always available and require gamma radiation for sterilisation. Furthermore frame structures are necessary to hold them upright when plants establish. A simpler technique developed in this laboratory is reported.

Glass tubes (30 × 4 cm) containing standard germination paper with a fold at the top were covered with aluminium foil, wrapped in covers and sterilised by autoclaving Surface-sterilised seeds inoculated with a peat-based test culture and allowed to sprout over soft agar (1% W/V) or moistened filter paper in sterile petri dish for 2 days. Three or four seeds were aseptically transferred by forceps to the folds of the germination paper in such a way that the radicle faced downward in the perforation made by forceps. Sterile nitrogen-free nutrient solution[3] (30 ml) was poured along the sides of the tubes with least disturbance to the seeds. Tubes kept in a stand were placed in glass house. Nutrient solution was added periodically as a source for nutrients and to maintain moisture. After 25 days paper with plants was removed, unfolded and plants examined for nodulation. Cowpea, black and green grams and pigeon pea and soybean were well nodulated in tubes and as many as 30, 35, 31, 10 and 13 nodules per plant were formed respectively in these legumes. Glass tubes of 15 × 2.5 cm were also used for this test. Repeated experiments have shown that this technique is well suited for nodulation test with large seeded legumes.

The advantages of lower cost and labour observed in plastic pouches are retained in this technique besides an added advantage of protection from frequent contamination due to its compactness. Plants grown in pouches were found quite susceptible to airborne contamination by rhizobia under dusty green house conditions[4], whereas in plants grown in tubes such contaminations were avoided by stoppering the tubes with cotton, leaving the shoot outside along the sides of the tubes. In paper pouches not all the plants grown showed uniform nodulation which might be due to non-compactness and loose drooping nature of roots. However in tubes almost all plants exhibited nodulation due to firmness and compaction achieved by rolling the paper. Use of sterilized sand soil medium might cause injury to roots of host plants which provides portal entry to rhizobia. Heat sterilization of soil released excess of ammonia and water soluble organic compounds that retard growth or toxic to plants[5]. Besides providing adequate aseptic conditions for nodulation in host plants, the toxicity or retardation of plants due to sterilized soil is avoided as soil is dispensed with. Above all, this technique can be carried out anywhere with minimum laboratory facilities.

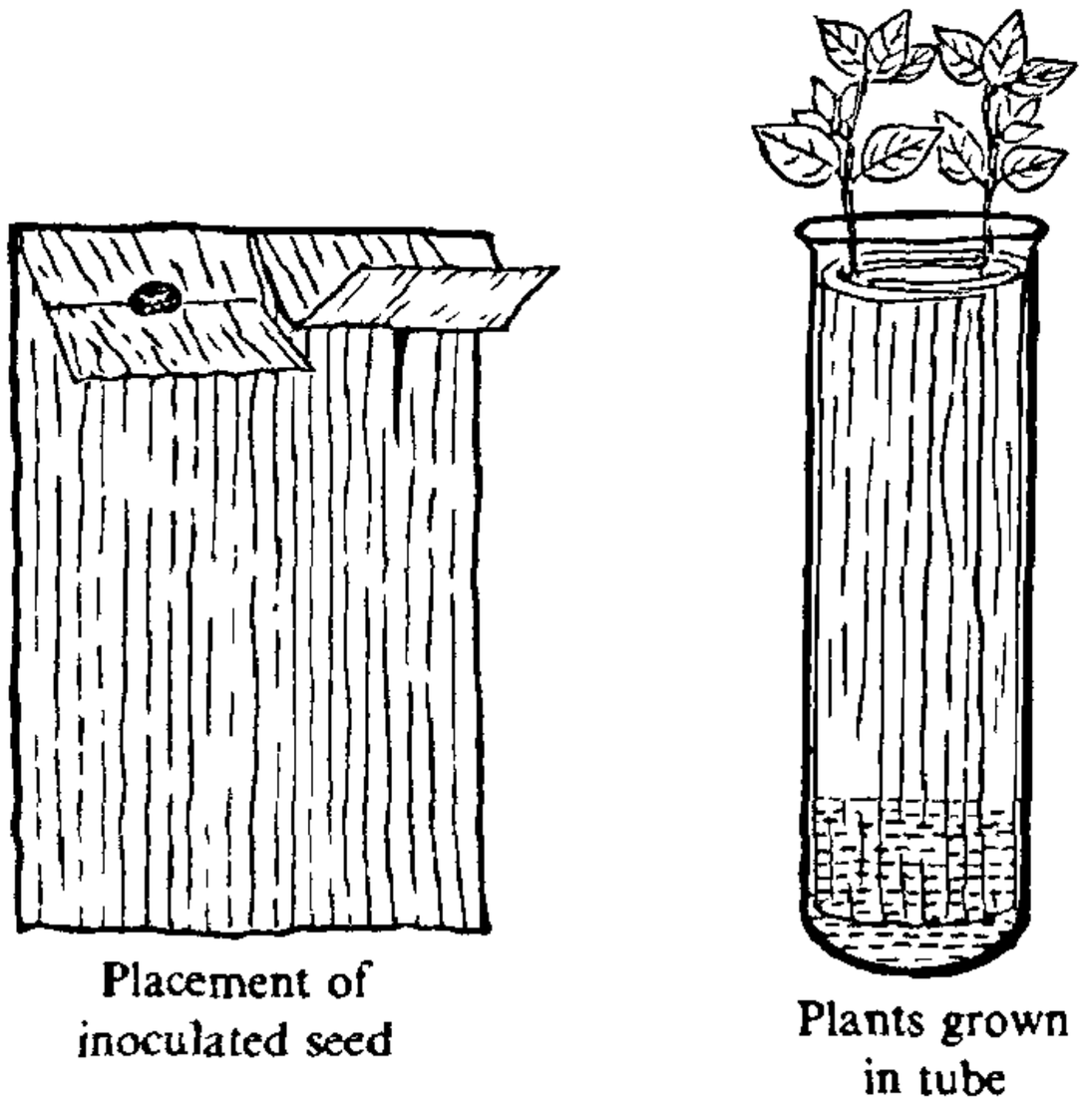

Figure 1. Plant infection test for rhizobia

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OPTIC LOBES IN THE SILVERFISH

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THE optic lobes of insects are situated in the anterolateral part of the brain. Normally there are three neuropiles, namely, the lamina ganglionaris, the medulla externa and the medulla interna (lobula)[1]. Important details of optic lobes, their axon pathways

and cell groups differ greatly in insects not only between orders but also within the same order. In apterygotes, the lamina ganglionaris, the medulla externa and the medulla interna are found in the same way as is characteristic of pterygotes[2]. The development of optic lobes is associated with the development of compound eyes in *Gelastocoris oculatus* (Fabricius) (Hemiptera)[3]. In the present study on the silverfish, *Lepisma saccharina* Linnaeus (Thysanura), it is found that the compound eyes are small and consequently the optic centres are less developed. Unlike three optic lobes found in the other groups of insects, only two are observed as has been reported in a study on a termite worker, *Odontotermes obesus*[4] (Rambur). Both the optic lobes remain confined within the limits of protocerebral region ensheathed by the neurilemma, and do not form optic peduncle. The outer convexo-concave neuropile is smaller and is comparable to lamina ganglionaris. Its convex surface faces towards compound eyes which are connected to lamina ganglionaris by post-retinal fibres. These fibres form the true optic nerve (figure 1). Neurons associated with the lamina are about 4–6 μ in diameter. Fibres from these neurons extend into the neuropile of lamina ganglionaris as well as the second optic ganglion. The lamina ganglionaris is connected to the second neuropile through optic chiasma. The decussation of chiasmatic fibres occurs from dorsal to ventral. The lamina ganglionaris does not show any zonal differentiation as has been reported in *Danaus plexippus*[5] Linnaeus, *Pieris brassicae*[6] Linnaeus and *Polistes hebraeus*[7] Fabricius.

The second or inner larger ganglion is not distinguishable into external or internal medulla and is referred to in this report only as medulla. This medulla distinction could also be found in the worker termite[4] although well-differentiated medulla externa and medulla interna have been reported in *D. plexippus*[5], *P. brassicae*[6] and *P. hebraeus*[7]. Neither the optic body[8] nor the additional accessory medulla[9] are observed in *L. saccharina*. Fibrous connections between the medulla, the lamina and protocerebral neuropile have been observed.

In conclusion it is suggested that the poorly organised optic lobes and their few fibrous connections with other cerebral structures of the brain indicate a direct relationship of the organization and development of the optic lobes with the nocturnal mode of living of the silverfish.

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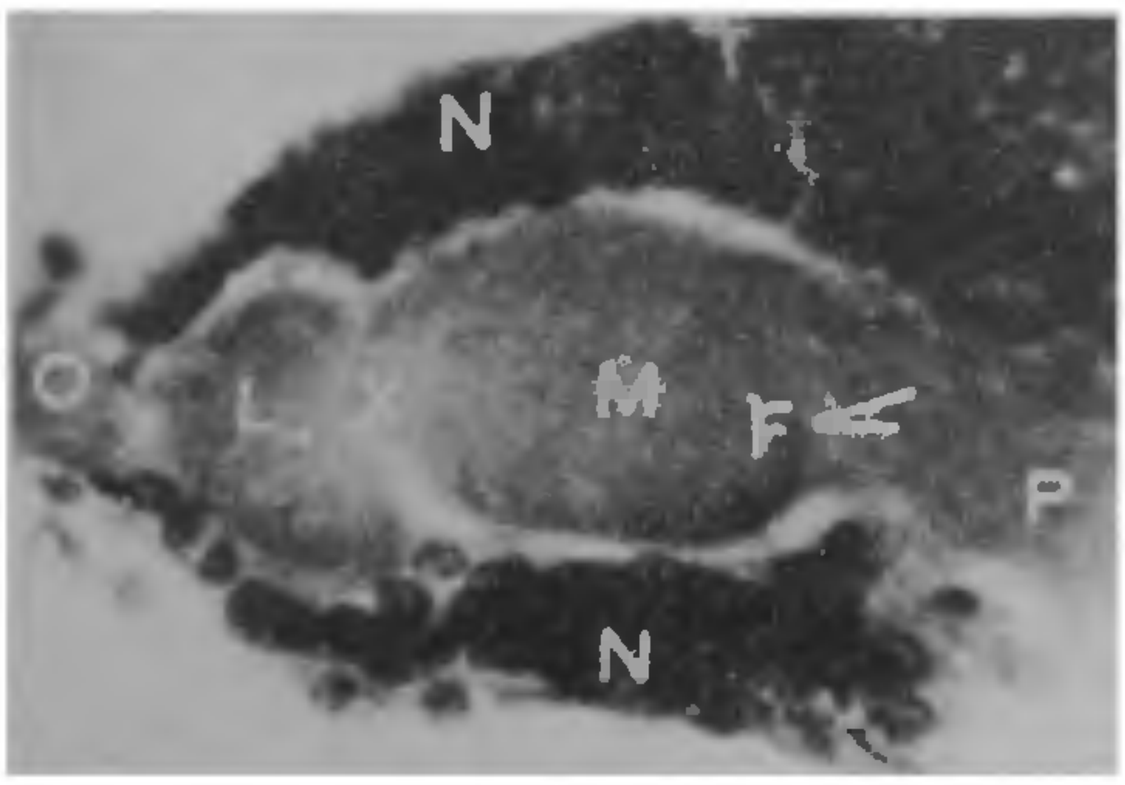

Figure 1. An anterolacteral part of the brain (transverse section) of *L. saccharina* showing optic ganglia. F—fibrous connection between medulla and protocerebral neuropile; L—lamina ganglionaris, M—medulla; N—neurons; O—optic nerve; P—protocerebral neuropile; X—optic chiasma. (Ehrlich's haematoxylin/eosin, × 1800).

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