1. Singh, C. S. P. and Kanjilal, S., *Indian J. Earth Sci.*, 1974, **1**, 113.
2 Soot-Ryen, T., In Moore, R. C. (ed.): *Treatise on invertebrate paleontology*, Pt. N, **1** (of 3), Mollusca 6, Bivalvia, The Geological Society of America & University of Kansas, 1969, N271.
3. Arkell, W. J., *Palaeontogr. Soc. London*, 1929, **81**, 1.
4. Cox, L. R., *Geol. Surv. India Memoir: Palaeont. Indica*, 1940, *ser.* 9, 1.
5. Ètallon, A., In Thurmann, J. and Ètallon, A., *Nouv. Mem. Soc. helvet. Sci. Nat.*, 1861–1864, **18–20**, 1 and atlas.
6. D'Orbigny, A., *Prodrome de paléontologie stratigraphique universelle des animax mollusques et rayonnés*, Paris, 1850, **1–2**, 394.
7. Cox, L. R., *Geol. Surv. India Mem.: Palaeont. Indica*, 1936, n.s., **22**, Mem. 2, 1.
8. Tamura, M., *Trans. Proc. Palaeont. Soc. Jpn*, 1960, n.s., **38**, 275.

ELECTRORETINOGRAM RESPONSES OF *LOCUSTA MIGRATORIA*

M. E. HUSSAIN, B. K. SHAMKUWAR and M. AMIN
School of Life Sciences, Jawaharlal Nehru University, New Delhi 110067, India.

ELECTRORETINOGRAM (ERG) studies on a 'day-active insect' *Locusta migratoria* were carried out. The ERG represents summated action potential from both the receptors and higher order neurons in response to light stimulations[1]. As against the common belief[2] that fast eyes of day-active insects show both ON as well as OFF response, we only detected a regular and marked ON response, a characteristic feature of nocturnal insects. The amplitude of ON response for the insect as a function of relative light intensity and pulse duration was determined. Adaptation experiments were also carried out.

The usual technique of ERG recording[3,4] was followed. The insects used in the study were provided by the Division of Entomology, IARI, New Delhi. The insects were immobilized properly with bees wax and colophony and fixed on the experimental stage which was placed inside a metallic chamber which served both as a Faraday Cage and a dark chamber. Fine platinum wires (0.01 μ) served as electrodes. The recording electrode was placed in a small hole, made in the Cornea, by an insect needle. The reference electrode was inserted close to the eye. Both the electrodes were connected to the differential inputs of a Tektronix 5110, 5A21N oscilloscope and the results were photographed.

For stimulation, a 150 W tungsten lamp was used. Calibrated neutral density filters were used to vary light intensity. The infrared radiations were excluded by using a heat filter. The light path was interrupted by a photographic shutter. An optical guide was used to direct the collimated light beam to the experimental eye. Relative light intensity, incident on the insect eye was determined with the help of Lux meter. The maximum intensity ($\log I = 0$) corresponded to 420 foot candles.

Light pulses of duration 1/125 to 1 second were used to elicit ERG responses over the intensity range of 3 log units. An interval of 1 or 2 min between successive light flashes allowed the eye to recover its sensitivity fully.

The amplitude of ON component of ERG served as a good indicator of the sensitivity of the eye to the intensity and duration of light stimulation.

The ERG's responses from the dark adapted eyes of *L. migratoria* are presented in figure 1. It is characterized by a sharp negative monophasic potential having only an ON component at the onset of light stimulation. No clear OFF component was detected at any stimulus duration during the experiment. However, the amplitude of negative potential decreased steeply as a function of light intensity. It bears an almost linear relationship to the relative intensity plotted on a logarithmic scale (figure 2).

In the compound eyes of insects two physiological types have been distinguished[2]: those of nocturnal or slow moving insects, which have slow compound eyes and have a negative monophasic wave, and the fast flying diurnal insects which have fast type eyes and a di or polyphasic potential. In contrast *L. migratoria* has a mode of life of the fast eye type but its ERG is of the slow type and resembles with the similar type of ERG recorded from a large number of nocturnal insects[5–7].

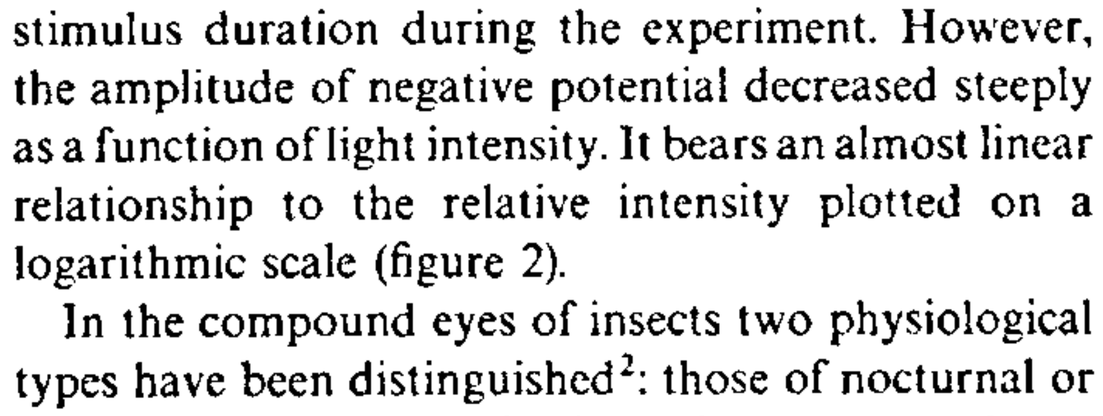

Figure 1. ERG of *L. migratoria* recorded at log I_0 light intensity and at different stimulus durations

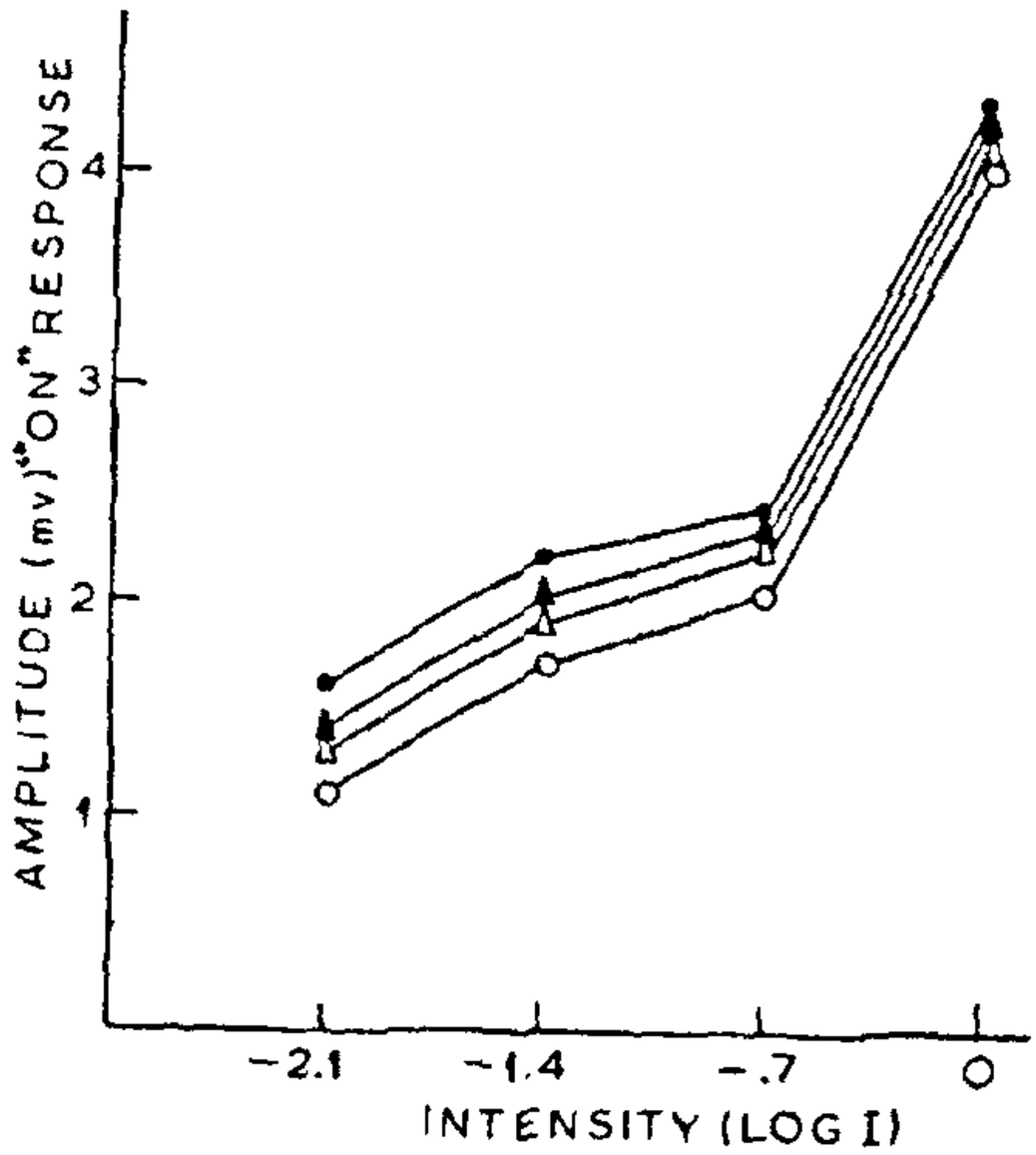

Figure 2. Amplitude of ON responses of *L. migratoria* plotted as a function of log *I*. The stimulus durations for the curves are ○ = 1/125, Δ = 1/50, ▲ = 1/25 sec; ● = 1/10 sec.

Also no significant difference was observed in the dark adaptation curves between the *L. migratoria* and nocturnal insects (figure 3). The fast eyes have been reported to regain their sensitivity within a few seconds[8] while it was observed to be 36 min in an experiment similar to the slow eyes. However, the adaptation occurs in two phases. The first phase lasts for about 4 min and involves an increase in the sensitivity over the range of 0.15 log units. The second phase covers an intensity range of 0.37 log units. Moreover, on the basis of ERG responses *L. migratoria* has been found to be more sensitive in poor light conditions in comparison with some other day active insects[9]. The adaptation response is also typical of dusk or night active insects. The two phases relate to the combined effect of photochemical and photomechanical events[10].

Lastly as regards the observation that *L. migratoria* in phase migrate at night[11], the present study might provide a possible explanation for their behaviour. Poor light conditions at night may be more suited to its eyes than bright light for its night migration.

The authors are thankful to Prof M. K. Chandrashekharan, School of Biological Sciences, Madurai Kamaraj Univeristy, for using this technique in his laboratory. MEH is thankful to UGC for a fellowship.

15 December 1983; Revised 8 March 1984

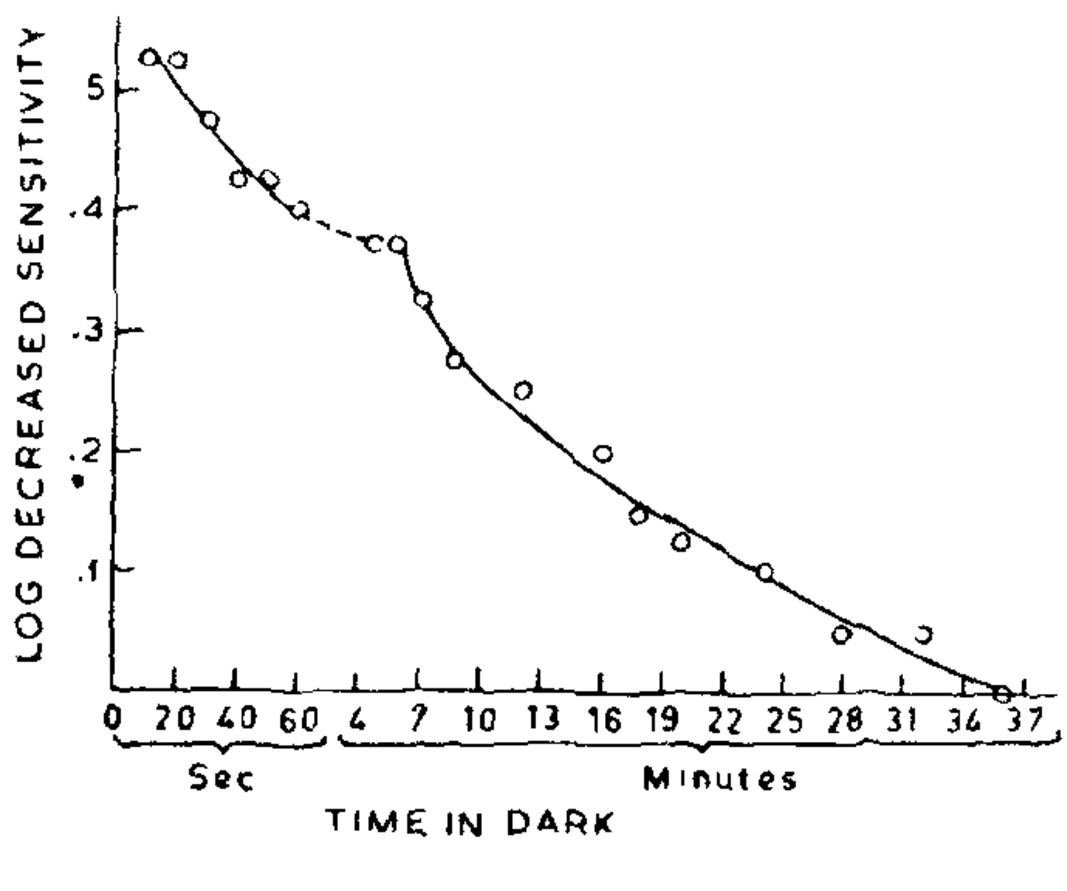

Figure 3. Dark adaptation curve of *L. migratoria*.

1. Mazokhin-Porshnyakov, G. A., *Insect vision*, New York, Plenum, 1969.
2. Autrum, H., *Exp. Cell Res.*, (*Suppl.*), 1958, **5**, 426.
3. Yinon, U. and Auerbach, E., *J. Exp. Biol.*, 1969, **51**, 635.
4. Chandran, V. R., Mohanty, P. and Amin, M., *Curr. Sci.*, 1981, **50**, 961.
5. Yinon, U., *J. Exp. Biol.*, 1971, **54**, 737.
6. Lall, A. B., *J. Insect Physiol.*, 1981, **27**, 461.
7. Eguchi, E., Watanabe, K., Hariyama, T. and Yamamoto, K., *J. Insect Physiol.*, 1982, **28**, 675.
8. Hussain, M. E., Shamkuwar, B. K. and Amin, M., *Indian J. Entomol.*, (Press)
9. Hussain, M. E., M.Phil. dissertation, Jawaharlal Nehru University, New Delhi, 1981.
10. Hoglund, G., *Acta Physiol. Scand.*, (Suppl.), 1966, **282**, 22.
11. Mahto, Y., Bhanotar, R. K. and Bhatnagar, R. K., *Entomol. Mon. Mag.*, 1977, **113**, 105.