METHODS FOR SAMPLING FOLIAGE AND INSECT POPULATIONS OF THE BEECH FOREST CANOPY

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INTRODUCTION

Lowland beech (*Nothofagus* spp.) forests of the west coast of the South Island, New Zealand, form a closed canopy at about 30 m above ground level. Access to this stratum for the purpose of sampling the insect population is difficult (Hoy, 1962). Milligan (pers. comm.) has used a .303 (7.6 mm) calibre rifle to shoot down samples of beech branches for the study of *Nascioides enysi.* Mazanec (1972) used a .410 (10.4 mm) calibre shotgun to shoot down samples of jarrah (*Eucalyptus marginata* Sm.) foliage in Australia. This note describes methods used to obtain samples of foliage from, and erect insect traps in, the canopy of lowland beech forest at Fletcher's Creek Biological Reserve, Inangahua (State Forest 127).

INSECT TRAPPING

Insect traps were suspended from pulleys set up in the canopy using the following equipment:

1. A 30-kg-pull fibreglass long bow.
2. Arrows: (a) Shafts: 40 gm weight, 0.8-0.9 m of 1-cm-dowel painted orange with plastic flights.
   (b) Tips: 25 gm of 5-mm-diameter mild steel wire bent in a "U" shape and taped to the shaft.
3. An open-faced fixed-spool casting reel bearing 200 m of 5.5-kg-breaking strain nylon monofilament, mounted on a stake with a 15-cm-diameter guide ring 1 m above the reel.
4. Wooden winches (20-cm-diameter reels);
   1 × 200 m 20-kg-breaking strain line (monofilament)
   4 × 200 m 180-kg-breaking strain line (braided nylon)
5. "Tuphblox" 4-cm-diameter pulleys (yacht type).

The arrow was fired from an open site in the undergrowth chosen for trap erection. The most suitable shot was one which was angled at about 10-20 degrees off vertical and gained enough height for the arrow to turn and fall straight down before re-entering

the canopy. Arrows were sometimes lost if they were not fired high enough or if their line of flight was not observed by a person standing to one side. The orange colour of the shaft and flights greatly aided arrow recovery. Once some experience was gained most shots were successful in placing a line over a suitable canopy branch (or branches). Arrows fired with or against the wind solved the problem of the light line drifting off the tree. If the light line settled in an unsuitable position another firing was made; this took about 5 minutes.

The arrow firing and fall zones will be termed A and B respectively. At A the stake bearing the casting reel was driven into the ground and angled to the line of flight. The arrow, weighted to aid descent through the canopy and undergrowth, was fired over a canopy tree with the 5.5-kg-line looped through a small hole in the tail. At B the 20-kg-line was attached by a swivel clip to the 5.5-kg-line which was wound back to A, towing the 20-kg-line over the crown of the tree. The 20-kg-line was then attached to a 180-kg-line and winched back to B. A pulley threaded with 180-kg-line was then attached at A, raised into the canopy and anchored from B. The canopy branches on which the pulley line lay held the pulley in position once the initial slack was taken up. Insect traps (light, suction, sticky and water) could then be attached to one end of the pulley line, raised and anchored with the other. Tethered trailing lines stabilised the trap and aided lowering while a swivel located above the pulley eliminated some of the line twisting. The water trap was a high-walled type, shallow trays were unsuitable. The 20-kg-line was too heavy for firing, but necessary because it was light enough to be towed by the 5.5-kg-firing line and strong enough for towing the 180-kg-line.

Using two pulleys approximately 10 m apart a Malaise trap, consisting of a vertical 4 m × 2 m screen of fine organdie under a cloth roof, equipped with collection funnels at each end, was suspended at 25 m in the canopy. The erection of such a trap system took 30-40 minutes and approximately 150 m of 180-kg-line. In windy conditions the Malaise trap was stabilised by tethered lines attached to the four lower corners of the "tent". A dowel (2-cm-diameter) frame gave shape to the trap.

COLLECTION OF FOLIAGE SAMPLES

Sawing

Branches below a canopy pulley could be sawn by an operator on the ground. A 60-cm-bow saw blade was fitted at each end with lugs projecting 5 cm below the cutting edge. The 180-kg-line threaded through the pulley was tied to the ends of the lugs so that the cutting edge was 5 cm from, and parallel to, the axis of the line. When the saw blade was pulled against a branch by an operator holding each end of the line from the pulley, the blade stood proud, allowing a transverse cut to be made (Fig. 1). When large branches (10-20 cm diameter) were sawn it was necessary to support the free end on a hook suspended from a second pulley. This maintained an open cut and allowed the sample to be lowered to the canvas sheet instead of falling. Line manipulation required the wearing of leather gloves for hand protection. If a suitable site was chosen several branches could be sawn from one canopy pulley. The pulley was kept as close as possible to the saw because this minimised the fouling and twisting of the saw line. The lower canopy was accessible with this technique and the time taken to collect one sample would be about 30 minutes. Small branches (< 2 cm diameter) were sawn with a fine-tooth pruning saw mounted in the line in the same

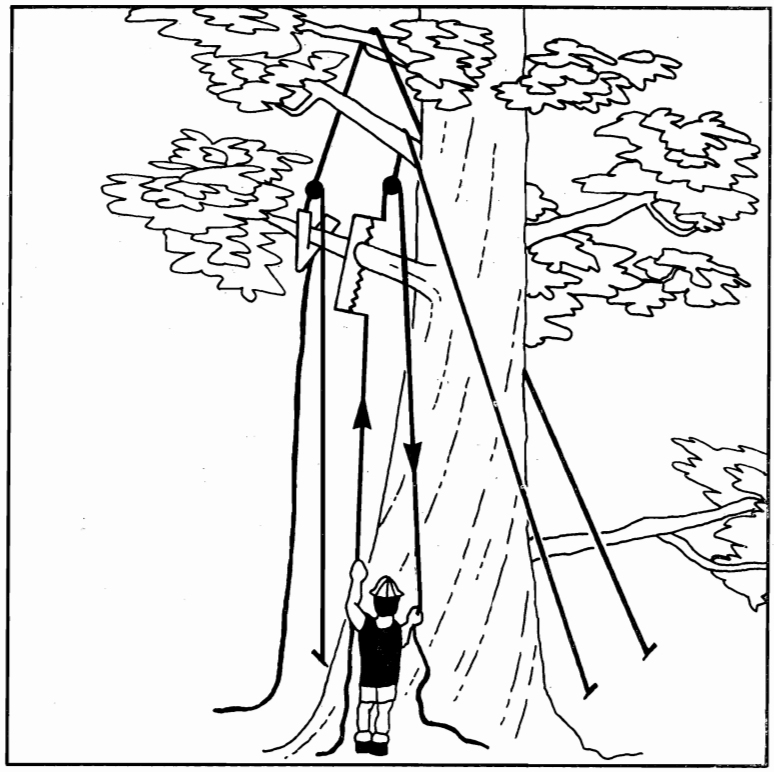

FIG. 1—Foliage sampling using an aerial-line saw.

fashion as the bow saw. When the lines were in position a branch of 10 cm diameter could be sawn in 5 minutes.

Shooting

A .22 (5.6 mm) calibre semi-automatic rifle equipped with a telescopic sight (cross-hair reticle, magnifying lens × 4 diameter and a collecting lens of 28 mm diameter) was clamped to a "Dexion" mount allowing adjustment of elevation, bolted to a variable-height photographic tripod. The sight was adjusted using a target at 10 m horizontal range, followed by further adjustment using a "target" at 30 m height in the canopy. Typical samples bore 1-2m^2 of foliage, were 2-6 cm thick, projected clear of lower foliage and were 25-30 m high in the canopy. Shots were fired at the under and then at the upper side of a chosen branch from a position at right angles to its axis, final shots across the centre severed the branch. Failure to cut the under or upper surfaces sometimes resulted in a hanging branch which required extra shots to bring down. The range of branch thickness sampled with the .22 rifle was 1-10 cm; branches of 8-10 cm were brought down with 10-15 shots. Branches were left hanging if 30 shots did not bring them down. These hanging branches were only about 5% of the total sampled. The sample was caught in a white 3 m × 3 m canvas sheet held by two

assistants. All visible insects that fell with the sample were collected, those falling on the sheet with aspirators, the others were included with the foliage which was cut up and sealed in plastic bags for later examination or extraction (Tullgren funnel). The time taken for the collection of a sample was 10-15 minutes. A .303 rifle was also used for sampling but the advantages of the semi-automatic .22 were: the ease and speed in aiming a series of shots; low noise and recoil levels resulting in little operator fatigue or disturbance of the surroundings; the safer range and lower cost of ammunition. Hollow-nose ammunition was used as this type cut wood more effectively than solid-nose.

Sampling by shooting was possible throughout the canopy, whereas line sawing was limited to the lower parts. Shooting was limited to those branches that would fall to the ground, this meant that the most dense areas of foliage were usually sampled at their extremities. This limitation was overcome by the prior sampling of the branches that obstructed the fall of those above.

REFERENCES

HOY, J. M. 1962: Eriococcidae (Homoptera: Coccoidea) of New Zealand. **N.Z. D.S.I.R. Res. Bull. 146:** 8-9.

MAZANEC, Z. 1972: The effect of defoliation by the leaf miner, **Perthida glyphopa** (Lepidoptera: Incurvariidae) on the growth of Jarrah. **Proc. 14th Internat. Cong. Entomol., Canberra.**