

and a fragment of red-coloured tinfoil were also found among the nesting materials.

On one occasion a swift was seen to steal nesting material from a sparrow's nest in a neighbouring building, despite the protesting occupant. Feathers from sparrows have been found mixed with the white lining of the nest cups.

During the period in which observations were made the earliest arrivals were noted on April 27; the latest on May 10.

During the ten or twelve days following the first arrivals some of the nests were usually occupied by one bird only—possibly males. On one occasion two swifts were found in a nest after arrival, both fast asleep.

On a few occasions coition was witnessed at the nesting site, the female clinging vertically to a beam; it is also believed to have occurred in the nest, but was not clearly seen. Simulated coition was observed many times while the birds were in flight in late July, by which time most nests contain young birds. Possibly non-breeding birds were involved; but this was not established.

Each year a number of non-breeding birds is present in the tower. In 1949 six non-breeders helped to make up the colony of twenty adult swifts. The non-breeders arrive in early May and nightly occupy a nest throughout the breeding-season, usually in pairs. One such couple, ringed in 1948, returned in 1949 and bred, using the nest in which they had been ringed.

Generally the first eggs are laid about the last week in May, but in 1949 an egg was laid on June 28, and it is known that in 1945 laying occurred on approximately July 6.

The nesting records vary considerably and, if a cold, rough or wet spell of weather be experienced, the eggs are sometimes thrown out of the nests or destroyed by the swifts. Eggs replaced by the observer are again ejected. Following this a second clutch is sometimes laid and young hatched out; but in several cases no second clutch was laid.

Inclement weather affected both adults and young, the former being confined to the nest for days at a time. Starvation and death often resulted, particularly to the nestlings. The presence of both adults in the nest over long periods resulted in the hatching of many of the parasitic dipterans, *Craterhina pallida*. They caused much irritation to the birds, which were constantly scratching themselves to get rid of the insects. A number of small red mites was also present in the nests and upon the birds at this time. The combined effects of starvation, parasitic flies and mites on the recorded deaths cannot easily be assessed, but must have been considerable.

During the exceptionally fine summer of 1949, when adults spent the maximum time away from the nests, not a single casualty occurred; of parasites also there were exceptionally few. When parasites were present, DDT was applied to both nests and birds; all parasites were destroyed. In all cases newly arrived migrant swifts were free from parasites.

Incubation is chiefly carried out by the females, which remain with their young throughout the first fortnight after hatching. The males relieve their mates occasionally during the daytime, particularly in the early evening; but the females return to the nests about an hour before nightfall. For the first two or three weeks after hatching, especially if the weather were unsettled, the males would be found

roosting in the nests with the females or near by. When the weather was very fine, one parent, probably the male, would often spend the night away from the nest and even from the tower. Where they pass the hours of darkness was not ascertained.

Towards the end of the fledgling period the young are often left alone in the nests at night.

The beginning of early return migration occurs towards the end of July and, according to Cutcliffe, the adults and young of early nests migrate first, followed by (presumed) males from nests that still contain young, and then by non-breeders.

The departure of the later-breeding adults and of the young generally takes place during the month of August. The latest to be recorded was in 1945 and took place on September 8.

PHYSICS OF LUBRICATION

THE Manchester and District Branch of the Institute of Physics and the British Rheologists Club (now the British Society of Rheology) held a symposium in the University of Manchester during June 29–July 1, 1950, on the subject of the physics of lubrication. An edited edition of the papers delivered at the symposium and of the discussion has recently been published as a supplement to the Institute's *British Journal of Applied Physics**

The contents are divided into two parts: (1) hydrodynamic lubrication and the rheology of lubricants, and (2) boundary-layer and extreme-pressure lubrication. The first paper in Part 1 is by Prof. D. E. Christopherson, of the University of Leeds, who gives a general survey of hydrodynamic lubrication, referring in particular to the basic assumptions of lubrication theory, the effects of temperature and pressure on the behaviour of lubricants, the bearing metal surface, and to the question of the occurrence of negative pressures and cavitation. The three other papers in this section deal with the rheology of lubricant films, the viscosity of lubricating oils at high rates of shear, and the lubrication of cotton and other textiles. Part 2 opens with an introductory paper by Dr. D. Clayton, of Imperial Chemical Industries, Ltd., in which a comprehensive review is given of the general background of the subject and of the subject-matter discussed in the succeeding thirteen papers. The non-specialist will find this introductory paper of particular value.

The symposium was held in order to bring together those working on the subject of lubrication in industrial, government and university laboratories. The papers are reports of individual pieces of research, and readers of the Supplement, lacking the atmosphere of the symposium, will not be able to derive the best benefit from the articles, although Prof. Christopherson's and Dr. Clayton's surveys will be of considerable assistance. Nevertheless, the series of articles do form, as the editor hopes, a clear and concisely written progress report. The elegant presentation, with the most useful addition of detailed subject and name indexes, make the Supplement, even at the somewhat high price of 15s., well worth having on the library shelves of all institutions having members interested in problems of lubrication and its application.

* Physics of Lubrication. *Brit. J. App. Phys.*, Suppl. 1. Pp. viii + 96. (Institute of Physics, 47 Belgrave Square, London, S.W.1, 1951.) 15s.