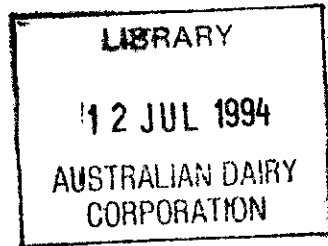


DRC -
CSe
41

FINAL REPORT



CROPPING AND DISTRIBUTION OF EXOTIC DUNG BEETLES IN SOUTH AUSTRALIA

Funded by Dairy Research and Development Corporation



DAIRY RESEARCH AND
DEVELOPMENT CORPORATION

PROJECT SUPERVISOR

**Dr Marina Tyndale-Biscoe
CSIRO Division of Entomology**

Summary

During 1991-92, a survey of South Australia determined which species of exotic dung beetles have become established, where, and in what numbers they were present. With the aid of the computer driven climate matching program, CLIMEX, it was determined which species, available for collection in NSW, were suitable but missing in the various regions of SA. Over the remainder of that and the following season, beetles were collected and sent to officers of the Department of Agriculture, for release on local farms. Beetles were also sent to officers of the Department of Agriculture in WA and Tasmania, where the climate matching had already been done. As well, some beetles were dispatched, upon request, to individual farmers in Victoria and NSW, supplementing the redistribution program of 1988-91. The following numbers and species were dispatched:

	1991-92	1992-93	Total
South Australia	635,112	6,172	641,284
Western Australia	788	4,912	5,700
Tasmania	352,660	79,399	432,069
Victoria	29,339	28,907	58,246
NSW	88,477	14,913	103,390

Thus the total number of dung beetles collected and redistributed during 1991-93 was 1,240,689.

Background

CSIRO has imported and released exotic dung beetles into Australia for the purpose of dung burial and the control of dung breeding flies. Fifty two separate species of dung beetles were released between the years 1969 and 1984, of which 23 species are known to have become established between one and six years after their date of release. Some of the species released in the warmer half of the continent bred up rapidly at their release sites and were subsequently cropped and redistributed into other climatically suitable areas, thus ensuring their rapid spread throughout the region. In the southern parts of the continent the relevant beetles have a longer generation time due to lower temperatures, and therefore none of the species had bred up into large enough populations by 1984, to make cropping and redistribution possible. One exception in the south east was *Onitis alexis* in the Araluen Valley, NSW, from where it was cropped and redistributed in 1980 all along the southern coast between Dapto and Bega. After 1982, CSIRO survey and cropping trips were discontinued due to lack of funds. However, during the years 1982-7, in the course of other work carried out by CSIRO personnel, it was observed that several of the exotic species had become abundant, e.g. *Onthophagus taurus*, *Euoniticellus fulvus* at Fyshwick, ACT; *E. pallipes* at Forbes, NSW; *Onthophagus binodis* in the Araluen Valley and on the southern tablelands. Additionally, some species were recovered for the first time since their release, e.g. *Geotrupes spiniger* at Braidwood, NSW, and *Onitis pecuarius* at Araluen Valley and around Bateman's Bay, NSW.

The rate of natural spread of dung beetles is relatively slow. Thus, *O. binodis*, present in the Araluen since 1980, had only spread to Mongarlowe, 40 km SE, by 1987. Cropping and redistribution of dung beetles results in potentially suitable areas being occupied within a few years instead of decades if left to disperse naturally.

The benefits expected from dung burial are several, but not all can be quantified in direct and obvious economic terms. The cost of harrowing and topping is \$24.7/ha.; thus elimination of only 4 harrowings and toppings a year saves \$98/ha. annually. Increase in nutrient recycling, improving soil structure, prevention of pasture contamination and erosion due to run-off have all been acknowledged as likely results from dung burial (1) but would require several years of study to be quantified. Finally, bushflies are a pest of cattle and man, and dairy farms are well known to be major breeding sites for the flies. This is because dung from cattle grazing on good quality pasture (often irrigated) enables better survival of immature flies, and produces larger flies than does dung produced by cattle grazing on non-irrigated and senescent pasture (2). Dung beetles have been shown to control fly breeding in dung pads (3, 4, and 5) in experimental situations. In recent years there has been an increasing number of observations of reductions in bush fly numbers in areas with high beetle densities (6, 7, 8, and Araluen during the summer of 1986-87, pers. obs.). Thus fly control, by decreasing the irritation caused to a milking herd, may result in increased milk production which may in time be measured in economic terms. It will certainly result in an improved quality of life for humans.

References

1. The biological control of dung in Australia. A report of an AMRC Workshop May/June 1982.
2. Greenham, P.M. (1972). The effect of the variability of cattle dung on the multiplication of the bush fly (*Musca vetustissima* Walk.). *J. anim. ecol.* 41, 153-165.
3. Bornemissza, G.F. (1970). Insectary studies on the control of dung breeding flies by the activity of the dung beetle, *Onthophagus gazella* F. (Coleoptera: Scarabaeidae). *J. Aust. ent. Soc.* 9, 31-41.
4. Ridsdill-Smith, T.J. (1981). Some effects of three species of dung beetles (Coleoptera: Scarabaeidae) in south-Western Australia on the survival of the bush fly, *Musca vetustissima* Walker (Diptera: Muscidae), in dung pads. *Bull. ent. Res.* 71, 425-433.
5. Wallace, M.M.H. and Tyndale-Biscoe, M. (1983). Attempts to measure the influence of dung beetles (Coleoptera: Scarabaeidae) on the field mortality of the bush fly *Musca vetustissima* Walker (Diptera: Muscidae) in south eastern Australia. *Bull. ent. res.* 73, 33-44.
6. Hughes, R.D., Tyndale-Biscoe, M. and Walker, J. (1978). Effect of introduced dung beetles (Coleoptera: Scarabaeidae) on the breeding and abundance of the Australian bush fly *Musca vetustissima* Walker (Diptera: Muscidae). *Bull. ent. Res.* 68, 361-372.
7. Ridsdill-Smith, T.J. and Matthiessen, J.N. (19887). Bush fly *Musca vetustissima* Walker (Diptera: Muscidae) control in relation to seasonal abundance of scarabaeine dung beetles (Coleoptera: Scarabaeinae) in South Western Australia. *Bull. ent. Res.* 78, 633-639.
8. Tyndale-Biscoe, M. and Vogt, W.G. (1991). Effects of adding exotic dung beetles to native fauna on bush fly breeding in the field. *Entomophaga* 36 (3), 395-401.

Objectives (Phase 2 of Project CSE41)

To survey South Australia, to determine the status of the original dung beetle releases. The aim is to accelerate the spread of these by further releases of the same species, and by additional species, where applicable.

Prepare an addendum to the Dung Beetle Book, consisting of current and potential distribution maps for South Australia for each species of exotic, and common native dung beetle.

Achievement of Objectives

The original release sites were surveyed in Oct-Dec 1991. A number of species were found to be absent from areas indicated as suitable by CLIMEX. For the remainder of the 1991-92 season, and the whole of the 1992-93 season, **Onthophagus taurus**, **Euoniticellus fulvus** and **Onitis pecuarius** were collected in NSW, and sent to the Mt Gambier, Mt Barker, Renmark, and Clare districts in SA.

Additionally, some finance was available to make further shipments of beetles to Tasmania, and beetles were supplied to dairy areas in Victoria and NSW upon request from farmers as a supplement to the main distribution in phase 1 of this project.

During the years 1991-92 and 1992-93 the numbers of **Geotrupes spiniger** in NSW were too low to be croppable. Hence that species was not redistributed to South Australia, although according to CLIMEX conditions for its survival are good along the coastal fringes.

Distribution maps for South Australia have been prepared, and have been sent to CSIRO Publications in Melbourne for publishing. These will be sold with each book as an addendum, and if the book is ever reprinted it will be bound into it.

Methodology

At the beginning the project was discussed with Mr Dennis Hopkins and Ken Henry, of the SA Department of Agriculture. They were fully informed of the proposal, and expressed their support and interest. Detailed surveys of dairy areas of South Australia were done, with visits to all original release sites. The current status of the exotic dung beetle species was examined, with special reference to areas where currently no exotic species occur. Samples were collected for identification, and the current distribution maps are based on these results. The results of these surveys were, together with requests for any comments they may have, were sent to the Dennis Hopkins in Adelaide.

After collection and packaging, the beetles were sent to Officers of the Department of Agriculture at Victor Harbour, Mt Barker, Mt Gambier, Clare and Murray Bridge. Their names were suggested by Mr Tim Newberry, the Principal Dairy Officer of the SA Department of Agriculture. They are the Dairy Advisors in the various dairy districts in South Australia. They collaborated with us by being responsible for contacting volunteer farmers to have beetles released on their properties, and for doing the releases.

Research Results:

E. fulvus, **O. taurus** and **O. binodis** are small diurnal beetles, (8-13mm long), and when abundant, can be found in many hundreds per pad, making them relatively easy

to collect. *O. pecuarius* and *G. spiniger*, in contrast, are much larger (15-20mm and 20-25mm long respectively); when abundant they average 10-40 beetles per pad. They are crepuscular, and if collected during their flight time then collections have to be made at night. By the following day the beetles have dug into the ground and have to be dug up, making them more difficult to collect in large numbers. *G. spiniger* was very scarce during the two years, and thus very few were collected for distribution.

The following numbers and species of beetles were cropped and redistributed during the two summer seasons of 1991-93.

	1991-2	1992-3
<i>SA</i>		
Euoniticellus fulvus	588,434	-
Onthophagus taurus	45,541	-
Onitis pecuarius	1,137	6,172
Total	641,284	
<i>WA</i>		
Onitis pecuarius	636	4,345
Hister nomas	152	492
Geotrupes spiniger		75
Total	5,700	
<i>Tas</i>		
Euoniticellus fulvus	307,646	56,420
Euoniticellus pallipes		879
Onthophagus taurus	45,024	20,436
Onitis pecuarius		1,664
Total	432,069	
<i>Vic</i>		
Euoniticellus fulvus	16,993	19,190
Onthophagus taurus	12,346	8,620
Onthophagus binodis		1,097
Total	58,246	
<i>NSW</i>		
Euoniticellus fulvus	59,320	8,112
Onthophagus taurus	28,157	3,704
Onthophagus binodis	1,000	3,097
Total	103,390	

Discussion

In South Australia, *Onthophagus taurus* and *Euoniticellus fulvus* were mainly released into the Mt Gambier and Renmark regions, since they were already present in good numbers around Mt Barker and Clare. *Onitis pecuarius* had never been released in South Australia before, and releases were made at Clare, Mt Barker and Mt Gambier regions, all potentially suitable sites.

The vast majority of the beetles sent to Tasmania were released at Elliott Research Station, near Burnie, as Dr Graeme Stevenson of the DPI was aiming at creating a "seed farm" from which in future beetles could be collected and redistributed to other areas.

Beetles sent to Victoria and NSW were mainly to dairy areas, in response to individual requests from farmers. The beetles sent to West Australia were to Dr Ian Dadour, in anticipation of the DRDC funding during the year 1993-94.

Beetles were released in batches of 5-700 large, and 1000 small beetles, since experience has shown that successful establishment is more likely with such large release numbers per site. Nevertheless, establishment is slow, and farmers will probably have to wait 2-5 years before noticing activity in dung pads. However, Mr. Doug Kershaw, of Tullendeena, Tasmania, did a survey during last summer (1993-94) and reported that every species has got established at some sites in Tasmania, and *G. spiniger* was present at all release sites, albeit still in small numbers. This indicates that the harvested beetles were of excellent quality and young enough to breed prolifically after being released into new areas.

Geotrupes spiniger ought, at some future date, be released in South Australia, as conditions for it are favourable in the south of the State. It is a useful beetle as it is the only one established to date which is "winter active" i.e. it over-winters in the adult stage, and thus is active in pads on warmer winter days as well as in early spring. Whether or not farmers will arrange to import them from interstate remains to be seen.

Communication

The current and potential distribution maps of beetles in South Australia will be sold with copies of the booklet "Common Dung Beetles in pastures of south-east Australia" for the use of farmers wanting to collect beetles themselves for their farms.

Publications

Tyndale-Biscoe M. (1990). Common Dung Beetles in Pastures of south-east Australia. CSIRO Australia.

Tyndale-Biscoe M. and Vogt W.G. (1991). Effects of adding exotic dung beetles to native fauna on bush fly breeding in the field. *Entomophaga* 36 (3), 395-401.

Tyndale-Biscoe M. (1994). Dung burial by native and introduced dung beetles. *Australian Journal of Agricultural Research*. In press.

Carson Creagh (1993) Dung beetles make their mark. *Ecos* 75, 27-29.