

MICROSCOPIC EXAMINATION OF THE SPERMATHECA AS AN
INDICATOR OF MATING SUCCESS IN *PODISUS MACULIVENTRIS* (SAY)¹Jesusa C. Legaspi², Virginia Russell³ and Benjamin C. Legaspi, Jr.⁴

The insect spermatheca performs several functions essential to reproduction: it stores male spermatozoa, provides conditions which sustain sperm viability often over prolonged periods (Davey 1985), and in some species, enables the female insect to control the sex of her progeny by selective release of spermatozoa during fertilization (Gupta and Smith 1969). By studying the state of dilation of a spermatheca, it should be possible to determine the mating status of the female and therefore to assess the degree of mating success in field populations. Such studies can yield important insights into population dynamics of field populations, especially in species where the degree of mating success can be a key determinant in such factors as sex ratios, as in the Aphelinidae (Viggiani 1984).

No studies on the spermatheca of the spined soldier bug, *Podisus maculiventris* (Say) (Heteroptera: Pentatomidae) have been reported in the literature. The most closely related work is that of Huebner (1980) who used electron microscopy to examine changes in the spermatheca of *Rhodnius prolixus* Stål (Reduviidae) in females which were fed and mated, fed but unmated, and starved virgins. However, his interest was at the cellular rather than the population level of organization. He found that virgin females had cells which were more regularly arranged, microtubules less prominent and nuclei more elongated compared to mated females. Starvation induced cellular disorganization and reduced cell size and gland thickness.

The insect used in this study, *P. maculiventris*, is a generalist predator found throughout North America (Henry and Froeschner 1988) and known to feed on at least 75 prey species from 41 families and 8 orders. This species has also been found in such varied agroecosystems as soybean (McPherson et al. 1982), alfalfa and corn fields; and in other plant communities such as pine, hemlock, deciduous forests, shrubland and goldenrod. Much recent work has been conducted on various aspects of the biology of *P. maculiventris*, including effects of low predation rates on life history characteristics (Legaspi and O'Neil 1994, Wiedenmann et al. 1994) and searching behavior in the field and laboratory (Wiedenmann and O'Neil 1992). The purpose of this study was to develop a rapid and relatively simple method for assessing the mating status of *P. maculiventris* by studying the changes in the spermatheca induced by mating.

Ten females of *P. maculiventris* were dissected 24-48 hours after mating. Ten females that were not allowed to mate were also dissected. The spermathecae were removed and fixed in 0.1M phosphate buffer (pH 7.4) containing 4% (w/v) paraformaldehyde and 1% (w/v) glutaraldehyde, after which they were dehydrated in an alcohol series and mounted on slides with permount. The spermathecae were then examined and photographed with an Olympus Vanox-S light microscope. Representative spermathecae of unmated and mated females are shown in FIG. 1A and 1B, respectively. They were opaque and pale yellow in color. The spermathecae of mated females are larger than those of unmated females. Spermathecae from mated females measured 1848 μ (SE 241) as compared to 759 μ in unmated females (SE 87) ($t = 4.2$, $p < 0.05$). The peanut-shaped portion at the tip of the spermatheca is orange and is the same size in both mated and unmated females. Spermathecae from mated females are dilated and spherical in shape,

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whereas those from unmated females are elongate. We believe that this technique may be a promising method for assessing mating status in other Heteroptera, or related species collected from the field.

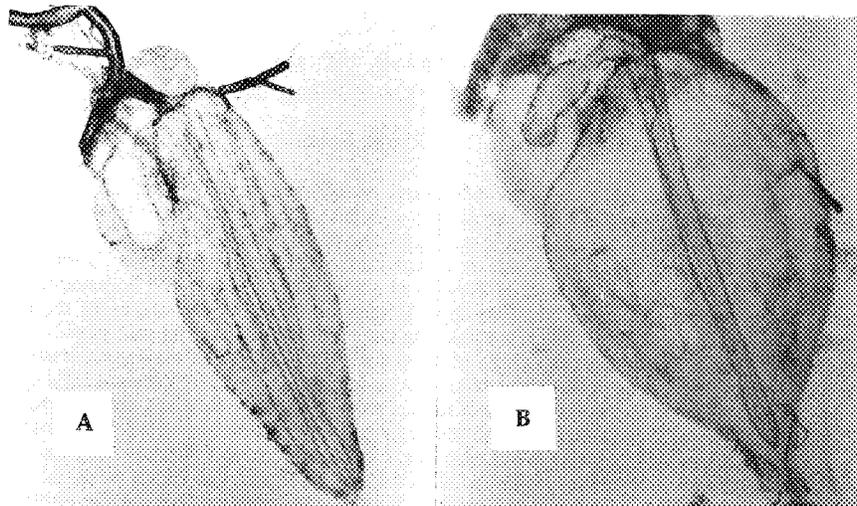


FIG. 1. Spermathecae of *Podisus maculiventris*. Note the greater dilation evident in the spermatheca of the mated female (B) relative to that of the unmated one (A). (65x)

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LITERATURE CITED

- Davey, K. G. 1985. The female reproductive tract. pp. 15-36 *In* G. A. Kerkut and L. I. Gilbert [eds.] *Comprehensive Insect Physiology, Biochemistry and Pharmacology*. Pergamon Press, Frankfurt.
- Gupta, B. L., and D. S. Smith. 1969. Fine structural organization of the spermatheca in the cockroach, *Periplaneta americana*. *Tissue and Cell* 1: 295-324.
- Henry, T. J., and R. C. Froeschner. 1988. *Catalog of the Heteroptera or True Bugs of Canada and the Continental United States*. New York: E. J. Brill, 958pp.
- Huebner, E. 1980. Spermathecal ultrastructure of the insect *Rhodnius prolixus* Stål. *Morphology* 166: 1-25.
- Legaspi, J. C., and R. J. O'Neil. 1994. Developmental response of nymphs of *Podisus maculiventris* (Heteroptera: Pentatomidae) reared under low numbers of prey. *Environ. Entomol.* (In press).
- McPherson, R. M., J. C. Smith, and W. A. Allen. 1982. Incidence of arthropod predators in different soybean cropping systems. *Environ. Entomol.* 11: 685-689.
- Viggiani, G. 1984. Bionomics of the Aphelinidae. *Ann. Rev. Entomol.* 29: 257-276.
- Wiedenmann, R. N., and R. J. O'Neil. 1992. Searching strategy of the predator *Podisus maculiventris* (Say) (Heteroptera: Pentatomidae). *Environ. Entomol.* 21: 1-9.
- Wiedenmann, R. N., J. C. Legaspi, and R. J. O'Neil. 1994. Impact of prey density and facultative plant feeding on the life history of the predator *Podisus maculiventris* (Heteroptera: Pentatomidae). *Thomas Say Publ. Entomol.* (In press).