Non-sessile animals need to search for the many and varied resources they require to survive and reproduce. The fitness of an animal will depend on its movement patterns or searching behaviour. This is the ability to interpret and act upon internal and external pieces of information, so as to minimise the animal's distance from resources and maximise the distance from stress sources such as predators (Jander's (1975) "orientation fitness").

In this paper we describe the tracks and searching behaviour of male and female Danaus plexippus in terms of the so called "rules" of movement as outlined by Smith (1974a), Gilbert et al. (1976), Jones (1977) and Kitching & Zalucki (1982). In a further paper, these descriptions will be built into a simulation model of egg-laying in females.

The direct observation of searching behaviour has been given considerable attention by entomologists and, in general, workers have found that a searching animal, upon locating its quarry, changes its movement patterns so as to remain within, and thoroughly search, the area in which a capture was made. Most authors have suggested that this sort of behaviour is an adaptation to feeding on prey which have clumped dispersions (e.g. Laing, 1937; Banks, 1957; Chandler, 1969; Marks, 1977).

Most studies have been restricted to animals' walking or crawling on plants or in artificial arenas under simplified laboratory conditions. Field
studies of flying insects are more difficult to make and various simplifications of the animal’s track have been employed at the recording stage. Levin et al. (1971), for instance, used only the angle of arrival at a point (e.g. flower) and the angle of departure to define the directionality component of the tracks of various bees and butterflies. One commonly used method of obtaining two-dimensional versions of the tracks of flying insects is to follow the insect from a distance, taking compass bearings at major direction changes and/or drawing the track on a plan view of the area. Such techniques have been used by Brussard & Ehrlich (1970) for the satyrid butterfly, Erebia epipsodea; by Heinrich (1976) for various bumblebees and Baker (1978) for various British pierid and nymphalid butterflies. A simple extension of this method is to mark out an area of interest into a grid of points using host plants and/or marker poles. An insect’s movement through the area can then be defined from point to point. Information is obtained from recorded commentaries by the observer (e.g. Kaiser, 1976; Jones, 1977). This method is restricted to two dimensions and simplifies the track into a series of directions and step sizes limited by the grid used. Zalucki et al. (1980) describe an inexpensive means of obtaining records of the tracks of flying insects. The detail provided by this method enables quantitative comparisons of the tracks of various butterflies. This paper presents results obtained using this method applied to adults of the butterfly, Danaus plexippus L. moving among various patterns of their host plants, Asclepias spp.

Methods

Glasshouse-grown milkweeds (Asclepias spp.) were planted out in various patterns at Tanah Merah, Queensland (27°41’ S; 153°10’ E), between May and June, 1979 (Fig. 1a, b). The study area had been cleared of shrubs and small trees. A few large gums (Eucalyptus spp.) remained on the northern boundary of the site, and some young gums and brush box (Tristania conferta) were present along the southern border. The land sloped gently to the east (about 1 m in 18 m). The grass surrounding and within the patches was mown every 1-2 weeks. Apart from the milkweeds which were in flower (Fig. 1a, b), other local nectar sources included Ageratum hortorum (see map) and some Lantana spp. bushes located to the south-east of the area. No supplementary food was provided during the experiments.

The first dispersion pattern used (Fig. 1a) consisted of a large patch of the three milkweed species; Asclepias fruticosa L., A. physocarpa (E. May) Schlecht and A. curassavica L. These were planted in a 9 x 10 m grid, with approximately 1 m between plants. The patch was located at the approximate centre of the area in which tracks were to be recorded. There were also four outlying plants (Fig. 1a). The second pattern consisted of a large patch of older plants in a 10 x 11 m grid (1 m between plants) alongside a patch of younger plants in a 6 x 6 m grid (2 m between plants). There were also small outlying clusters of plants. In each case mixtures of all three Asclepias spp. were used.

The butterflies.

Danaus plexippus and its food plant were introduced to Australia. Both have spread throughout eastern Australia (Smithers, 1977). General accounts of its biology in North