

OBSERVATIONS ON FLIGHTS OF RELEASED TOBACCO
HORNWORM MOTHS, *MANDUCA SEXTA* (JOHANNSON)
ORDER LEPIDOPTERA; FAMILY SPHINGIDAE¹

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When released over water, tobacco hornworm (*Manduca sexta*) moths flew with the wind, even at wind speeds of 4.8 to 8.0 km/hr. The moths flew toward cover only when released within about 7.6 m from the cover. When coming to rest the moths sought shaded sites. Flight take-off was not inhibited by rainfall, and the moths were able to lift from the water surface after falling onto it. The moths made over-water flights in escaping from an island.

During the summers of 1967 and 1968 observations were made on the flight behavior of tobacco hornworm (*Manduca sexta*) moths released from captivity. The observations were aimed at obtaining information on the extent of orientation of the moths with wind and toward concealing cover, the extent of initiation of flight during rainfall, the ability of the moths to lift from water surface, and the incidence of over-water flights of the moths. The study was made on Hatteras Island and on Roanoke and Pamlico Sounds in eastern North Carolina. The research reported in this paper was part of a study seeking information aimed at control of the tobacco hornworm moth by the sterilization-release method.

METHODS AND MATERIALS

The moths used in the tests came from both field-collected and laboratory-reared larvae. Releases were made on days following emergence of the moths from the pupal stage. The moths were transported in cages by boat to release sites over water and by automobile to those on land. The releases usually were made by allowing the moths to fly from open cages. In the tests of the ability of moths to lift from the water surface, the moths were emptied from cages onto the water surface. The moths were marked by spraying them with paint from a pressurized can. A test to determine whether the moths would make over-water flights in escaping from an island involved the release of 4,183 marked moths on Hatteras

Island. A total of 5,463 moths was used in the tests. In an effort to recapture the moths, 36 blacklight traps were operated on Hatteras Island, and one was operated on Gull Island in Pamlico Sound, 3.2 km from Hatteras Island. The traps on Hatteras Island were powered with gasoline-operated generators, and the one on Gull Island was battery-powered. Otherwise, the traps were of the type described by Stewart and Hart (1967). Measurements of wind speed were made with an anemometer.

RESULTS AND DISCUSSION

Orientation relative to wind.—Of 519 moths released when the wind was blowing 16.0 to 19.3 km/hr, 386 (74.4 percent) flew approximately with the wind, 98 (18.9 percent) flew across the wind, 35 (6.7 percent) flew to shore without flying high enough to be exposed to the full force of the wind. Of 316 moths released when the wind was blowing 4.8 to 8.0 km/hr, 254 (80.4 percent) flew approximately with the wind, 42 (13.3 percent) flew across the wind, 20 (6.3 percent) flew against the wind. The moths thus showed a strong tendency to fly with the wind even at the relatively low wind speed of 4.8 to 8.0 km/hr.

Orientation relative to concealing cover.—Of 42 moths released over water about 30.4 m from Roanoke Island, 6 (14.3 percent) flew toward Roanoke Island, and 36 (85.7 percent) flew away from it; of 38 moths released about 15.2 m from Roanoke Island, 8 (21.1 percent) flew toward the island, and 30 (78.9 percent) flew away from it; of 40 moths released 7.6 m from Roanoke Island, 36 (90.0 percent) flew toward the island, and 4 (10.0 percent) flew away from it. The moths thus flew toward Roanoke Island and its concealing cover to a greater degree when released 7.6 m from the island than when released at more distant sites.

Flight take-off during precipitation.—Thirty-three of 48 (68.7 percent) moths flew from a cage remaining open in a heavy rain during the interval 21:00 to

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21:20. In a later test without rainfall, 54 of 100 (54 percent) moths left a cage in the same interval of time; thus, initiation of flight was not inhibited by rainfall. However, flight initiation may sometimes be inhibited by rainfall, at least among some species, for Green (1962) reported flight activity of pine shoot moths (*Rhyacionia buoliana*) declining with increased intensity of rainfall. However it must be noted that the hornworm moth is a very strong flier while pine shoot moths are comparatively weak fliers.

Lift-off from water surface.—Of 217 moths emptied from a cage onto the water surface, 138 (63.6 percent) lifted from the water surface. It appeared that falling onto the water surface would not in itself be a fatal experience for tobacco hornworm moths crossing water areas. Williams (1958) reported finding moths of an unidentified species floating dead on the ocean surface, presumably forced from flight by heavy wind and rain.

Orientation relative to light.—Of the 138 moths lifting from the water surface, 76 finally alighted on the boat from which they were thrown. Of these 76 moths, 68 (89.5 percent) selected shaded sites; 8 (10.5 percent) selected unshaded sites. When seeking rest areas during the daytime, most of the moths thus sought shaded sites.

Over-water flight.—Of 4,183 moths re-

leased on Hatteras Island, three were recaptured on Gull Island in Pamlico Sound 3.2 km from Hatteras Island. Only one of the 4,183 moths was recaptured in the 36 traps on Hatteras Island, although 1,731 moths were released within 1.6 km from a line of 16 traps. The direction of the wind in relation to the traps and release sites of the 1,731 moths was variable and unknown. Also, the trap on Gull Island was irregularly checked, and correlation of the flights with the wind was impossible. However, with the three moths being recaptured on Gull Island after release on Hatteras Island, over-water flight was indicated. Thus, the moths left the island which contained blossoming flowers suitable for a food source and flew over a water area devoid of food.

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