

moved towards the costal margin; (3) there has been a general overall decrease in the size of the wing.

5. In flightless species the eyes are small and the elytra interlock firmly.

6. The atrophied wings of the New Zealand species-group of *Dorcus* and of *Lissotes* are reduced to different extents in different species. Probably the ancestral species of each group arrived in New Zealand as a flying beetle.

7. The hindwings in one species of *Ceratognathus* (*C. passaliformis*) are beginning to atrophy.

8. There are vast differences between distribution patterns of flightless and fully winged lucanids in New Zealand. Flightless species tend to be allopatric and to have restricted ranges; they occur almost exclusively in lowland areas. **Fully winged species** usually have wide, overlapping ranges, and some are restricted to montane regions.

9. Adults of all species probably feed on sap and are unspecific in their choice of food plants. Larvae of flightless species complete their development in rotten wood or soil; those of *Dendroblax* probably eat roots; those of *Ceratognathus* feed on sound, dead wood and some species probably are attached to specific host plants.

10. *Dorcus*, *Lissotes* and *Dendroblax* have evolved in New Zealand from separate colonizing invaders. The New Zealand species of *Ceratognathus* seem to be the progeny of at least three species that arrived from Australia or Tasmania at widely separated times. No secondary genera of Lucanidae have evolved yet in the New Zealand area.

11. Speciation in the flightless genera seems to have resulted mainly from isolation of flightless populations on islands and in ice-free refuges. Some speciation in the New Zealand *Ceratognathus* group has resulted directly from colonization of at least three Australian or Tasmanian species; the progeny of these have split into montane and lowland species, and into large- and small-sized species which are morphologically very similar.

12. Some of the existing species of *Lissotes* probably began evolving as long ago as the Pliocene (more than 2,000,000 years ago) and no later than the Last Interglacial (70,000 to 150,000 years ago) from a flightless stock that became isolated on islands.

13. The *Dorcus* species-group probably has been in the New Zealand area longer than the *Lissotes* group.

14. *Dendroblax earlii* seems to be an old plastic species in New Zealand, rather than a recent arrival.

ACKNOWLEDGMENTS

For the loan of material I am indebted to Mr P. M. Johns, of the University of Canterbury, Christchurch; Mrs B. M. May, of the Plant Diseases Division, D.S.I.R., Auckland; Mr J. C. Watt, of the University of Auckland; and Mr R. Zondag, of the Forest Research Institute, Rotorua. I wish to express my thanks to Drs R. R. Forster, of the Otago Museum, Dunedin, and G. Kuschel, of the University of Chile, Santiago, Chile, for the innumerable helpful criticisms and suggestions they made during the preparation of this paper. I am especially in-