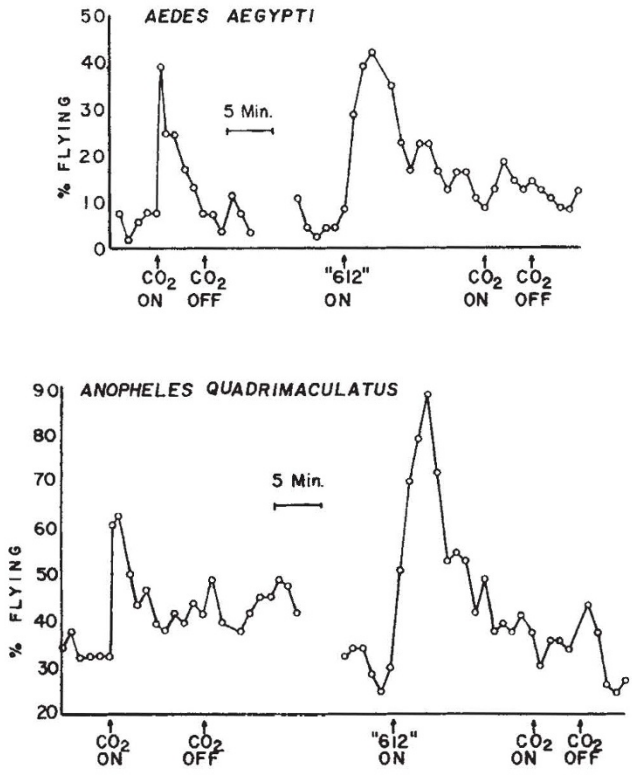

Fig. 1

alone or in conjunction with a residual insecticide. The fact that clothing impregnated with '612' and other repellents can afford protection for several weeks shows that evaporation would be slow enough to give a lasting effect. The rather poor resistance to washing of '612' may make it less useful outdoors than substances with better water resistance, but it should work well under cover[4].

Limited practical trials would be more useful at this stage than additional laboratory tests like those reported here, but it would be necessary to test any substance so used to ensure that it is not toxic to mammals.

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[1] Burgess, L., *Nature*, **184**, 1968 (1959).
[2] Daykin, P. N., Kellogg, F. E., and Wright, R. H., *Canad. Entomol.*, 97(3), 239 (1965).
[3] Daykin, P. N., and Kellogg, F. E., *Canad. Entomol.*, 97(3), 264 (1965).
[4] King, W. V., *Chemicals Evaluated as Insecticides and Repellents at Orlando, Fla.* (U.S. Department of Agriculture, *Handbook* No. 69, 1954).

Sexuality and Apomixis in *Taraxacum*

UNTIL 1949, the available evidence indicated that species of *Taraxacum* in the Mediterranean region and in Asia were sexual, and that those in north, west and central Europe were apomictic (apart from two small sexual populations in Sweden and Switzerland). In 1949, Tschermak-Woess[1] discovered sexual plants in apomictic populations in south Austria and these have been further studied by Fürnkranz[2-4]. He established the rule that sexual plants are diploid and apomictic plants polyploid (although Sörensen and Gudjonsson[5] had shown that plants with $(3n-1)$ chromosomes may show sexuality).

Fürnkranz also found that diploid sexuals have regular pollen and polyploid apomicts irregular pollen, presumably because of multivalent formation and partial restitution during male meiosis in the apomicts. He found that most populations in the sections *Vulgaria* (= *T. officinale* Weber) and *Erythrosperma* (= *T. laevigatum* (Willd.) DC.) in south Austria showed some sexuality; sometimes the proportion was as high as 50 per cent. He was able to obtain artificial hybrids between sexuals and also between sexuals and apomicts, using the apomicts as male parents.

In Europe we have found one population near the Jungfrau in Austria, believed to belong to the section *Fontana* (described by van Soest[6]), which may be totally sexual; this is comparable with *T. obtusilobum* Dahlst. from Sweden, or *T. pieninicum* Pawl. from Poland[7]. Moreover, in seven populations in the *Vulgaria* and *Erythrosperma* from Czechoslovakia and Poland which have been sampled, triploid apomictic and diploid sexual plants occur together; the diploid plants differ from the apomicts only in size.

Much larger samples have been taken in Great Britain. Of 132 seed collections from all parts of the country on which chromosome counts have been made, only two have proved to be diploid and, as expected, the plants are sexual. They are from lowland localities in County Durham. Fürnkranz's technique of pollen examination was found to be valuable in diagnosing sexuality, though it must be used with caution. Some *Erythrosperma* show perfectly regular pollen of considerable size, derived from dyads; such plants are tetraploid and apomictic. Other apomictic *Erythrosperma* have pollen as small as that of sexuals but slightly irregular.

The pollen of 1,200 plants in 195 populations from thirty-one vice-counties, ranging from Hampshire to Sutherland, has been examined. In eight populations, presumed sexual plants have been found of which 15–50 per cent have regular pollen; these plants all belong to the sections *Vulgaria* or *Erythrosperma*. Six of the populations are in County Durham, one in Northumberland, and one in north Yorkshire, although only 40 per cent of the populations of these sections examined come from these three counties. It is worth noting that sexuality has only been recorded in populations where the apomicts are triploid. No sexuals have been found in the section *Spectabilia*, which is usually tetraploid or pentaploid, or among tetraploid *Erythrosperma*.

Analyses of six populations in Durham and Northumberland in which *Vulgaria* and *Erythrosperma* biotypes occur together indicate that hybridization has occurred (sexual plants have been recorded from two of these populations). About 70 per cent of the plants in the populations have intermediate characters, and scatter diagrams indicate that introgression is occurring. The differences between the sections, normally so clear-cut, have been blurred.

These investigations, which are being continued, are of interest in relation to the genetic control of the breeding system in *Taraxacum*; a question of particular interest is whether the diploid sexuals are of primary or of secondary origin (see also Sörensen[8]).

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[1] Tschermak-Woess, E., *Osterr. Bot. Z.*, **96**, 56 (1949).
[2] Fürnkranz, D., *Osterr. Bot. Z.*, **107**, 310 (1960).
[3] Fürnkranz, D., *Osterr. Bot. Z.*, **108**, 408 (1961).
[4] Fürnkranz, D., *Ber. Deutsch. Bot. Ges.*, **78**, 139 (1965).
[5] Sörensen, T., and Gudjonsson, G., *Kong. Dansk Vid. Selsk. Biol. Skr.*, **4** (2) (1946).
[6] van Soest, J. L., *Acta Bot. Neerl.*, **8**, 77 (1959).
[7] Malecka, J., *Acta Biolog. Cracov. (Ser. Bot.)*, **4**, 25 (1961).
[8] Sörensen, T., *Bot. Tidskr.*, **54** (1), 1 (1958).