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IDENTIFICATION AND EVALUATION OF NEW ORNITHOPUS L.  
GERMPLASM WITH SPECIAL REFERENCE TO SEED CHARACTERS

A thesis presented in partial fulfilment  
of the requirement for the Degree of  
Master of Agricultural Science  
in Seed Technology  
at Massey University  
Palmerston North  
New Zealand

SHIMIN FU

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## ABSTRACT

Serradella species (Ornithopus L.) are promising annual forage legumes used in many parts of the world, especially in sandy and infertile dryland areas. One hundred and seven accessions of serradella were described and evaluated in Palmerston North, New Zealand. Fifty accessions were part of a 1986 DSIR sponsored forage germplasm collection from Southwest Europe. The rest of the accessions were introduced and/or collected from Australia and New Zealand. The study concentrated on the morphological description and evaluation of agronomic characteristics of the serradella accessions, as well as seed characteristics, including seed development and breaking of hardseed.

Four species (O. sativus, O. compressus, O. perpusillus and O. pinnatus) and one subspecies (O. sativus subsp. isthmocarpus) of serradella were identified and described in terms of their morphological characteristics. Morphological characteristics varied less than agronomic characters in serradella. For most accessions seed multiplication was successful. There was a relationship between flowering date and days to maturity, with the days from appearance of the first flower to seed maturity (harvesting date) decreasing as first flower emergence was delayed. Within species some accessions ripened in significantly shorter periods than others. Some had significantly heavier 1000 segment weight than others. In species normally considered to have a characteristic of high hardseed levels, a wide range in percentage hardseed was found among accessions of yellow serradella and slender serradella. In a study of seed development, seed viability of two serradella cultivars Grasslands 'Koha' (O. sativus) and a 'hybrid' (O. sativus x O. compressus) reached a maximum at 32 days after peak flowering. There was no germination unless fresh seed was dried. Hard seed developed at the age of 16 days in the hybrid. Soaking O. compressus and O. pinnatus seed in concentrated sulphuric acid for 30 minutes was the optimum treatment for breaking hard seed without causing seed damage.

**TO THE MEMORY OF DR. MARGOT B. FORDE**  
**A RESPECTED FRIEND AND SUPERVISOR**

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## INTRODUCTION

Plant exploration, together with notable contributions from plant breeding and selection, has contributed greatly to the use of legumes for pasture improvement ('t Mannetje et. al., 1980). This study is a contribution to the description and evaluation of some serradella species collected for pasture germplasm resources by Dr. M.B. Forde and Dr. H.S. Easton, DSIR Grasslands, Palmerston North, New Zealand in 1986. During their trip to SW Europe, 50 accessions of serradella (Ornithopus) were collected. These had not been grown and assessed for agronomic characteristics until this study was started in 1990.

The description of accessions and the recording of the information in databases are aspects of genetic resources work which have progressed slowly. The large number of samples now conserved in genebanks makes their comprehensive description and evaluation a formidable task (Williams, 1989).

The controlled use of 'wild' plant germplasm is largely dependent upon accurate description and taxonomic identification, followed by comprehensive evaluations by competent authorities. The thoroughness of such evaluation depends upon the number of accessions under observation at a given time, the diversity of genera or species, and the availability of specialists. Transferring a plant from its original habitat to a different location and environment often results in phenotypic differences, and in many cases unconscious selection results in genetic change. Thus descriptive records, from the time of original discovery and throughout the evaluation period, become highly important. They should be prepared for long-term reference, and assembled methodically for computer adaptation (Hyland, 1970).

Ornithopus is a small leguminous genus of six species and subspecies. Five species and subspecies are found in Mediterranean regions of Western Europe and North Africa, and one

in South America. The species are soft pubescent annual herbs with finely divided leaves, small pink or yellow flowers and indehiscent pods which break into one-seeded segments. The common name for these plants is " serradella ", in reference to the serrate leaflets. Adaptation to sandy soils appears to be a common feature throughout the genus (Gladstones et. al., 1964).

The species are all highly palatable and are used for forage in their areas of origin, and also in Eastern Europe, United States of America, Australia and New Zealand. The most commonly used species are yellow serradella (O. compressus), pink or French serradella (O. sativus) and slender serradella (O. pinnatus).

The seed characteristics of these species are of great importance for their agronomic usage. For successful reseeded in some environments it is essential that hard seed builds up in the soil, but if all the seed is hard then there is not enough immediate germination. O. sativus lacks hard seed, while O. compressus may have too much hard seed. Embryo dormancy can also be a problem.

The objectives of this study were:

- (1) to identify and describe the accessions and harvest seed for further study;
- (2) to study the seed characteristics of each species and investigate the variation between accessions with respect to the potential for genetic improvement in agronomically important characteristics such as hard-seededness, dormancy and hullability.
- (3) to investigate methods for dehulling and breaking hard seed.

In this study, one hundred and seven accessions (both collected and introduced) were described for morphological and agronomic characteristics and tested for seed multiplication. Some were also tested for seed characteristics, seed development and a method for breaking

hard seed. The study was divided into three parts. The first experiment concentrated on the description and multiplication of all accessions. Seed development of two serradella cultivars was recorded in the second experiment, while in the third, the use of concentrated sulphuric acid to break hard seed was tested in two serradella species, O. compressus and O. pinnatus, both of which have a high percentage of hardseed.