COLONIZATION OF *CULICOIDES VARIIPENNIS VARIIPENNIS* FROM NEW YORK

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ABSTRACT. The northeastern form of *Culicoides variipennis,* which has been thought unlikely to be colonized, was colonized. All populations of this species throughout its range probably possess to a greater or lesser degree the characteristic of mating in a confined space rather than requiring swarming for colonization.

The northeastern form of the biting midge, *Culicoides variipennis* (Coquillett), is generally believed (Downes 1978, Wirth and Jones 1957) to comprise the single species or subspecies *C. v. variipennis* Wirth and Jones. A single female from Virginia was selected as lectotype by Wirth and Jones (1957). Downes (1978) stated that this northeastern form does not lend itself to colonization because it requires the sustained flight achieved in swarming and will not mate in a confined space.

This paper reports the successful colonization of *C. v. variipennis* from New York, which occurred through mating in the confined space of colony cages, and further reports colonization from P (parent)– to F_1- generation adults rather than from P field-collected immatures as previously reported by Jones and Foster (1978).

METHODS

Females of *C. v. variipennis,* which were not separated into parous and nulliparous forms, were aspirated from CO_2-baited light trap catches of live insects taken in a pastureland community, Tompkins Co., New York. They were held 1–4 days on 10% sugar solution and water before shipment from Ithaca, New York to the Denver laboratory. Flies were shipped lightly chilled in ½-pint (8.5 diameter × 4 mm high) Sealright® containers modified by replacing the lid with fine-mesh nylon organdy and inserting a 2-dram vial of water plugged with a section of cotton dental roll into the side of the carton. Cartons were wrapped in damp cloth, packed in styrofoam shipping containers, and shipped via air mail courier service. Females were usually placed for membrane feeding on a blood-virus mixture on the same day they were received in Denver.

Colonization was achieved as part of vector-competence studies with *C. variipennis* and bluetongue virus (Reviewed: Jones and Foster, 1978). Adults were held in small cages (8.5 diameter × 4 mm high) that did not allow mating through swarming. Females were given a single blood meal (9 parts defibrinated normal sheep blood: 1 part bluetongue virus) and held 10–14 days. Females that took at least a moderate blood meal were set up for subsequent virus assay. The eggs deposited were handled by procedures normal to colony maintenance (Jones et al. 1969), and eggs were stored up to 10 days at ca 8°C before use. The ascending growth rate for the colony was calculated as the number of F_2 eggs deposited divided by the number of F_1 used (Jones and Foster, 1978).

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RESULTS

A colony (coded CS. 032) was established (Table 1) in the F_2 with the use of 200 of the 270 F_1 eggs deposited by 2–4 females. The successful colonization attempt was from the combined F_1 pupae derived from 6 closely spaced shipments because of the small numbers of F_1 pupae. Mating was commonly noted in colony cages of early generations. The colony was established readily as shown by a strong ascending growth rate of 10.8 from the F_1 to the F_2. Mortality in holding P flies was usually low and all populations of P flies deposited at least a few eggs (Table 1).

DISCUSSION

The species *C. variipennis* apparently normally mates through swarming, but populations also possess to a greater or lesser degree the characteristic of being able to mate in a confined space (stenogamy). Jones and Foster (1978) re-

Table 1. Colonization data for *C. v. variipennis*, 1978.

Population Code[1]	Number of: Blood-fed females alive at test, Start	Blood-fed females alive at test, End	Estimated eggs deposited	Pupae recovered
CSP. 011. 001	42	6	115	6
CSA. 011. 001	1	1	0	
CSP. 024. 001	47	22	150	73
025. 001	39	23	60	36
027. 001	63	31	50	10
028. 001	35	27	50	21
030. 001	73	43	35	20
032. 001	45	28	50	17
	302	174	395	177
CSA. 032. 002	20	9	0	
003	21	16	0	
005	32	15	270[2]	
	73	40	270	190
CSB. 032. 001	10	8	380	
002	13	12	475	
005	43	29	1300	
007	2	1	0	
	68	50	2155	—
CSP. 034. 001	55	20	650	387
CSA. 034. 001	2	2	0	
002	11	8	0	
004	42	32	0	
005	33	26	0	
006	13	6	0	
	101	74	0	

[1] Computer code for field populations: "C" refers to field populations, "S" refers to populations shipped from Cornell, and the third digit refers to generations (P=parent, A=F_1, B=F_2, etc.). The second set of 3 digits completes a 6 digit unique number that refers to the chronological acquisition of field populations from an investigator. The third set of 3 digits refers to small cage numbers as cages of flies are used in the laboratory at each generation level.

[2] Inadvertent discard of the second egg batch of 70 eggs.

ported that some field populations of *C. variipennis* are easily colonized, and that successful colonization depended on whether a population possessed this characteristic of mating in a confined space rather than requiring swarming for mating. They gave data for the colonization of 4 populations (Texas, Idaho, and two from Kentucky). The two from Kentucky were colonized with difficulty: P-generation mating was not seen in colony cages, few P females oviposited, and the ascending growth rate was low for early generations; mating swarms were commonly seen near one larval site from which larvae were used for colonization. In contrast, the colony from Idaho was colonized easily and P-generation mating was observed in colony cages. After many unsuccessful attempts, a colony was established in 1978 from a population from Colorado (Jones, in manuscript).

Numerous efforts have been made in the past 22 years to colonize field populations of *C. variipennis*. Most of these were unsuccessful (Jones, in manuscript), apparently largely because the populations used (Texas, Colorado, Oregon, etc.) did not possess to a sufficient degree the characteristic that allowed mating in the confined space of colony cages. It now seems evident that any population of *C. variipennis* in its geographic range may be stenogamous.

The use of live-collected adults for colonization studies rather than adults reared from a discrete larval site as has been done in the past (Jones and Foster, 1978), may be a useful procedure for the colonization of *C. variipennis*. A large percentage of field-collected adult females can be expected to be inseminated, so a primary problem is whether they will oviposit under the colonization conditions imposed. Females from all field populations used thus far have readily taken a blood meal in the laboratory. In all cases for the populations from New York (Table 1), at least a few fertile eggs were obtained from P-generation adults and these eggs produced F_1 pupae. However, in only one of two instances (a third with only six F_1 pupae) were F_2 eggs produced by mating between F_1 adults, and this single instance occurred in only one of 9 cages of flies. Thus, there are 2 important advantages to using live-collected adults for colonization studies. First, with F_1- rather than P-generation females, flies are used where the population is already partially adapted to laboratory rearing conditions. But more important, the use of live-collected females can be expected to provide a composite of populations as defined by discrete larval sites. Thus, the heterogeneity of the "collected" population and the probability of stenogamy may be increased.

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