

### *Pupal Behaviour*

Pupal behaviour cannot be discussed independently of the adult male. The latter spends most of his time on the water surface hunting for pupae. (See below.) Since it is to the advantage of the pupa not to be caught until on the verge of emergence, its behaviour seems to be altogether adapted to avoidance of pursuing males.

Pupae were found to spend their time mostly resting on the bottom or moving about under water. They avoided the surface except to pop there one or two seconds, returning to the bottom again, where they often came to rest on their sides with every appearance of being dead. Gradually, and without kicking, the dorsum of the thorax would right itself so that the curved abdomen and paddles were resting on the bottom. Pupae do not rise to the surface automatically, as other species do; a strong kick, or push, against the bottom sends them to the surface for a quick gasp of air. They are apparently in complete equilibrium with the water, possibly because the air bubble they carry is so small in comparison to body weight. This bubble may also shift its position when the pupae are tumbling, thus accounting for the gradual righting of the body on the bottom after having surfaced.

When adult males were in pursuit of pupae in a large pan, the latter would swim 8 to 10 inches either on their side or with a tumbling up-and-down movement before quickly surfacing, demonstrating an avoidance reaction to shadow or movement on the water surface. Young pupae, with chitin not yet hardened, were often injured when males grasped them with their fore tarsal claws. These injured pupae would usually kick on their sides at the surface or at the bottom and die, sometimes 24 to 48 hours later.

The change in surfacing behaviour just before emergence was shown clearly when sample timings were made on pupae of different ages when no adult males were on the water (Table III). Pupae less than 72 hours old spent less than 13% of their time at the surface. The one close to emergence was at the surface 87% of the time, in spells as long as 16 minutes. Soon after these long periods at the surface begin, a shiny film of air starts collecting between the cuticle and the pre-adult. This is the time when the male can quickly insert the sharp-pointed pair of dististyles into the dorsal saddle groove, after capturing the pupa with its powerful forelegs and tarsal claws.

## THE ADULT STAGE

### *Emergence and Mating*

Both male and female *Opifex* can emerge from the pupal skin unassisted by adult males, but more of both sexes are successful when a male is holding the pupal case and thus assuring that the emerging mosquito will not capsize. When the male attaches his dististyles and part of both basistyles, he always does so at the dorsal fission line of the saddle-shaped declivity of the pupa's thorax. The frenzied commotion of capture—i.e., the struggle before attachment of the male's genitalia to the pupa's thorax, may attract other males which often join in the melee and often cause the pupa to escape.

When the adult begins to emerge, the male quickly inserts the entire genitalia and eighth abdominal segment into the thoracic region of the pupa. As the adult emerges, the male appresses his genitalia to the lateral side of the abdomen as it