrete through pores lining the border of the groove (4). Although the anatomy of the nasolabial glands has been described grossly, at the light microscopy level, and by transmission electron microscopy (3), the nasolabial groove has been described only macroscopically (1, 4).

In this paper I describe the nasolabial groove of the dwarf salamander, *Eurycea quadridigitata* (Holbrook), as seen by scanning electron microscopy. Examination of the nasolabial groove of this species is of special interest since there is sexual dimorphism of the snout related to the nasolabial glands (3). Sexually active males possess elongate projections from the upper lip called cirri. Cirri are composed of an extension of nasolabial glands ventral to the lip, and the nasolabial groove extends the length of the cirrus (3). Female and sexually inactive male *E. quadridigitata* lack cirri (3).

Materials and Methods

Individuals of *Eurycea quadridigitata* were collected 22 September, 1973, 10.6 km NNW Ville Platte, Evangeline Parish, Louisiana. Males collected possessed cirri. The portion of the snout with the nasolabial groove was removed from both sides of the head of two males and one female. These tissue specimens from the snout were fixed 24 hours in 5% glutaraldehyde in Millonig's phosphate buffer, rinsed in the phosphate buffer, and post-fixed 90 minutes in a solution of 10% sucrose and 2% osmium tetroxide in the phosphate buffer. After dehydration in acetone and carbon dioxide, the tissue specimens were carbon-gold coated. The tissue specimens were viewed with a Cambridge Stereoscan Model 600 using either 7 or 15 kV.

Results

The appearance of proximal portions of the groove is the same in male and female specimens (Fig. 1A-1C). The only sexual dimorphism occurs along distal portions of the groove. In the female, the groove terminates distally into a few short branches on a slight bulge from

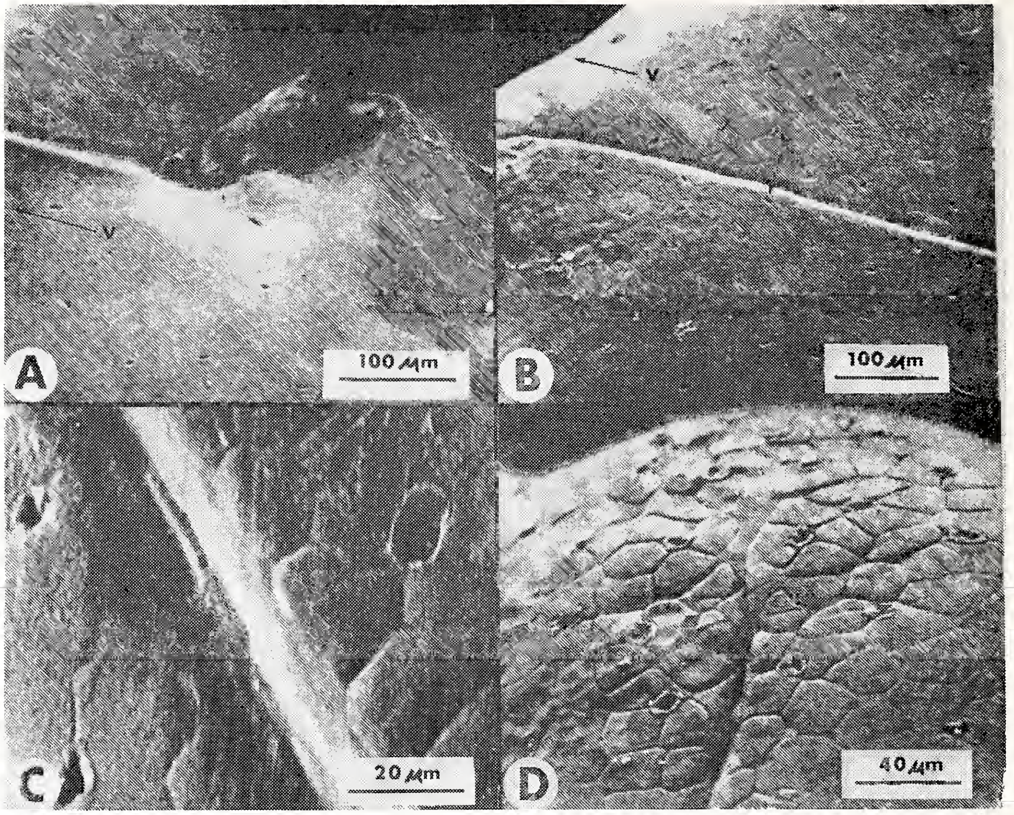

FIGURE 1. *Scanning electron micrographs of the nasolabial area of a female* Eurycea quadridigitata. *A. Naris, showing nasolabial groove passing from postero-ventral border. Bulge on posterior border of naris is the crescentic fold. B. Length of the nasolabial groove alongside head. Note the parallel row of nasolabial gland pores along each side of groove. C. Detail of nasolabial groove. Note the nasolabial gland pores along groove and modification of surrounding epidermal cells. D. Termination of the groove on lip. Note abundance of pores, hypertrophy of the epidermis, secretory product lining the pores, and the branching of the groove. P = pores of nasolabial glands, V = ventral.*

the upper lip (Fig. 1D). In the males, the groove extends the length of the cirrus (Fig. 2). As the groove terminates ventrally, it forks into four or five branches that span the width of the distal tip of the cirrus (Fig. 2B).

From the external naris to the lip, the nasolabial groove appears as a trough 20-30 µm wide (Fig. 1B-C). Depth of the groove could not be measured, but the depth appears similar to the width (Fig. 1C) except the forks at the distal end of the groove appear shallower (Figs. 1D, 2B and 2D).

Along the main portion of the groove between the external naris and the upper lip are six or seven regularly spaced pores on each side of the groove (Fig. 1B). These pores represent orifices of the nasolabial glands. Each pore is about 10-20 µm in diameter and does not differ in appearance from pores of mucous glands scattered over the epidermis (Fig. 1B-C).

The epidermis of the snout is smooth except along the border of the nasolabial groove where the epidermal cells appear relatively hyper-

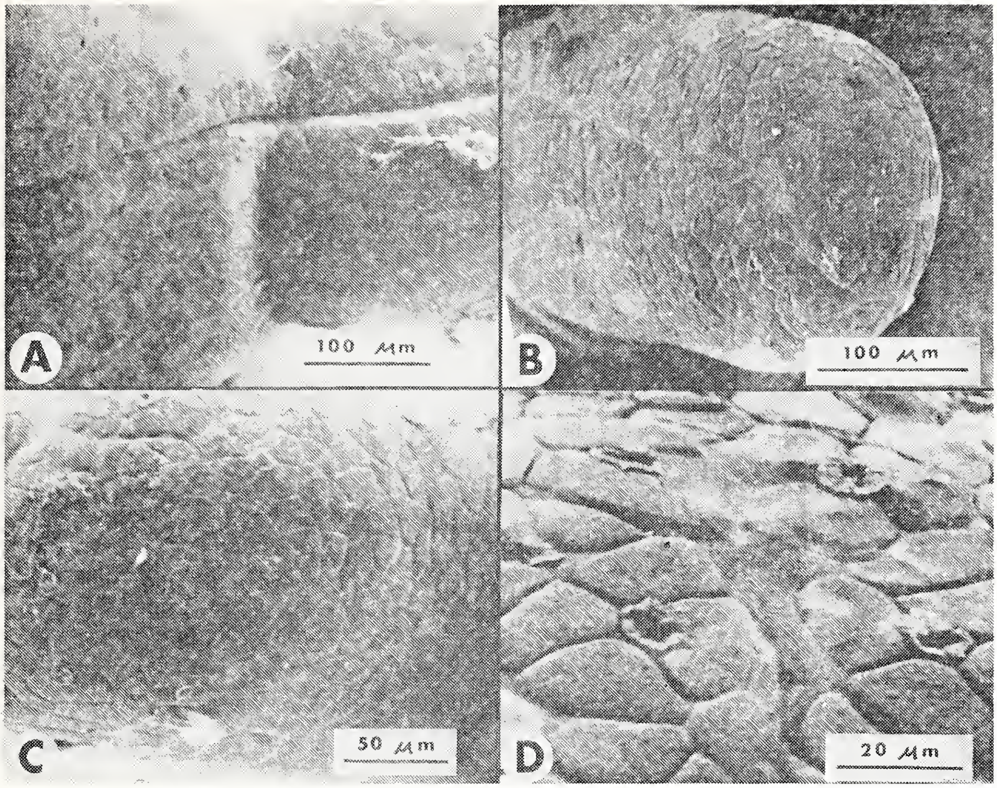

FIGURE 2. *Scanning electron micrographs of the nasolabial groove of a male* Eurycea quadridigitata. *A Nasolabial groove as it extends onto cirrus. B. Ventral tip of the cirrus. C. Side of the cirrus opposite to the nasolabial groove. D. Higher magnification of a terminal branch of the nasolabial groove showing hypertrophied epidermis and nasolabial gland pores lined with secretory product.*

trophied. These cells are raised and swollen, and the cell boundaries are quite distinct (Fig. 1C). In females, hypertrophy of the epidermis reaches its peak at the distal end of the groove, and orifices of the nasolabial glands are spread around the area (Fig. 1D). In the males, the epidermis of the entire cirrus is hypertrophied, and orifices of nasolabial glands are scattered over the surface of the cirrus although pores are especially concentrated along the most distal end of the groove and among the forks (Fig. 2).

A secretion product is present around the orifices of the nasolabial glands along the distal end and branches of the groove of the female (Fig. 1D) and around the pores on the cirri of the males (Fig. 2).

The crescentic fold, described by Whipple (4) as the external expression of a muscle involved in closing the naris, appears as a bulge on the posterior edge of the naris (Fig. 1A).

Discussion

My observations differ in two respects from those of Whipple (4) on *Desmognathus fuscus* and Brown and Martof (1) on 13 species of plethodontids including *Eurycea quadridigitata*. These authors stated that nasolabial gland pores are each situated on slight elevations. In my samples, the pores are not elevated above contiguous epidermal cells (see especially Fig. 1B, 1D and 2D). Also, Whipple (4) and Brown and Martof (1) reported that two orifices nearest the external naris are especially definite in location. One of these orifices is at the upper end of the crescentic fold and the other is on the ventral edge of the naris just anterior to the junction of the naris and the nasolabial groove. In *Desmognathus fuscus*, these two pores are associated with the most highly developed nasolabial glands (4). In my specimens, two such distinctive pores adjacent to the naris could not be definitely identified. Perhaps this is because the most highly developed and numerous nasolabial glands in *E. quadridigitata* are not those in the nasal region but those along the ventral border of the lip (3).

By tapping the nose on the substrate, the nasolabial groove transports chemicals in surface fluids to Jacobsen's organ (2). In *E. quadridigitata*, cirri are found only in sexually active males (3), and the nasolabial groove extends the length of the cirrus and extensively branches at the distal tip. It may be hypothesized that cirri are adaptations for perception of olfactory cues important in the breeding activities of male *E. quadridigitata*.

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