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Production of Unisexual Progenies by the Sorghum Midge, *Contarinia sorghicola*^{1,2}

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ABSTRACT

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Mated females of the sorghum midge, *Contarinia sorghicola* (Coquillett) (Diptera: Cecidomyiidae), produce exclusively either male or female progenies. Unmated females deposit few eggs and produce no offspring. Production of single-sex progeny was not due to differential larval mortality of one sex.

The sorghum midge, *Contarinia sorghicola* (Coquillett), is a very serious pest of sorghum (Young and Teetes 1977). Females deposit eggs in flowering spikelets of the sorghum panicle and the larval and pupal stages are completed within an individual spikelet. The life cycle is completed in 14 to 16 days, which permits 9 to 11 overlapping generations per season (Harding 1965). Adult midges live only a few hours after emergence from the sorghum spikelet.

The occurrence of unisexual progenies (i.e., broods either exclusively male or exclusively female) was first recorded in gall midges in 1929 by Barnes (1931). Painter (1930) reported the existence of unisexual progenies in the Hessian fly, *Mayetiola destructor* (Say). Unisexuality is also known to occur in the closely related family Sciaridae (Metz 1925). In all these cases, reproduction is strictly bisexual, not parthenogenetic.

Materials and Methods

Clear polystyrene "clip-on" cages (3 by 3 by 3 cm) confined sorghum midges to field-grown flowering sorghum spikelets. Two circular openings cut in adjacent sides of the cages and covered with fine-mesh Lumite® saran screening provided ventilation.

Sorghum panicles were covered individually with saran sleeve cages before exertion from the flag leaf sheath to prevent oviposition by midges occurring naturally in the field. When panicles began to flower, these cages were removed and the smaller polystyrene cages were clipped around 25 flowering (susceptible to oviposition) sorghum spikelets. Sorghum midges were then introduced into the cages.

Cages were left attached to the sorghum panicle for 25 days, through adult emergence. Then cages were returned to the laboratory where the number and sex of each brood were determined. In each case, the number of recorded midges was adjusted to account for the introduced parent(s). Randomly selected spikelets were dissected at regular intervals to detect dead midges within the spikelets.

Over 8 weeks, 55 females were placed individually into clip-on cages. These females had been aspirated from nearby flowering sorghum panicles, and we assume they were mated because they were ovipositing.

Virgin males and females were used for infestations in a later experiment. Unmated adults were obtained by placing single infested sorghum spikelets in plastic vials fitted with cotton plugs and collecting isolated adults as they emerged. A virgin female was placed in each of the 25 cages, and in each of another 25 cages was placed an unmated male and an unmated female. Mating took place within the cage. After 25 days the cages were returned to the laboratory and adult progeny was counted and sexed.

Results and Discussion

Mated females produced either all-male or all-female progeny. The ratio of female-producing females to male-producing females was nearly 1 to 1 (33 to 32). The number of progeny in female broods (mean = 10.8), however, was slightly larger than the number of progeny in male broods (mean = 9.5). This resulted in an overall female-to-male ratio of ca. 1.14 to 1. A similar sex ratio (1.25 to 1) was reported constant through the season in field populations of sorghum midge by Baxendale (1980).

Virgin females produced no offspring. However, a few eggs were deposited in some cases.

These experiments were conducted over a wide range of environmental conditions during July, August, and September. It is unlikely that seasonal effects or varying environmental conditions account for the production of progeny of a single sex.

We extended the work another year. In 1980, individual mated females were placed on 50 sorghum and johnsongrass panicles, and in all cases only offspring of one sex were produced.

The mechanisms responsible for the production of unisexual progenies in sorghum midge are not clearly understood. Painter (1930) discounted differential death rates between the sexes of the Hessian fly as a mechanism of the unisexuality because both male and female progenies occurred in side-by-side experiments. We reasoned that if unisexual broods were the result of differential larval mortality, the number of dead midge immatures should approximate the number of surviving adults. But the number of dead immatures never approached that of the surviving adults. Metz (1938) showed that the production of unisexual progenies in *Sciara* resulted from the genetic make-up of the female parent.

Similar studies have not been conducted on the sorghum midge.

¹ Diptera: Cecidomyiidae.

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