

immediately above the first, and it passed 13 scars on the way, for instance from scar 11 to 24 in Fig. 2.

This was the basic pattern on this plant but complications arose. Sometimes a frond failed to develop, and occasionally an extra frond appeared in an unscheduled position. Looking at the trunk of a mature mamaku one notices that the pattern of scars becomes very regular and more compact with age. With older plants, new fronds tend to come in batches of three or more, rather than singly, and this obviously complicates some aspects of observation. On this plant the vertical distance between scar 14 and scar 29, representing the growth of one year, was 30cm.

In conclusion, I emphasise that these observations apply to one plant, at one stage of growth, in one district only, and may not be of general application.

Asplenium Bulbils

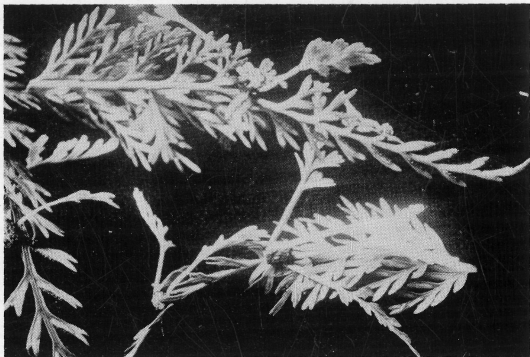
F. C. Duguid, Levin

Having an unending supply of bulbils on my aspleniums, I took the opportunity to follow their growth, right from the first tiny green knobs, smaller than pins' heads, lying on the upper surface of the fronds, up against veins. The green knobs were naked, but soon they became covered with some small brown scales, triangular-cordate in shape and netted like lace.

Later, one or two simplified fronds erupted from the top of each enlarging knob, their number and complexity increasing with the growth of this storage bulb from which they sprang. The tip of the parent pinnule producing a bulbil then became bent out of its original position so that it formed a keel-like appendage pointing downwards, in contrast to the ring of little fronds pointing upwards in positions resembling the arrangement of fronds on a mature fern growing in the ground. As the load of bulbils grew heavier, the parent frond dropped more and more till its tip, in many cases, was pointing downwards; the fronds of the bulbils were seen to adjust to this parental droop, still holding themselves aloft in a suitably erect position with the "keel" acting as balancer. The top-heavy collection of young fronds may be borne on a nearly pea-sized storage bulb, which acts as a fulcrum. It is not only the weight of the bulbils which draws the parent frond downwards, but also the heavy drain on its moisture content. A heavily-bearing frond will eventually sag to the ground, wither and die, but its papery remains form a mulch, conserving moisture at ground-level, where the bulbils send roots into the moist soil and form a colony of young plants beside their source.

During its development on the parent frond each bulbil produces a constant supply of tiny rhizoids. Individually these are short-lived, shrivelling in the air, but they are followed by new rhizoids, all of an almost imperceptible length, and always the newer ones have growing tips ready to strike into the soil when the bulbil finally reaches the ground. Any bulbils which fall or are knocked off the parent frond are balanced in such a way by the keel-like lobe of the parent frond that they "fall on their feet", with everything in correct position for immediate growth into the soil.

If a bulbil falls off prematurely, with insufficient fluid and nutriment in the storage bulb, then the young plant, if it survives, may take up to two years before reaching an adequate condition to make normal progress in the ground. This I discovered when a bulbil was knocked off an unusual form of *Asplenium* before it had time to build up sufficient storage. In attempting to grow this bulbil I gave it great care, but it appeared to die. Months later, the remains, which I had planted in a damp and sheltered position, were found to have sprouted a very small frond. Gradually the number of fronds increased, but its growth was painfully slow compared with that of well-developed bulbils falling to the ground at their normal stage of growth.



Deflexed pinnules of parent frond