

19

Reproduction

1. Introduction

As was discussed in Chapter 2 (Section 4.1), an important factor in the success of the Insecta is their high reproductive capacity, the ability of a single female to give rise to many offspring, a relatively large proportion of which may reach sexual maturity under favorable conditions. As reproduction is almost always sexual in insects, there arise within insect populations large numbers of genetic combinations, as well as mutations, which can be tested out in the prevailing environmental conditions. As these conditions change with time, insects are able to adapt readily, through natural selection, to a new situation. Over the short term their high reproductive capacity enables insects to exploit temporarily favorable conditions, for example, availability of suitable food plants. The latter requires that both the timing of mating, egg production, and hatching, and the location of a suitable egg-laying site must be carefully “assessed” by an insect.

Like other terrestrial animals insects have had to solve two major problems in connection with their reproductive biology, namely, the bringing together of sperm and egg in the absence of surrounding water and the provision of a suitable watery environment in which an embryo can develop. The solution to these problems has been the evolution of internal fertilization and an egg surrounded by a waterproof cover (chorion), respectively. The latter has itself created two secondary problems. First, because of the generally impermeable nature of the chorion, structural modifications have had to evolve to ensure that adequate gaseous exchange can occur during embryonic development. Second, the chorion is formed while an egg is still within the ovarian follicle, that is, prior to fertilization, which has necessitated the development of special pores (micropyles) to permit entry of sperm.

2. Structure and Function of the Reproductive System

The external structure of male and female reproductive systems has been dealt with in Chapter 3 (Section 5.2.1), so that only the structure of internal reproductive organs will be described here.

2.1. Female

Functions of the female reproductive system include production of eggs, including yolk and chorion formation, reception and storage of sperm, sometimes for a considerable period, and coordination of events that lead to fertilization and oviposition.

Though details vary, the female system (Figure 19.1) essentially includes a pair of ovaries from each of which runs a lateral oviduct. The lateral oviducts fuse in the midline, and the common oviduct typically enters a saclike structure, the vagina. In some species the vaginal wall evaginates to form a pouchlike structure, the bursa copulatrix, in which

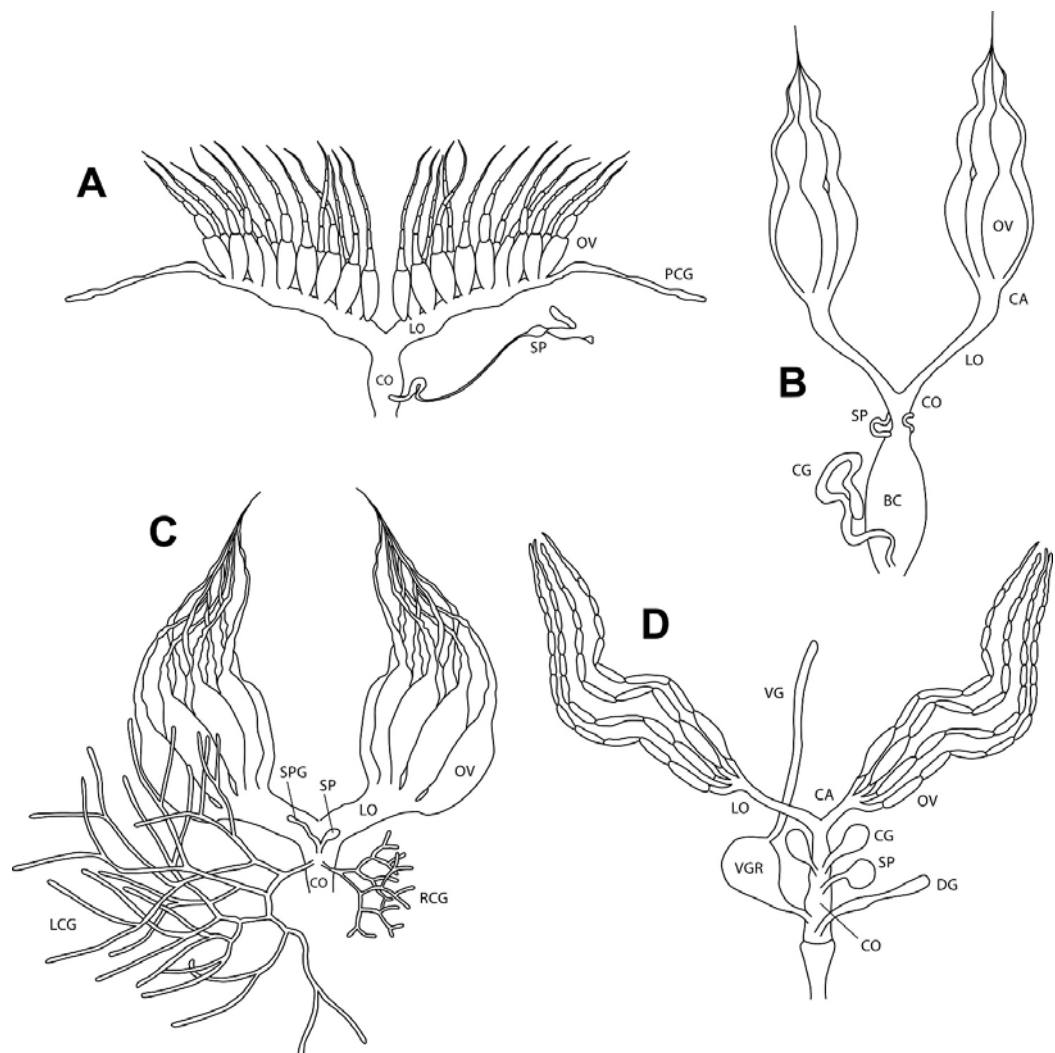


FIGURE 19.1. Representative female reproductive systems (not to scale). (A) *Melanoplus sanguinipes* (Orthoptera); (B) *Rhodnius prolixus* (Hemiptera); (C) *Periplaneta americana* (Dictyoptera); and (D) *Nasonia vitripennis* (Hymenoptera). Abbreviations: BC, bursa copulatrix; CA, calyx; CG, collateral (accessory) glands; CO, common oviduct; DG, Dufour's gland; LCG, left colleterial gland; LO, lateral oviduct; OV, ovariole; PCG, pseudocolleterial gland; RCG, right colleterial gland; SP, spermatheca; SPG, spermathecal gland; VG, venom gland; VGR, venom gland reservoir. [A, C, D, from C. Gillott, 2002, *Insect accessory reproductive glands: Key players in production and protection of eggs*, in: *Chemoecology of Insect Eggs and Egg Deposition* (M. Hilker and T. Meinert, eds.), By permission of Blackwell Verlag, Berlin; B, from R. P. Ruegg, 1981, *Factors influencing reproduction in Rhodnius prolixus* (Insecta: Hemiptera), Ph.D. Thesis, York University, Canada.]