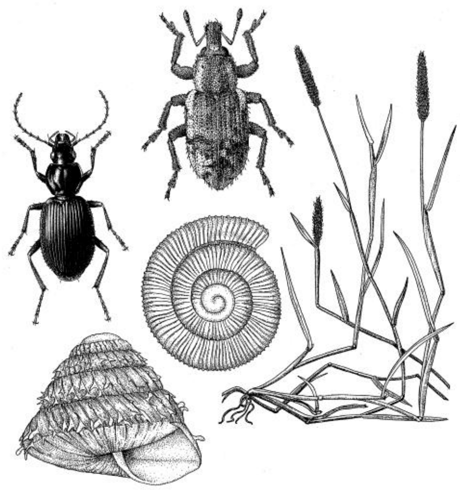
Effects *of Neotyphodium uncinatum* infected, loline-containing, meadow fescue–ryegrass hybrid grasses on the feeding behaviour of black beetle and red-headed pasture cockchafer.

3. Assessment of incidence of black beetle adult damage to seedlings in Cropmark Seeds cultivar evaluation trials at Silverdale Road, Hamilton

Report prepared for Cropmark Seeds Ltd

by Gary M. Barker



G. M. Barker & Research Associates

The Invertebrate Biodiversity Specialists
Working in production agriculture and its interface with
biodiversity conservation

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Report. No. 104 May 2011

SUMMARY

Five small plot trials established by Cropmark Seeds Ltd at Silverdale Road, Hamilton in autumn 2011 were assessed for damage to seedlings by the adult stage of black beetle (*Heteronychus arator*). The incidence of seedling damage was low but readily detected. Counts of seedlings damaged in three 2m transects per plot showed significant differences among genotypes in each of the five trials.

Observations suggested that, in general, more seedlings had sustained damage by black beetle in plots with higher vegetation vigour and cover. This observation was confirmed when mean counts/6m row were regressed against mean herbage mass (kgDM/ha) estimated by pasture probe. Examination of the residuals from this regression indicated that some genotypes sustained more damage, and others less damage, than expected given the herbage mass present.

INTRODUCTION

As part of its forage cultivar development programme, Cropmark Seeds established five adjoining small plot trials at Silverdale Road, Hamilton for evaluation of agronomic performance of promising genotypes along with some commercial cultivars. The opportunity was taken to assess seedling damage by adult black beetle (*Heteronychus arator* (Fabricius))in each of the trials as a complement for laboratory assay and field trial work on this and others pests being undertaken on contract to Cropmark Seeds.

MATERIALS AND METHODS

Cropmark Seeds Ltd established five adjoining cultivar evaluation trials in small plots at Silverdale Road, Hamilton. Seed of ryegrasses and meadow fescues was sown autumn 2011 into a cultivated seedbed with a precision drill in 1 x 6m plots.

On May 4 2011 the extent of seedling damage by adult black beetle was assessed. For each plot, the numbers of seedlings exhibiting damage were counted in each of three 2m long transects running along seedling rows. These transects were non-overlapping but otherwise randomly placed within the plot.

Damage by adult beetles was recognized as tillers severed or otherwise chewed at or near meristem level (at or below the soil surface). Tillers damaged several weeks prior to assessments were evident due to their yellowed, necrotic appearance, especially that of the inner-most (youngest) leaf. Tillers most recently damaged were evident as wilting of the inner-most leaf. All damaged tillers were detached from the seedling roots or became such readily when gently pulled with the fingers.

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Data on seedling damage were subject to analysis of variance, based counts of seedlings exhibiting damage in 6m row transects. Regression analyses were used to examine the effect of herbage mass on frequency of seedling damage using data provided by Aaron Henderson from pasture probe readings. These statistical analyses were performed using S-Plus and MS Excel.

RESULTS

The results of the counts of damaged seedling are presented in Tables 1-5. Within each of the five trials there were significant differences among genotypes in the level of seedling damage sustained.

Table 1. Frequency of black beetle adult damage to seedlings among perennial ryegrass and meadow fescue genotypes

		Damaged seedlings/6m row
ABERMAGIC AR1		1.00
ALTO AR37		0.00
ARROW AR1		1.00
BANGUET 2 E3NDO5		0.00
BASE AR37		0.00
BEALY NEA2		0.50
EXPO AR1		0.50
EXTREME AR37		0.50
FPA1002U5		0.50
FPA1002U6		0.50
HALO AR37		0.50
LPA1002A		0.50
LPA1002U12		0.50
LPB1002A		0.50
LPCD1004A		0.50
LPD1004A		1.00
LPE0904A		1.00
LPRA0802A		0.50
LPRCD0802A		1.00
MATRIX SE		0.50
ONE50 AR37		0.00
TROJAN NEA2		0.00
ULTRA AR1		1.00
ULTRA LE		0.50
Mean		0.438
F-value $_{df}$		2.180 $_{23, 95}$
P-value		< 0.001
Fisher's $LSD_{0.05}$		0.537

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Table 2. Frequency of black beetle adult damage to seedlings among hybrid perennial ryegrass and meadow fescue genotypes		
		Damaged seedlings/6m row
DELISH AR1		2.75
FH2007AA		0.00
FHA1002A		2.25
FHABC0902A		1.00
FHB1002A		0.50
FHBDF0802U6		1.50
FHC1002U12		0.50
FHD1002U13		1.00
HARPER AR1		1.50
LHA0902N		2.00
LHA1002A		1.00
LHA1002AF		1.00
LHB1004A		3.00
LHB1004N		2.00
MAVERICK G2		1.50
OHAU AR1		0.00
OHAU AR37		0.00
PG1212 AR37		0.00
Mean		1.194
F-value $_{df}$		$2.663_{17, 71}$
P-value		0.003
Fisher's $LSD_{0.05}$		1.161

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Table 3. Frequency of black beetle adult damage to seedling LM annual ryegrass genotypes		
		Damaged seedlings/6m row
FEAST 2		2.00
LMA1002N		0.25
LMA1002U13		1.00
LMB1002FN		2.00
LMB1002U13		0.00
LMC0902N		1.00
LMCL0902N		4.50
LMRAB0802N		2.00
PG255 AR37		0.50
SONIK		1.00
TABU		5.50
Mean		1.795
F-value $_{df}$		$13.467_{10, 43}$
P-value		< 0.001
Fisher's $LSD_{0.05}$		0.964

Table 4. Frequency of black beetle adult damage to seedling LMNFVT annual ryegrass genotypes		
		Damaged seedlings/6m row
LMC0902N		2.50
LMRAB0802N		0.00
PG2023		1.00
PG255 AR37		0.00
TABU		4.50
Mean		1.600
F-value $_{df}$		$18.375_{4, 19}$
P-value		< 0.001
Fisher's $LSD_{0.05}$		0.953

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Table 5. Frequency of black beetle adult damage to seedling LMA annual ryegrass genotypes		
		Damaged seedlings/6m row
ARCHIE		4.50
LM2007F		0.75
LMC1004N		2.00
LMD1004N		3.00
SULTAN		2.50
WINTER STAR 2		3.50
ZOOM		3.50
Mean		2.821
F-value $_{df}$		$2.765_{6, 27}$
P-value		0.038
Fisher's $LSD_{0.05}$		1.555

If it is assumed that the five trials were part of a single evaluation and results can be pooled within a single analysis, there were highly significant differences among genotypes ($F = 7.432_{64, 259}$, $P < 0.001$). Perennial genotypes tended to have sustained lesser damage than hybrids and those of annual parentage (Table 6).

Table 6. Frequency of black beetle adult damage to seedling among different parentage classes of genotypes		
		Damaged seedlings/6m row
Perennials		0.44
Hybrids		1.19
LMNFVT annuals		1.60
LMA annuals		2.82
LM annuals		1.80
Mean		1.22

In undertaking the counts, it was apparent that, in general, more seedlings had sustained damage by black beetle in plots with higher vegetation vigour and cover. This observation was confirmed when mean counts/6m row were regressed against mean herbage mass (kg DM/ha) estimated by pasture

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probe (data courtesy A. Henderson) (Figure 1). Examination of the residuals from this regression (Figures 2 and 3) indicated that some genotypes sustained more damage, and others less damage, than expected given the herbage mass present.

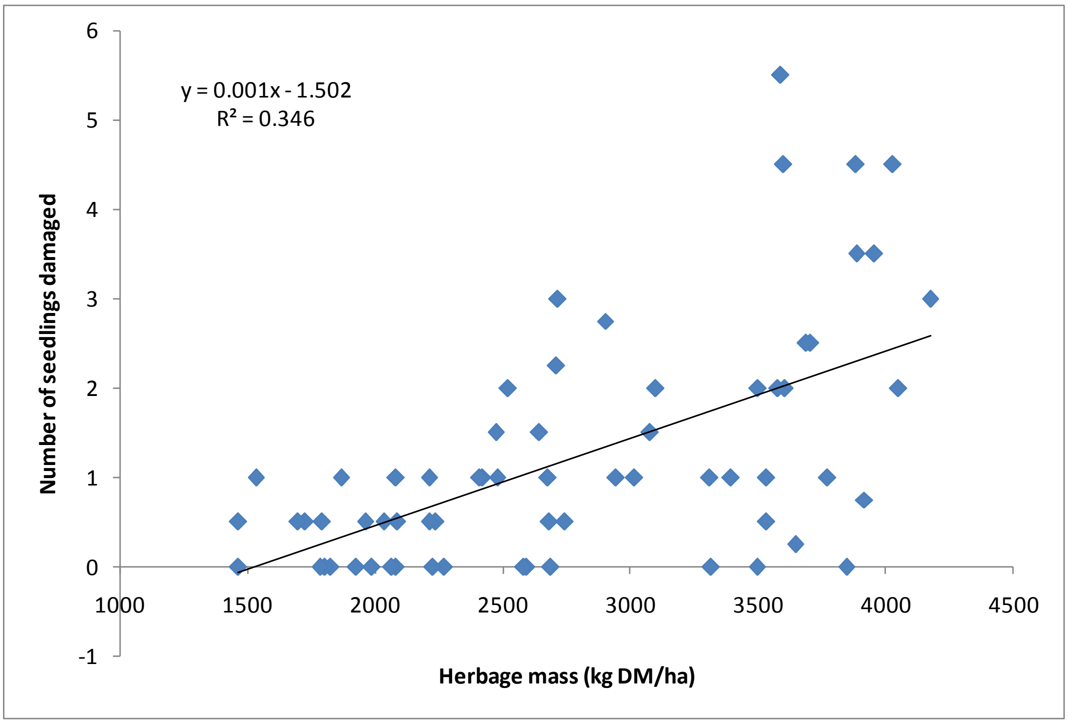

Figure 1. Relationship between herbage mass (kg DM/kg) and numbers of seedlings damaged by black beetle adults (mean/6m row) for genotypes pooled across the five trials.

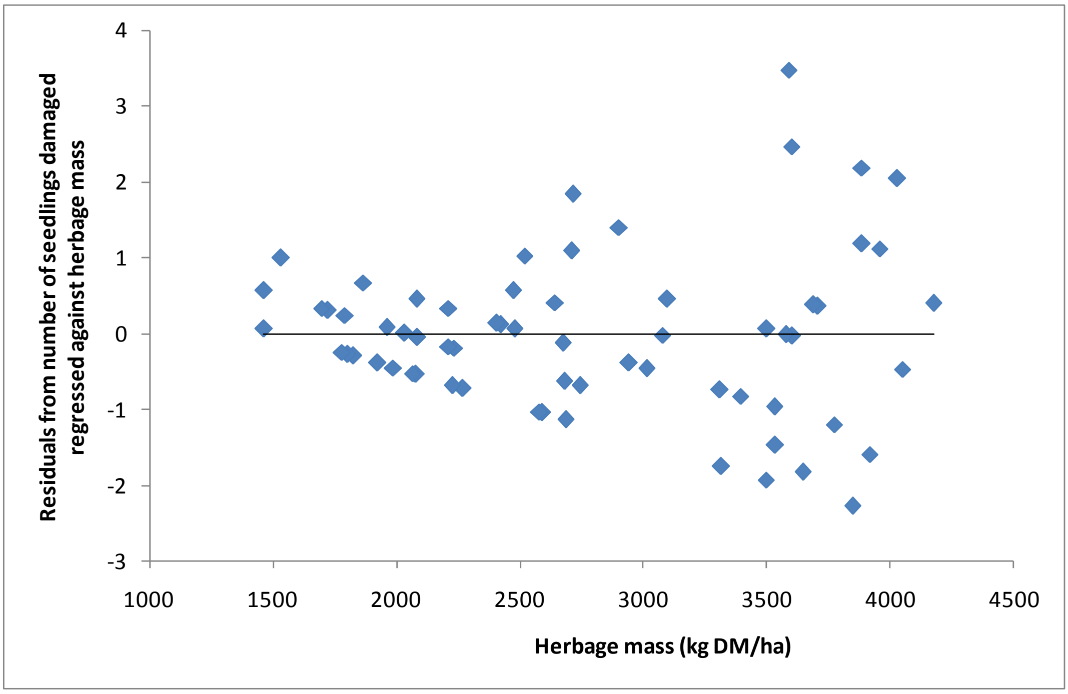

Figure 2. Relationship between residuals from regression of herbage mass (kg DM/kg) and numbers of seedlings damaged by black beetle adults for genotypes pooled across the five trials.

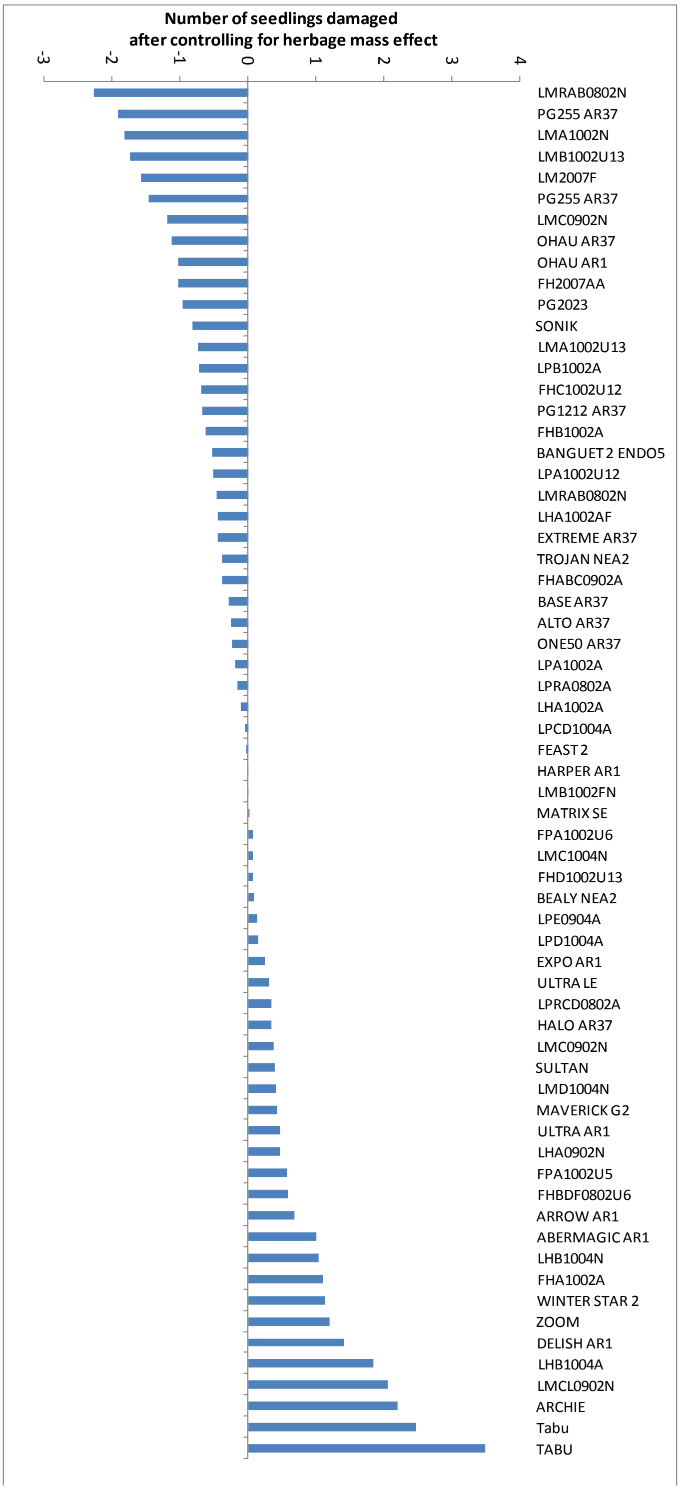

Figure 3. Departures from expected numbers of seedling damaged by black beetle adults when herbage mass is accounted for. Bars are residuals from regression of herbage mass (kg DM/kg) and numbers of seedlings damaged by black beetle for genotypes pooled across the five trials. Positive residuals indicated higher levels of damage, and negative values lower levels of damage than expected from herbage mass present. Note cultivar Tabu was included in two of the trials, hence the two means.

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DISCUSSION

The level of damage by black beetle adults was low but nonetheless easily detected in the field. These initial results clearly indicate differences among genotypes in level of seedling damage sustained. Further assessments over the winter-spring season will be undertaken to confirm these genotype effects.

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