

## SHORT COMMUNICATION

# Glandular Areas Associated with the Male Genitalia in *Triatoma rubrofasciata* (Triatominae, Reduviidae, Hemiptera) and Other Reduviidae

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*In this paper, glandular areas associated with the phallus in Triatoma rubrofasciata are described and illustrated for the first time. The glandular areas lie in the membrane surrounding the articulatory apparatus. In order to unambiguously define the locality of the respective glandular areas, some features of the pygophore-phallus connection are redescribed. A possible functional context of the gland secretions is discussed. A preliminary study of several other Reduviidae implies that the described glandular areas occur in a wider range of taxa in this group.*

Key words: Reduviidae - Triatominae - exocrine gland - male external genitalia

During a study on external male genitalia in Reduviidae, staining with Chlorazol Black E and microscopic observation of genitalic structures revealed the presence of three areas of glandular units associated with the basal articulatory apparatus in *Triatoma rubrofasciata* (De Geer, 1773) (Triatominae, Reduviidae) originating from South India (Pondicherry State, Karikal, IX-63, P. S. Nathan) deposited in the American Museum of Natural History, New York. Glandular areas associated with the male genitalic segments in Reduviidae are known so far only from the description of "hypodermal glandular areas" in the intersegmental membrane of segments 8 and 9 by Barth (1980) in *Triatoma infestans* (Klug, 1834).

Descriptions of the pygophore and the phallus in Triatominae and other Reduviidae are abundant (Davis 1966, Jurberg 1977, Schaefer 1999), but these descriptions and illustrations largely fail to depict the interconnection of these two structures. In order to understand the exact position of the glandular areas described in this paper, a short description of this aspect of the pygophore-phallus-complex appears to be necessary.

For scanning electron microscopy of the glandular structures, the pygophore was macerated in KOH, cleaned in water with detergent, dehydrated, critical point dried, coated with gold and observed in a HITACHI S-4700.

*Interconnection of the pygophore-phallus complex in T. rubrofasciata* - The pygophore (segment 9; s9) in Heteroptera forms a sclerotised capsule which gives rise to the proctiger (segments 10 and 11) and the phallus

(basal articulatory apparatus (artap) + aedeagus (aed), with the ductus ejaculatorius (dej) entering the aedeagus through the articulatory apparatus) including the parameres (Fig. 1, proctiger and parameres not shown). In addition, in Reduviidae, the lateral pygophore rim possesses two pairs of infolding membranous lobes, the dorsal surfaces of which may be sclerotised. The dorsal and anterior infolding [closer to the "dorsal rim" sensu Schaefer (1999)] was termed "lateral infolding" by Schaefer (1999), and he referred to the ventral and posterior infolding [closer to the "ventral rim" (vrim) sensu Schaefer (1999)] as the "infolding of the ventral rim" (Fig. 1, only the posterior infolding shown; infvrim). Ventral to these folds, a membrane stretches between the rim of the pygophore and the basal articulatory apparatus (Fig. 1a, b), which I call the pygophore-phallus interconnecting membrane (intmemb). The epidermis which gives rise to the interconnecting membrane and the basal articulatory apparatus is here assumed to be continuous. The sclerites which comprise the basal articulatory apparatus [basal plates (bp), basal plate bridge (bplbr), ponticulus medianalis (pontmed), ductifer (duc), capitate processes (caproc), remotor apodemes (remapo), suspensory apodemes (suspapo)] may thus be described as heavily sclerotised areas of this membrane (Figs 1, 2). During dissection of the male external genitalia, the interconnecting membrane is usually ruptured which may explain why the glandular areas described below have not been described in the past.

*Description of glandular areas surrounding the basal articulatory apparatus in T. rubrofasciata* - KOH-macerated specimens of *T. rubrofasciata* were examined during this study. Therefore, only sclerotised parts of glandular secretory units were observed. These include a cuticular canal, a terminal knob-shaped receiving canal and a somewhat extended portion of the cuticular canal, between the receiving canal and the actual cuticular canal, which I call the saccule according to Farine (1987).

This project was carried out during an Anette Kade Fellowship at the American Museum of Natural History, New York. Fax: +49-(0)30-838-53916. E-mail: cweir@zedat.fu-berlin.de Received 27 January 2003 Accepted 30 April 2003

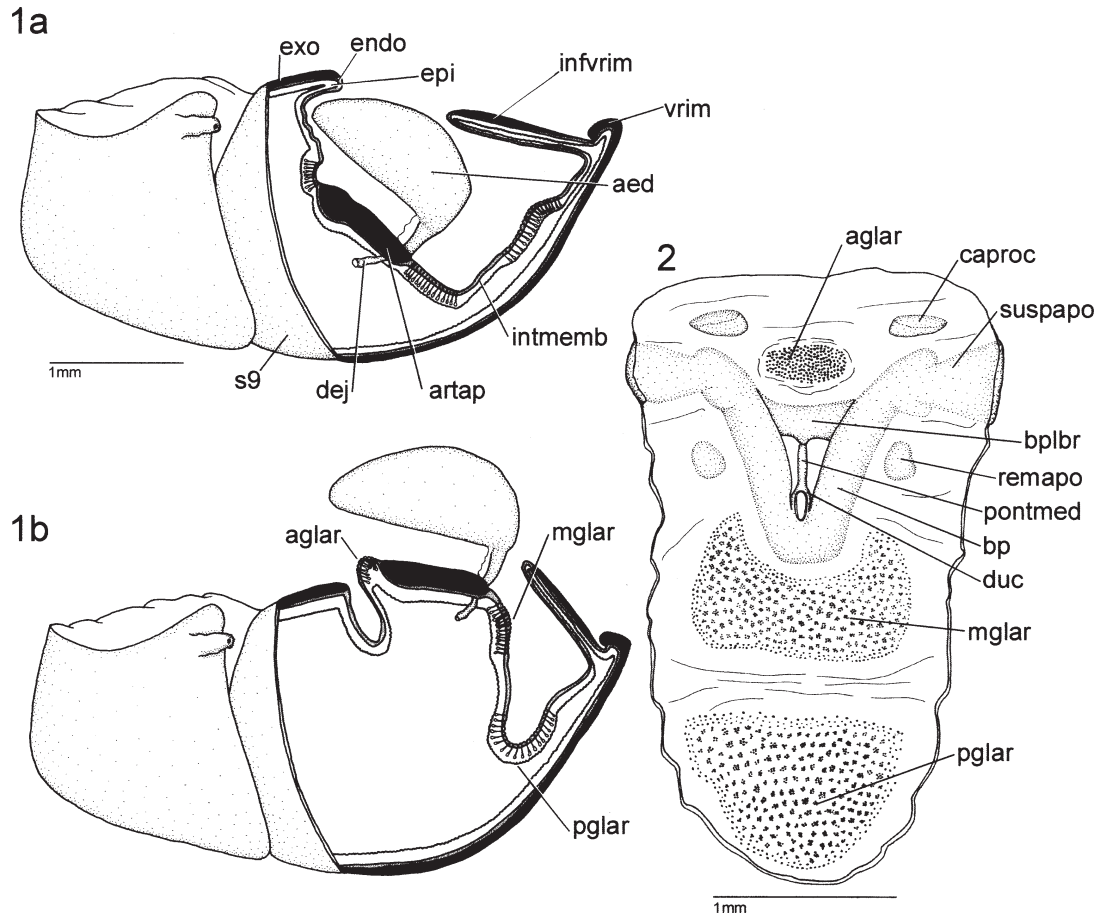
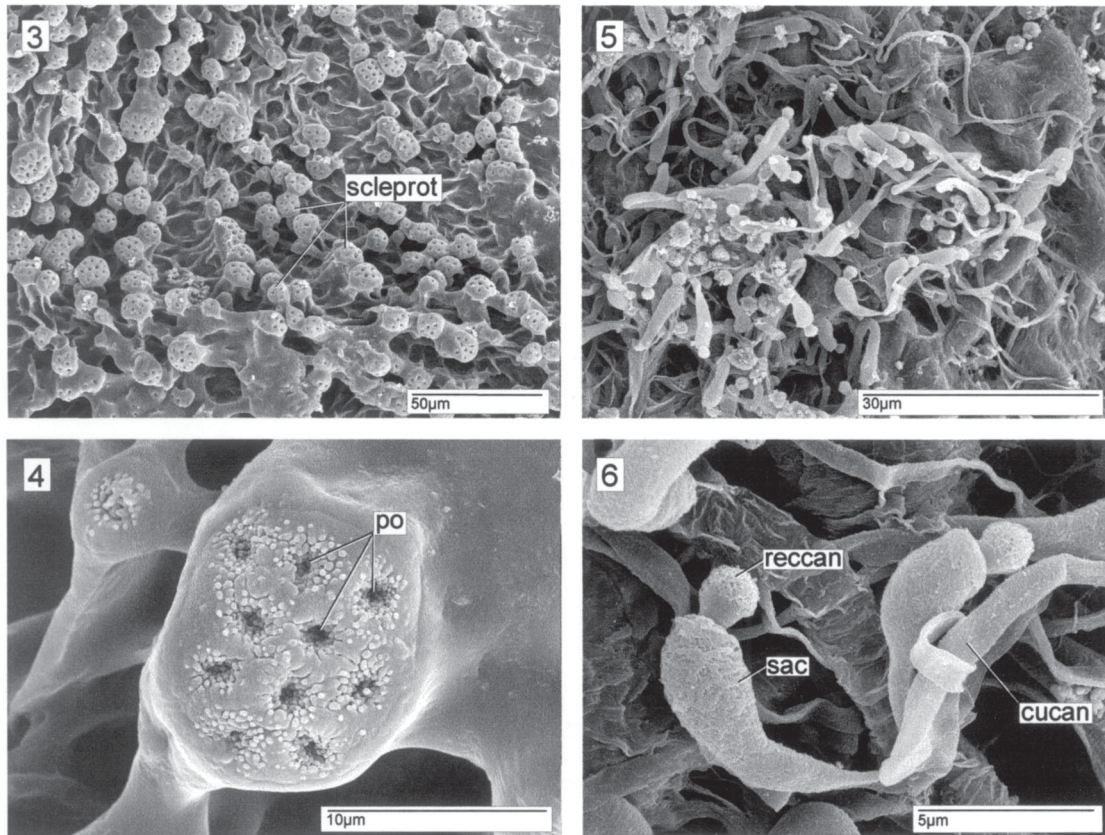


Fig. 1: paramedian optical section of pygophore and phallus in *Triatoma rubrofasciata*, (a) phallus in rest; (b) phallus slightly everted; black: exocuticle, dark grey: endocuticle, light grey: epidermis. Fig. 2: elements of the basal articulatory apparatus and the pygophore-phallus interconnecting membrane in *T. rubrofasciata* in frontal view showing the location of the glandular areas of the basal plate. Abbreviations: aed, aedeagus; aglar, anterior glandular area; artap, articulatory apparatus; bp, basal plates; bplbr, basal plate bridge; caproc, capitate process; dej, ductus ejaculatorius; duc, ductifer; endo, endocuticle; epi, epidermis; exo, exocuticle; infvrim, infolding of the ventral rim; intmemb, pygophore-phallus interconnecting membrane; mglar, median glandular area; pglar, posterior glandular area; pontmed, ponticulus medianalis; remapo, remotor apodeme; s9, segment 9; suspapo, suspensory apodeme; vrim, ventral rim.

Three well-defined glandular areas are present in the interconnecting membrane close to the basal articulatory apparatus, which I will refer to as anterior (aglar), median (mglar) and posterior glandular areas (pglar) according to their relative positions (Fig. 2). The anterior glandular area of the basal plate is located in the interconnecting membrane between the points of attachment of the suspensory apodemes, dorsal to the basal plate bridge (Figs 1, 2). Glandular units towards the margin of the glandular areas are equidistant from each other, with the pores located on individual sclerotised protuberances (sclerot), whereas the more centrally located units appear to be grouped: up to 15 units open on one large sclerotised protuberance (Figs 3-5). The sclerotised portions of each glandular unit comprise a small saccule (sac;  $\sim 8 \mu\text{m}$ ) with receiving canal (reccan;  $3.5 \mu\text{m}$ ) (Fig. 6), a cuticular canal (cucan) and a pore (po;  $2 \mu\text{m}$ ) surrounded by small tubercles (Fig. 4). The median glandular area of the basal plate lies in the interconnecting membrane ventral and posterior to the basal plates. The posterior glandular area

is separated from the median glandular area only by a stripe of membrane devoid of glandular units. The structure of the glandular units of both areas corresponds to those of the anterior glandular area, but the sclerotised protuberance are less densely spaced.

Barth (1980), in a detailed histological analysis, described paired glandular areas on the intersegmental membrane between segment 8 and 9 in *T. infestans*. I found these glandular areas also to be present in *T. rubrofasciata*. Furthermore, the glandular units illustrated by Barth resemble the glandular units of the interconnecting membrane with regard to shape and approximate size of the saccule and arrangement of glandular units. Barth (1980) thought the secretions of the glandular units were lubricants which facilitate the movements of the male external genitalia. However, this is not the only possible functional hypotheses for the glandular units between segments 8 and 9 (Barth's glandular area) and on the interconnecting membrane between segment 9 and the phallus (glandular areas of the basal plate).



Figs 3-6: scanning electron microscopies of pores and glandular units. Fig. 3. grouped pores of the median glandular area, 600x. Fig. 4. protuberance with several pores of the median glandular area, 5000x. Fig. 5. glandular units of the posterior glandular area, 1800x. Fig. 6. receiving canal, sac and cuticular canal of a glandular unit of the posterior glandular area, 8000x.

*Comment on a possible functional context of the secretions of the basal plate glandular areas* - An association of glandular structures with the external genitalia may imply a role in mate finding, mate recognition, or mating. Eversion of the phallus from the genitalic atrium formed by the pygophore appears to be necessary in order to fully expose the membrane onto which the glandular units open (Fig. 1a, b). This exposure may be a prerequisite for spreading the secretions. Eversion of the phallus occurs possibly before, and certainly during, copulation. Thus, its function in the context of mating – other than purely mechanical – may be pointed out as a possibility.

A literature survey on chemical ecology in Triatominae, including a summary of putative sex pheromones, was recently published by Cruz-Lopez et al. (2001). Fontan et al. (2002) gave behavioural evidence for the existence of male and female attractants in *T. infestans* and they discussed Brindley's glands and cuticular hydrocarbons as possible sources for components of this pheromone. However, the glandular areas previously described by Barth (1980), and those described in this paper in *T. rubrofasciata*, may present another possible source for a female attractant or stimulant.

*Preliminary observation on the systematic distribution of the basal plate glandular areas* - The glandular areas described in this paper are not restricted to *T.*

*rubrofasciata*, but also exist in other Reduviidae. A preliminary survey revealed them in species of Salyavatinae (*Salyavata*, *Petalochirus*), Stenopodainae (*Canthesancus*, *Ctenotrachelus*), Spaheridopinae (*Sphaeridops*), Vesciinae (*Vescia*, *Mirambulus*), Ectrichodiinae (*Nularda*), Harpactorinae (*Pristhesancus*), and Physoderinae (*Physoderes*). The glandular areas were not found in the single Pachynomidae, *Pachynomus picipes*, observed in this study.

#### ACKNOWLEDGEMENTS

To Randall T Schuh, American Museum of Natural History, New York, for his assistance during my visit and for commenting on the manuscript.

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