Larvae collected are shown in table 1. *Culiseta longiareolata* and 5 different *Culex* species utilized the oviposition sites. *Cx. quinquefasciatus* occurred most frequently and except for 1 collection was confined to the urban area. Nearly as prevalent were *Cs. longiareolata*, which occurred to about the same extent in rural and urban environments, and *Cx. pipiens* which was commoner in the urban area. The remaining 3 species were much rarer.

On 10 occasions larvae of *Cx. quinquefasciatus* and *Cx. pipiens* were found co-existing. Samples of male mosquitoes were reared from such collections and the genitalia of 117 individuals were examined without, however, finding any evidence of hybridization between these 2 taxa. This supports the view that these 2 members of the *Cx. pipiens* complex are distinct species in South Africa.

Third or fourth instar larvae were present in 3 containers in the urban area during midwinter on July 22. There were collections of *Cs. longiareolata, Cx. quinquefasciatus* and in the 3rd container *Cx. quinquefasciatus* and *Cx. pipiens* together which were probably larvae overwintering by quiescence. Such larvae have been recorded previously in the highveld region of South Africa in the case of 2 of these species-*Cx. pipiens* and *Cx. quinquefasciatus* (Jupp, 1969 and 1975) but this is a new observation in the case of *Cx. longiareolata.*

The overall total of 83 collections for larvae of all species taken from the containers in the 15 month period may be compared with only 15 similar collections made from the same number of identical containers exposed for the same duration in another project at Olifantsvlei near Johannesburg in the Highveld region (Jupp, unpublished). The difference in the number of collections at these 2 localities may be attributed to the relative abundance of other aquatic breeding sites at Olifantsvlei available to mosquitoes as compared to a shortage of such sites in the Bethulie area. Species of *Culex* and *Culiseta* in the arid environment of Bethulie tend, out of necessity, to utilize whatever oviposition site is made available to them. Furthermore, the much larger number of collections from containers in the urban area of Bethulie compared with the rural area may reflect a shortage of other breeding sites in the town as compared to the farms where there are dams and streams.

Table 1. Number of occurrences of mosquito species in larval collections made from containers exposed for oviposition in rural and urban environments at Bethulie, February 1970 through March 1971.

	Rural	Urban
Cs. longiareolata	10	13
Cx. pipiens	5	14
Cx. quinquefasciatus	1	24
Cx. theileri	2	6
Cx. tigripes	1	0
Cx. univittatus	5	2
Totals	24	59

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AN AUTOMATIC APPARATUS FOR EXPOSING INSECT EGGS TO THIRTEEN PHOTOPERIODS (INCLUDING CREPUSCULAR PERIODS).

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INTRODUCTION

Investigations with arthropods have shown a marked sensitivity to length of day, particularly amongst those species exhibiting facultative diapause. Several species of culicids lay eggs which enter diapause when exposed to photoperiods of less than 12 hours.

The influence of photoperiod on the eggs of *Aedes (Ochlerotatus) caspius* (Pallas, 1771) has been studied (Sinègre 1974) as part of a larger programme aimed at the control of populations colonizing the temporary pools in the coastal marshes of Mediterranean France (Gabinaud 1975). For laboratory studies, an

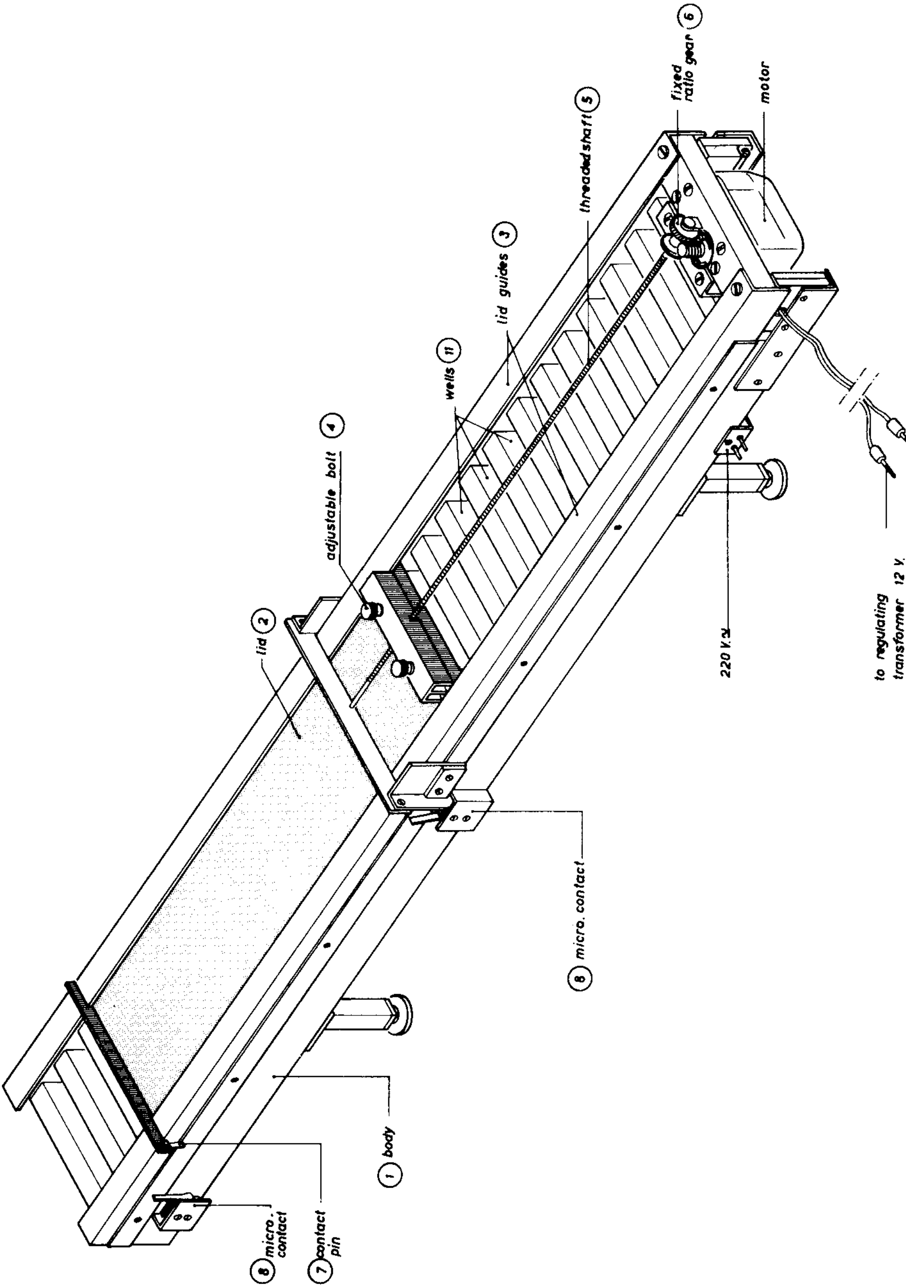

Figure 1. Multi-photoperiod apparatus: A. Diagram B. Photograph.

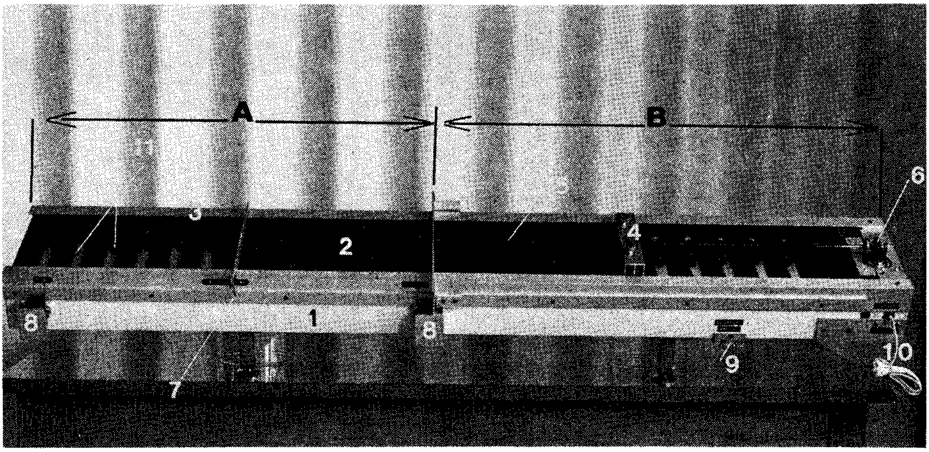

FIGURE 1. Multi-photoperiod apparatus: A. diagram, B. photograph.

automatic apparatus was designed and constructed which would provide, concurrently, 13 different photoperiods. The system's reliability was proved during an uninterrupted run of 18 months. Contemporary systems do not produce as many concurrent photoperiods with crepuscular periods (e.g. Cothran & Gyrisco 1966, Adler 1969, Wilson 1970).

DESCRIPTION OF THE APPARATUS

PRINCIPLE. The apparatus, which is placed in a constantly-illuminated incubator, is basically a row of wells and a mechanically-driven, sliding lid which takes 12 hr to complete its run in each direction.

Figure 1 shows a view of the apparatus containing 26 equidistantly spaced wells. Of these wells the 13 on the left are replicated by the 13 on the right, but in reverse order in respect to the photoperiods received. The movement of the light-excluding lid over the right-hand series of wells has allowed the inclusion of the left-hand series, without increasing the length of the apparatus (126 cm.) which was determined by the size of the available incubator (128 cm.)

If we consider only the right half of the apparatus (Fig. 1B,B) the first well from the right is always uncovered (photoperiod LD 24:0), and as the lid moves to the left the eleven wells following are successively uncovered; similarly, as the lid travels to the right, they are covered. The thirteenth well remains constantly covered (LD 0:24). The lid travels 50 cm. in each direction in 24 hr, its leading edge traversing a well (width 2.1 cm.) in 30 min, thus giving a dawn and a crepuscular period to each exposed well.

As the left-hand side of the apparatus is a replica of the right, it can be seen that the photoperiods are identical for these 2 symmetrically placed sets of wells, except that the dawn and crepuscular periods are reversed. The outermost wells receive the full 24 hr light period, but this decreases the nearer the well is to the center of the apparatus. Thus, 2 sets of 13 photoperiods (11 of which have dawn and crepuscular periods) are produced: 24:0. 22:2; 20:4, 18:6, 16:8, 14:10, 12:12 , 10:14, 8:16, 6:18, 4:20, 2:22 and 0:24.

CONSTRUCTION. The apparatus is made of wood, the sides and base being covered with formica; it is supported on 4 adjustable legs. The wells in the upper surface are lined with adhesive black velveteen to ensure a light-excluding seal. The lid is completely covered with black formica, and slides easily over the velveteen, despite the closeness of the fit imposed by the need to exclude all light.

A metal plate is attached to the right end of the lid (Fig. 1, (4)) by 2 nuts and bolts which hold it firmly in place, but allow the lid to be removed quickly in order to obtain access to the central wells. In the center of this metal plate is a threaded hole through which runs a long threaded shaft (Fig. 1 (5)), in such a way that the lid moves according to the direction of rotation of the power source governing its movement.

The power source is a wind-screen shield wiper motor with an intermediate reduction

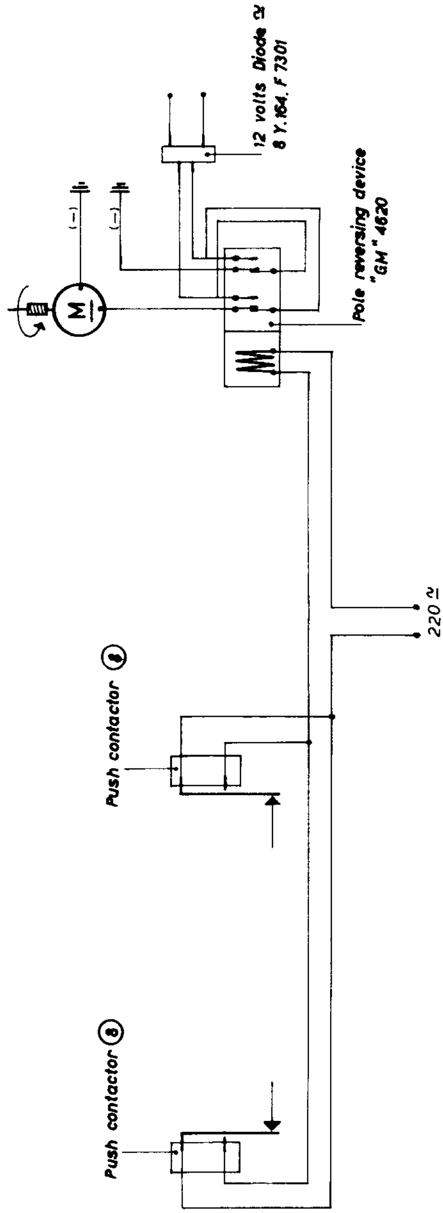

Figure 2. Electrical equipment of the multi-photoperiod apparatus.

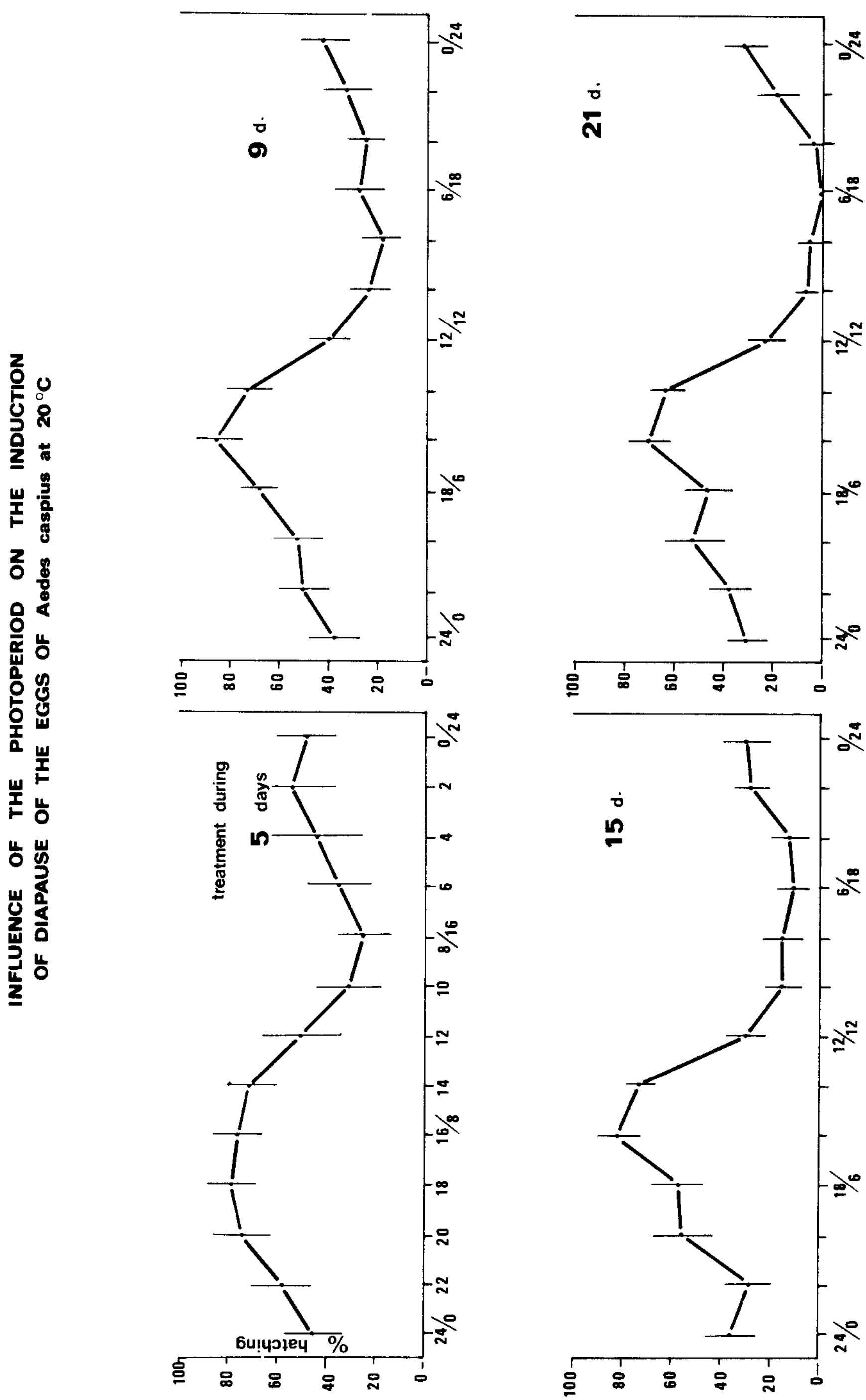

Figure 3. Influence of 13 photoperiods on diapause induction in *Aedes caspius* eggs at 20°C.

gear (Fig. 1 (6)); a transformer with a variable rheostat (as used in microscope lamps) enables the rotation of the shaft to be adjusted to the desired speed. At the extreme left end of the lid a protruding pin (Fig. 1 (7)) acts as a trip switch to one of the two microswitches (Fig. 1 (8)) positioned on the frame at either end of the lid's run.

ELECTRICAL EQUIPMENT. As either of the microswitches is triggered by the protruding pin, the microswitch activates a pole-reversing relay containing a diode which rectifies the 12-volt current of the transformer, causing the DC permanent magnet motor to change its direction of rotation by following the polarity of the relay (Figure 2).

EXPERIMENTAL

Mosquito eggs are placed on plastic strips, which are laid inside open-ended glass cylinders (2.1 cm diameter x 14.5 cm. length); each cylinder fits snugly in a well. The glass cylinders are plugged with cotton wool, which is kept damp to maintain the high humidity necessary to the dormant eggs of *Aedes caspius*.

One result from the many experiments made with this apparatus (Sinègre 1974) is produced in Figure 3.

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TOXORHYNCHITES HEADS AS *AEDES* TRAPS

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An amusing incident that occurred recently in our insectary seems worth recording, at least for its humor; the situation could also be of scientific significance and may point to something of practical value.

To provide food for the predacious larvae of *Toxorhynchites amboinensis* (a strain from Hawaii supplied by Dr. Leon Rosen), broods of *Aedes aegypti* larvae (the West African 'Liverpool strain' supplied by Dr. David Denham) are raised as required. To preclude possibilities of cannibalism among the larvae of *Tx. amboinensis*, each of these relatively large larvae is usually kept in an individual water container throughout its development to the pupal stage. The rate of consumption of prey, such as *Ae. aegypti* larvae, by *Tx. amboinensis* larvae is determined by various factors (c.f. Trpis 1972, for *T. brevipalpis*), the ambient temperature and the size of potential prey being of particular importance. At 26–28°C, for example, a 4th instar *Tx. amboinensis* can consume 2nd or 3rd instar larvae of *Ae. aegypti* at a rate of 10/day for more than a week. Given the chance, hungry 4th instar larvae of *Tx. amboinensis* attack one another and will even devour the pupae of their own species. Compulsive killing, beyond the requirement for food, is an unexplained phenomenon with fully grown *Toxorhynchites* larvae (c.f. Crans and Slaff 1977, for *T. rutilus septentrionalis*).

In order to minimize work in the insectary at Easter, 1978, it was decided to pool over 50 *Tx. amboinensis* larvae, mostly 4th instars, by putting them all in a large bowl with thousands of *Ae. aegypti* larvae (mostly 3rd and 4th instars) as prey. To limit growth of the prey, none of the usual *Ae. aegypti* larval food (desiccated liver powder) was added to the bowl of water containing the mass of larvae of both species.

After having been left for 4 days, the majority of the *Ae. aegypti* larvae remained alive and active, although the predatory larvae of *Tx. amboinensis* had consumed an appreciable number of them. Despite the abundance of suitable prey available, however, some *Tx. amboinensis* larvae had evidently become fratricidal: the bottom of the bowl was found to be littered with partly-eaten cadavers of *Tx. amboinensis* larvae and several pupae, as well as the