

Scanning electron microscope study of the palar pegs of three species of Corixidae (Hemiptera)

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ABSTRACT. Scanning electron microscope studies were performed on the palar pegs of male forelegs of *Trichocorixa sexcincta*, *Sigara alternata* and *Hesperocorixa interrupta*. The studies showed the pegs to be basically conical and chevron-ridged, with a wide base that tapered off to a narrow apex. Clear species differences were apparent with respect to the size of the peg, the number of ridges on an individual peg, and the number and arrangement of the pegs on the pala. The possible behavioural and evolutionary significance of the palar pegs is discussed in relation to mating.

Introduction

The existence of a row of pegs on the pala, the single jointed anterior tarsus, has been noted in the males of all species of Corixinae. It was at one time believed to produce the sounds heard during mating. This theory was abandoned when von Mitis (1936; see also Butler, 1923) implicated the pars stridens in this function. Larsen (1938) suggested the peg row was used to grasp the female during copulation and Popham (1961) explained how this hold was achieved. First, the male darts to the back of the female and presses his flattened head against her pronotum. Then he extends his front legs sideways so that the 'distal pegs become caught under the curved longitudinal ridge of the lateral flange of the hemielytron' (Popham, 1961). This firm clasping permits the two sexes to swim around while *in copula*. Furthermore, Popham described the peg as composed of a 'circular base on which is a short peduncle supporting a larger conical structure'. The peg is not inserted perpendicularly but rather is slanted toward the centre of the pala.

Our study deals with three species of Corixinae collected in New Haven, Connecticut.

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It focuses on the microscopic characteristics of the palar pegs with respect to their behavioural and evolutionary significance.

Procedure

Specimens were maintained in water, and air-dried for several days before dissection and mounting. Species were identified using Hungerford's (1948) guide to Corixidae of the Western Hemisphere. The forelegs were taken off by inserting a dissecting needle into the region between the femur and thorax and snapping them off in a lever-like motion.

The scanning electron microscope used was the ETEC Corporation Autoscan with specimen stages up to 5 cm in diameter. Forelegs were secured to the stages by double stick tape and coated with gold-palladium to prevent 'charging'. Close-up photographs of the pegs were made at similar powers of magnification (1800× and 2200×) to facilitate interspecific comparison.

Results

Scanning electron microphotographs of the palae and the pegs revealed interesting distinctions between the species. As is well

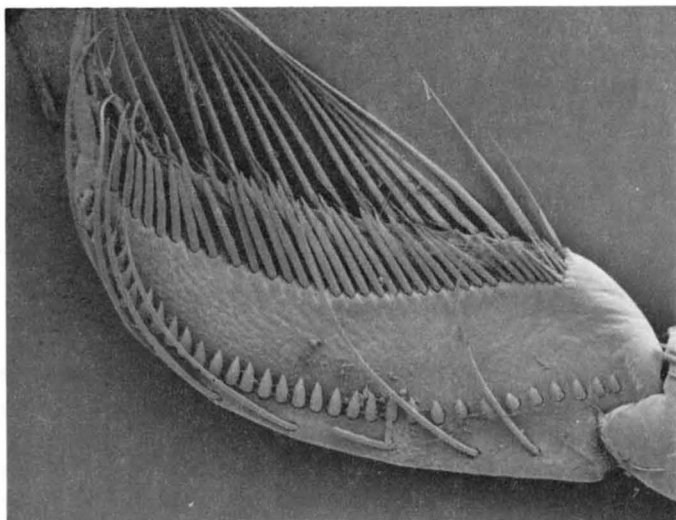


FIG. 1. Pala of *Sigara alternata*. X 150

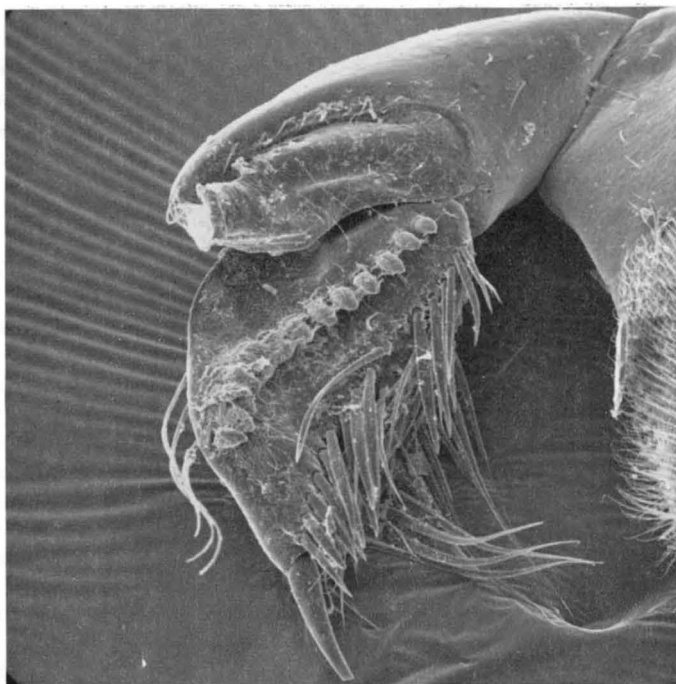


FIG. 2. Pala of *Trichocorixa sexcincta*. X 200

known (e.g. Hungerford, 1948), the peg row of *Sigara alternata* (Say) (Fig. 1) has about thirty-three pegs lying close to the dorsal margin. The much smaller *Trichocorixa sexcincta* (Champion) (Fig. 2) has fourteen pegs in the row, lying along the midline,

while the large *Hesperocorixa interrupta* (Say) (Fig. 3) has twenty-eight pegs lying slightly off the midline. The pegs appear as conical projections, but they are ornamented with an entirely unsuspected set of chevron-shaped ridges. On the squat

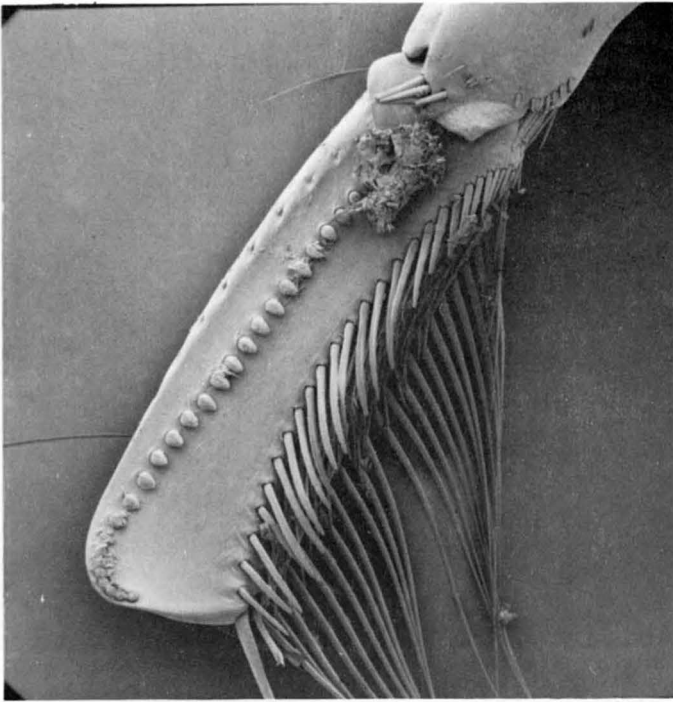


FIG. 3. Pala of *Hesperocorixa interrupta*. X 80

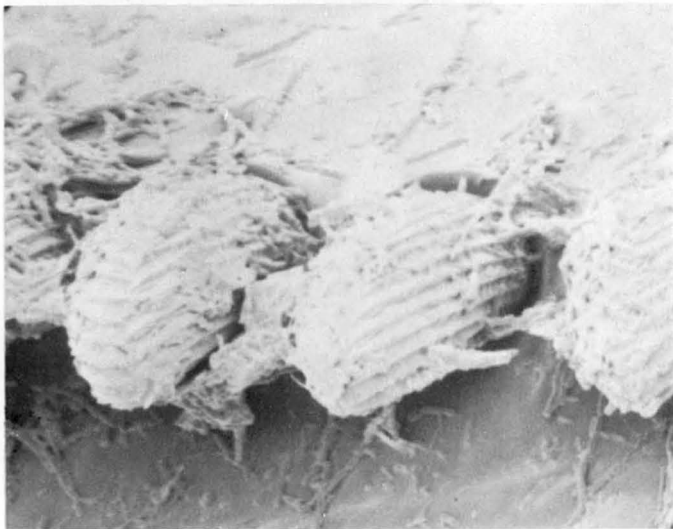


FIG. 4. Palar pegs of *Trichocorixa sexcincta*. X 2200

and stubby pegs of *H.interrupta*, the largest species, and of *T.sexcincta*, the smallest species studied, there are usually ten such ridges (Figs. 4 and 5 respectively), while on the slender, pointed pegs of *S.alternata*

there are thirteen to sixteen (Fig. 6). In some cases, the two sides of the chevron do not meet. In *H.interrupta* the eight most distal pegs are small and have reduced (four) ridges (Fig. 7). These small pegs probably

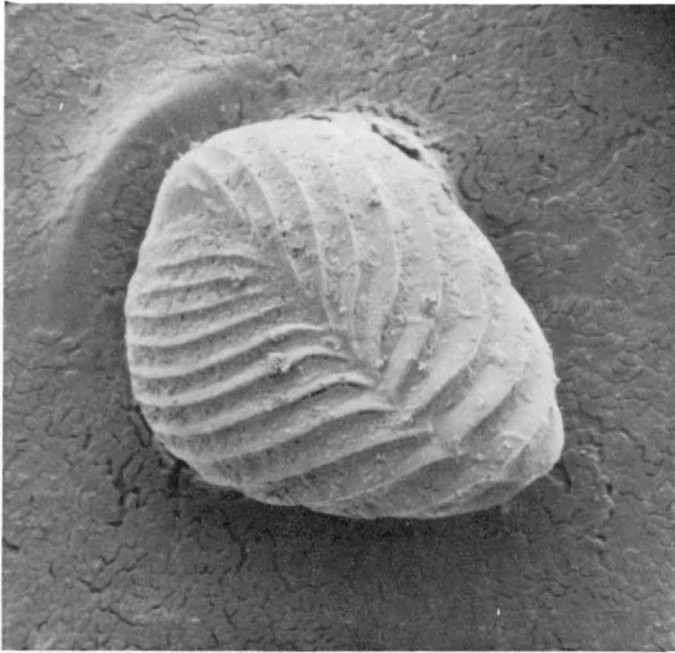


FIG. 5. Proximal palmar legs of *Hesperocorixa interrupta*, view from above. X 2200

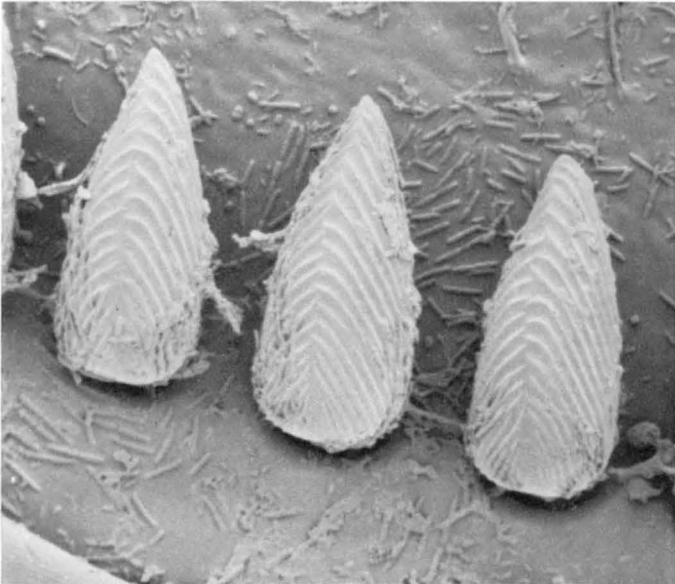


FIG. 6. Distal palmar legs of *Sigara alternata*. X 1800

are out of line when the pala is used in grasping the female, and thus of little functional significance,

Discussion

In the laboratory, pairs *in copula* both alive and instantaneously killed by boiling water,

were examined to determine the actual mating configurations. It was evident that the male has two separate methods of grasping the female. As he mounts the female, he splits his abdomen between the fifth and sixth segments on the side displaying the strigil. The female inserts her abdomen in the resulting

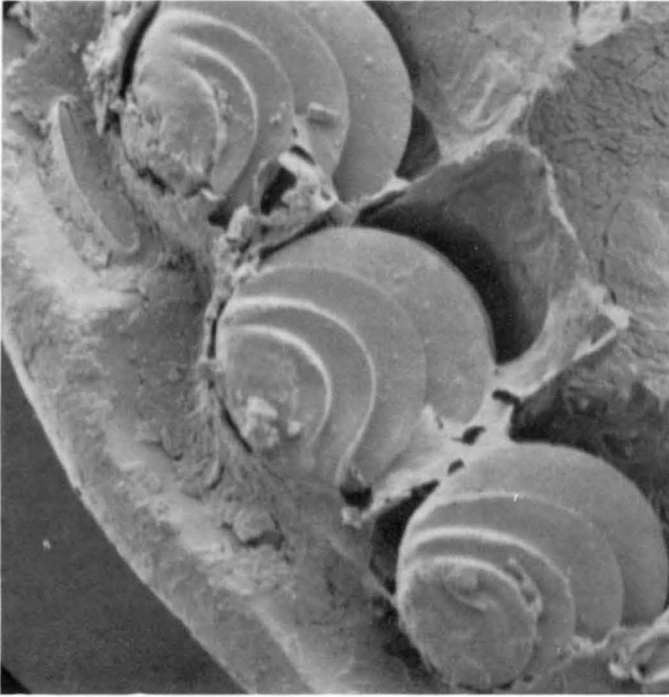


FIG. 7. Distal (vestigial) palar pegs of *Hesperocorixa interrupta*. X 2200

groove, so that the distal part of his abdomen is underneath hers and the strigil is in contact with her ventral side. Quite possibly, the male scrapes or strokes (moves the strigil back and forth across the female's abdomen) the strigil against the hard surface of the female's abdomen producing one of the sounds heard during mating. In *Micronecta*, King (1976) has found that the strigil is used in sound production by scraping the organ against the sharp, smooth edge of the fifth segment as part of the premating behaviour. It may be suggested that, as the stridulatory mechanisms of the front legs were developed, the strigil has evolved rather differently in the Corixinae.

In addition to the abdominal hold, the male grasps the female using his front legs. He slides the row of palar pegs into the lateral flange of the hemelytron. The pegs with ten to sixteen chevron-shaped ridges (sometimes rather asymmetrically aligned) may reasonably be regarded as increasing friction and therefore providing a firmer grasp of the female. This double hold securely attaches the female and allows the two to swim together while *in copula*.

Popham (1961) also suggested an evolutionary relation and explanation for the different arrangements and sizes of the pegs. He hypothesized that more primitive species have straight front legs (pala—tibia—femur) and a functional peg row which is parallel to and runs along the entire dorsal margin of the pala (e.g. *Hesperocorixa sahlbergi* (Fieb.)). In contrast, more advanced species (e.g. *Sigara distincta* (Fieb.)) have evolved a curved tibia which improves their filter feeding technique. In line with this change, they also have a characteristic arrangement of two types of pegs on their triangular curved pala. On the distal half of the pala, these pegs are fully developed (large and pointed) and chevron-ridged while on the proximal half they are vestigial and undeveloped.

Our findings corroborate and elaborate on Popham's theory. In observing *H. interrupta* and *S. alternata* (by coincidence two of the same genera considered by Popham) we noticed that the former species had a straight front leg and a rectangular pala with two types of pegs (Fig. 4): a long straight row of chevron-ridged pegs along the dorsal margin which are apparently used for grasping the

female (Fig. 5), and a small clump of less well differentiated semicircularly-ridged pegs at the distal tip which are out of line and probably not involved in grasping (Fig. 7). The other species, *S.alternata*, also had two types of pegs, but their arrangement is reversed. That is, the distal pegs are chevron-ridged and developed while the proximal ones are vestigial. This is undoubtedly a consequence of the curved tibia which now forces the proximal region of the pala out of line for grasping, leaving only the distal pegs of the pala functional for grasping (Fig. 1).

It may be suggested that differences in size, shape and arrangement of pegs on the pala are another part of species isolating mechanisms in corixids. Thus, if a male of one species attempts to clasp the female of another, his peg row will either not fit into the lateral flange of the hemelytron, or the pegs will be too large or too small to fit in comfortably.

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