VEGETATIVE BARRIERS INFLUENCE FLIGHT DIRECTION OF SALTMARSH GREENHEADS

N. O. MORGAN[1] AND R. P. LEE[1]

Chemical and Biophysical Control Laboratory, Agricultural Environmental Quality Institute
Agricultural Research Service, U. S. Department of Agriculture
Beltsville, Maryland 20705

ABSTRACT. A dense wall of tall bushes and reed grasses that separates the salt marsh breeding grounds of greenhead tabanids, *Tabanus nigrovittatus* Macquart, from recreational seashore areas is an effective fly barrier. Gaps in the vegetative barrier are travel routes for greenheads. New Jersey box traps placed in or near the gaps attracted many of the flies moving through these gaps.

The saltmarsh greenhead, *Tabanus nigrovittatus* Macquart, is an important pest of men and animals at the seashore of the mid-Atlantic states. The fly is especially attracted to sunbathers whom it even pursues into the surf, and, unfortunately, it is present from June to late September.

The studies reported here were conducted during 1975 at Assateague State Park, Maryland, where maximum abundance of *T. nigrovittatus* occurs in August, to determine the effect of dense, tall, vegetative barriers on saltmarsh greenhead flights between the marshes and the recreational seashore areas. At the same time, the New Jersey box trap was further evaluated as a greenhead survey/control device. A site was selected for study because it had predictable high populations of saltmarsh greenheads and also had vegetative and topographic features. If a combination of vegetative barriers and correct placement of effective fly traps reduced the incidence of biting fly attacks at this recreational area, the technique might be used in similar areas to protect livestock.

In 1973 E. P. Catts, medical entomologist of the University of Delaware, described in a personal communication the responses of saltmarsh greenheads to dense walls of tall reed grasses. The flies were observed flying around but never through the vegetative barrier. Schultze et al. (1975) placed a solid barrier across a road used as a flyway by greenheads and observed the flies going around rather than over the barrier. They also described tabanid flights around hedges rather than over or through them.

The trap we selected was the New Jersey box trap. Bracken et al. (1962) observed tabanid attraction to silhouettes painted glossy black, and Roberts (1970) collected greatest numbers of Mississippi tabanids in light-colored Malaise traps. However, both agreed that numbers of tabanids increased with the degree of contrast between the trap and background. Other structural features of traps were shown by others to affect trap performance in collections of this species. For example, Hansens et al. (1971) described several trap types for controlling saltmarsh greenheads in New Jersy and reported that the box-on-legs Manning trap captured the greatest number of flies. More recently, Uebel (1974) compared 6 horse fly traps for efficacy at coastal and inland sites of Maryland. He found that a modified Manning trap (renamed New Jersey box trap) with all black exterior and white interior was most effective for capturing greenheads on Assateague Island. We therefore used the black exterior trap to contrast with the light-colored sand background of the study area.

MATERIALS AND METHODS

TEST AREA. Assateague Island (53 x 0.5-1.6 km) is a portion of the Atlantic Coast barrier reef. Extending the length

[1] Current laboratory: Biological Evaluation of Chemicals Laboratory, Agricultural Environmental Quality Institute, Agricultural Research Service, USDA, Beltsville, Maryland 20705.

of the island and separating the salt marshes from the beaches is a natural vegetative barrier of conifers, evergreen bushes, and tall reed grasses. Where the line of vegetation has not been disturbed for > 5 yr, it is very dense and reaches heights of 3.5-5 m. However, this barrier has been interrupted in many locations by installation of drainage ditches; by the wild horses (Chincoteague ponies) that wander across the island; by people seeking blue crabs in the salt marsh, drainage ditches that create 1- to 3-m wide lanes through the brush; and by public utility rights-of way, barren lanes 10-20 m wide. Preliminary research suggested that these gaps in the wall had become greenhead flyways for flies moving from the marshes through the barrier to the recreational areas. An unpaved north-south road borders the beach side of the barrier, but recent remedial plantings of tall reed grass at the barrier end of drainage ditches have improved the vegetative barrier along the road.

Assateague State Park is located 10-14 km from the north end of the island where the salt marsh is 300-400 m wide, the vegetative barrier is 10-30 m thick, and the seashore recreation area is ca. 300 m wide (includes an improved sand dune that separates the camping area from the beach). Warm-blooded animals other than humans that are available for greenhead blood meals include: the sika deer, *Cervus nippon* Temmick; raccoon, *Procyon lotor* (L.); cottontail, *Sylvilagus floridanus* (J. A. Allen); rice rat, *Oryzomys palustris* (Harlan); white-footed mouse, *Peromyscus leucopus* (Rafinesque); and the Chincoteague pony.

The fly trap locations shown on the map (Fig. 1) were selected to measure the effect of interruptions in the barrier on greenhead flights. All 24 traps were placed on the beach side of the road, 7 (gap traps) in line with low vegetation, obvious lanes, and gaps through the vegetative barrier. The remaining 17 traps (barrier traps) were located opposite dense, tall vegetation. The area between the road and beach was mainly flat and grassy, but there were scattered sand dunes, small clumps of reed grass, and interlocking groups of bayberry bushes > 3 m tall. All traps were > 3 m from the nearest large bushes or reeds and would be plainly visible to flies cruising at elevations > 0.5 m.

TRAPS. The New Jersey box trap used was a 61-cm cube with 4 rigid sides of 1-cm-thick plywood; the top was 18 mesh aluminum screen. Two doors in the sides made possible periodical removal of captured flies; screen door latches were used to secure the doors. The trap was painted black on the outside and white inside. Within the trap an inverted "V" of aluminum screened from the 2 sides with doors to 5 1-cm-diam fly entry ports spaced 10 cm apart along the apex. The distance between apex and top was 10 cm. Flies attracted to the box moved up from the underside of the trap through an entry port into the trap where they either died or were killed by a weekly application of pyrethrins. Traps were mounted 90 cm above the ground or > 10 cm above the salt grasses and wildflowers common to the test area.

Flies were removed from the traps weekly, and the catch for each trap was sorted, counted, and recorded. Minutes before the flies were removed from a trap, a 4-5 sec burst from a pyrethrins aerosol bomb was applied to the trap contents to insure that all flies were either dead or stunned so none could escape.

RESULTS AND DISCUSSION

The 7 gap traps placed directly opposite lanes or gaps in the vegetative barrier were much more effective than the other 17 traps in capturing greenheads. According to the analysis of variance, the difference between the collections in the 2 types of trap sites was highly significant. The number of flies taken per trap per day averaged 5.6 (range of 2.11-16.48) for the barrier traps and 41.12 (range of 25.45-63.14) for the gap traps.

The gap trap that consistently had the greater catch was located on a sand dune about 1 m higher than the adjacent traps. Scattered small dunes and clumps of ever-

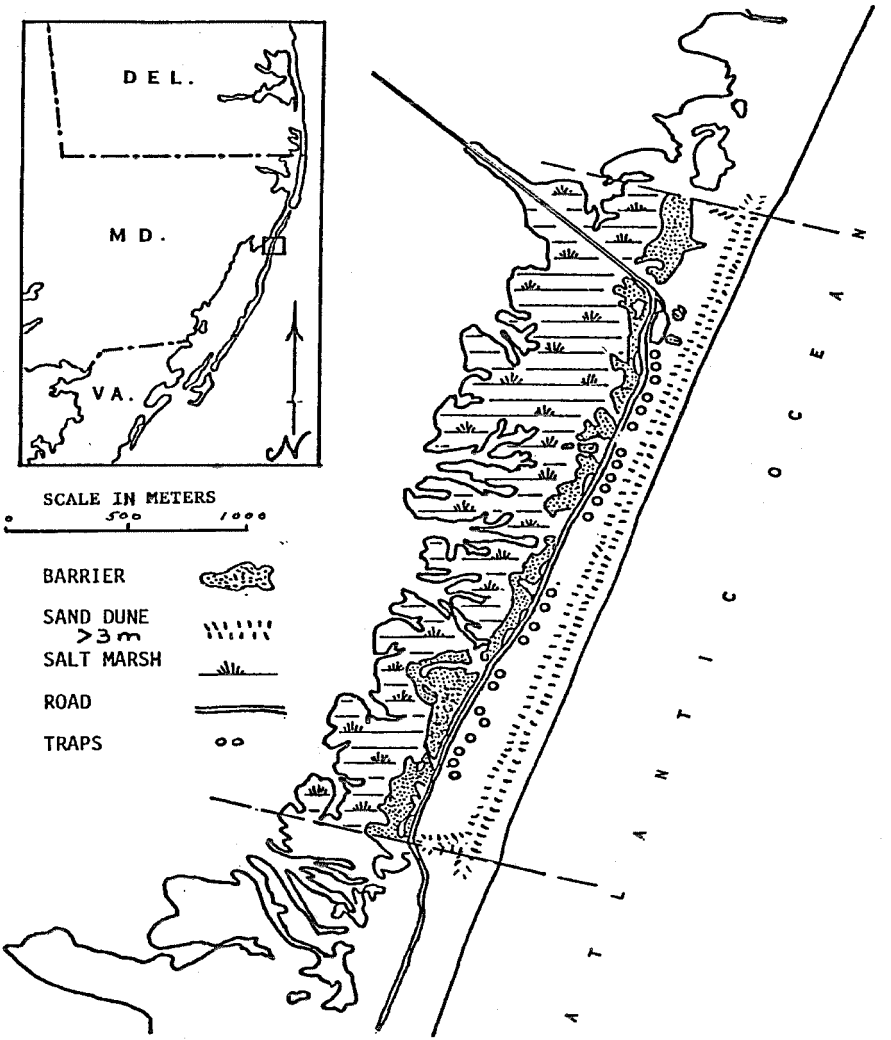

Fig. 1

Fig. 1. Map of Assateague State Park, Assateague Island, Maryland showing relationship of trap sites to salt marsh, vegetative barrier, and the recreational sand dune-beach area.

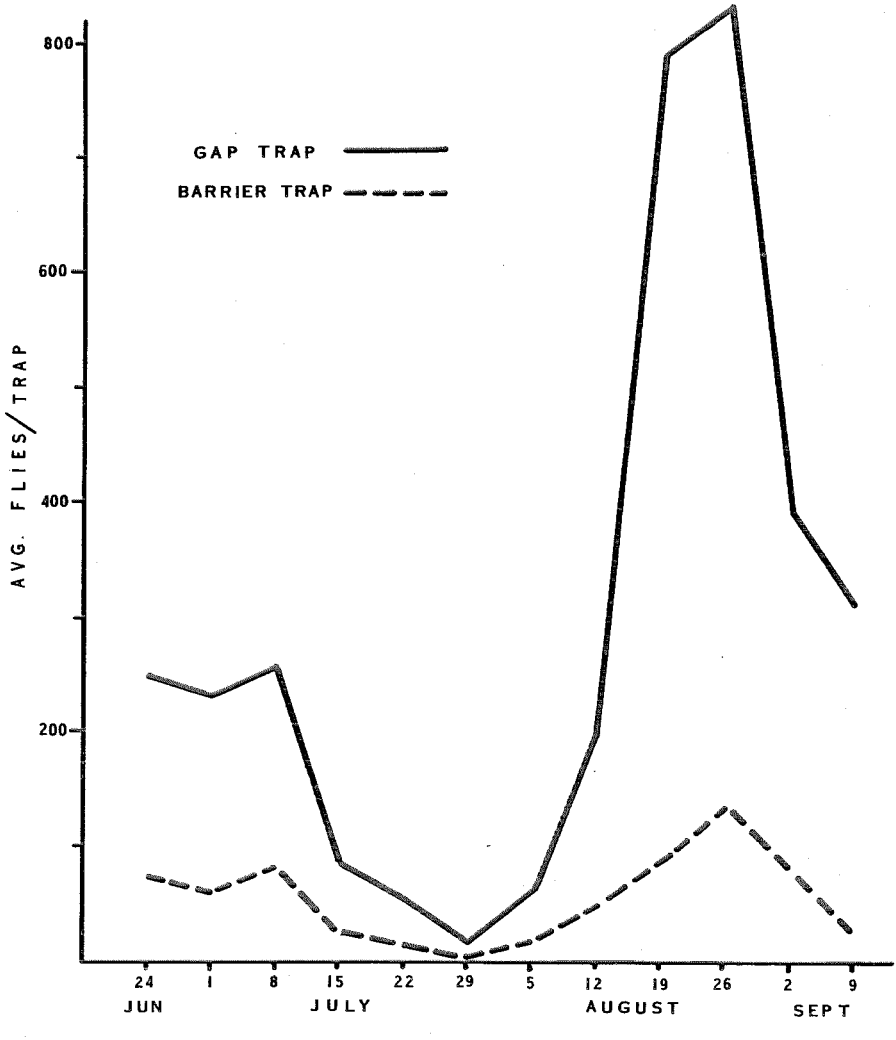

Fig. 2.

Fig. 2. Seasonal abundance of saltmarsh greenheads measured by weekly catches in New Jersey box traps placed either by barrier gaps or by effective barriers.

green shrubs were 10-15 m north and south of the trap, and the vegetative barrier opposite consisted of shrubs < 2 m tall that extended for 30-40 m.

Another effective trap was located at the confluence of 2 lanes from a new road under construction that paralleled the existing road but extended along the west edge of the vegetative barrier. The new road had created a north-south lane that apparently attracted tabanids seeking a way through the barrier and channeled them towards the lanes leading to the trap. The vegetation between the 2 roads was dense and very tall, and the only openings for 60-70 m on either side of the trap were the 2 lanes that passed around a pumphouse and converged across the main road opposite the trap. The 5 other gap traps were directly opposite obvious lanes through the vegetation.

As in previous years of greenhead trapping at Assateague State Park, the fly populations peaked twice in late June and in mid-August (Fig.2). During the July slump (July 8–29), the weather was similar to that in previous years: (the daily maximum air temperature ranged from 23 to 30.6°C; the minimum ranged from 17.2 to 22.2°C; and 157 mm precipitation fell during 10 days (ranged 1-33 mm/day).

From our results, vegetative barriers must be continuous to be seemingly effective because gaps 0.5-1 m wide or low growth apparently are rapidly found by greenheads. Areas where barriers are 1-2 m high are as ineffective as no barriers. Tall reed grasses should be included more often in barrier plantings since these grasses mature rapidly (are 2-3 m tall by the beginning of the greenhead season), reproduce easily in the Maryland salt marshes, and develop a very dense vegetative clump that is practically impenetrable by greenheads.

The influence of dense, tall, vegetative barriers on greenhead flights between 2 separated areas can be shown by comparing fly catches in 3 pairs of adjacent traps (3 gap traps, A, B, and C versus 3 barrier traps a, b, and c). Traps A, B, and C were opposite obvious gaps in the barriers; traps a, b, and c were within 10 m of traps A, B, and C but were shielded from the line of sight through the gaps. In each instance the barrier was < 3 m tall, 7-15 m deep, and extended < 40 m from the gap. The average weekly trap catches were 442.0, 222.4, and 372.9 for traps A, B, and C, respectively, as opposed to 24.4, 22.5, and 15.3 for traps a, b, and c, respectively. These data support that of Schultze et al. (1975) in that the dense barrier definitely influences flight patterns of the saltmarsh greenhead. Still some flies may go over barriers if no gaps are found.

A combination of greenhead reaction to barriers that interrupt flight paths and the strategic placement of box traps, perhaps baited with CO_2, may be effective in deflecting or reducing greenheads and perhaps other diurnal, haematophagous Diptera breeding in salt marshes from recreational areas or pastures of livestock.

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