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THE ROLE OF CATTLE DUNG IN SEED DISPERSAL OF MAJOR SPECIES IN A *ZOYSIA JAPONICA* PASTURE IN JAPAN

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Abstract

To evaluate the role of cattle dung in seed dispersal of major species in *Zoysia japonica* pasture in Japan, we investigated the species composition and density of seeds in cattle dung by means of a germination test. Of 20 major species which had a mean coverage of more than 0.1%, 90% were detected as seeds in cattle dung. In addition, the species composition and density of seeds in cattle dung differed among three sampling seasons. Seeds of the six most prevalent species in terms of coverage were detected from cattle dung during the growing season. Hence, we conclude that it is possible for major species to invade other grasslands and pastures by means of cattle dung.

Keywords: Cattle, dung, seed dispersal, *Zoysia japonica*, semi-natural grassland

Introduction

Zoysia japonica pasture is one of the typical types of semi-natural grassland in Japan (Numata 1969). The pasture consists chiefly of grazing-tolerant species and species that are unpalatable to cattle, and most of them have seed banks in the soil. In general, it develops from *Miscanthus sinensis* grassland, a typical type of semi-natural grassland, as a result of cattle grazing in Japan. However, *M. sinensis* grassland does not have seed banks of major species in *Z. japonica* pasture (Hayashi and Numata 1975).

Recently, Ide et al. (1998) clarified the importance of seed dispersal by cattle dung, by which means *Poa pratensis* was maintained and spread efficiently in an artificial grazing pasture. Therefore, clarification of the seed density and species composition in cattle dung is important to determine the reason why *M. sinensis* grassland changes to *Z. japonica* pasture as a result of cattle grazing.

Material and Methods

The study site was located on a *Z. japonica* pasture in Sugadaira, Nagano, Japan. Sugadaira belongs to the cool temperate zone. The annual mean temperature is 6.1 and the annual precipitation is about 1300 mm. This site is covered with snow during winter.

We arranged a 0.01 ha plot (10 m x 10 m) for a floristic composition survey, and divided it into 100 quadrats of equal length and width. In spring (middle June), summer (early August) and autumn (late September) in1998, the aerial cover of each species was estimated visually in each quadrat. The mean coverage of each species was the average of data for the three seasons, consisting of the percentage of the mean aerial cover of each species calculated from all quadrats.

Density and composition of seeds in cattle dung were investigated by a germination test as follows. Cattle dung (about 800gDM) was collected from around the plot in the same period of each vegetation survey. It was homogenized and divided into 8 samples. Each sample was spread on sterilized soil in a plastic tray. We checked the number and species of emerged seedlings in each sample every three days. Accordingly, the seed density of cattle dung was expressed as the seedling density.

Results and Discussion

Fifty species of spermatophytic seeds were observed in a 0.01 ha plot during the growing season. On the other hand, 23 species of seeds were detected from cattle dung during the growing season. However, Mitamura et al. (1982) reported that only 13 species of seeds (3 species were unidentified) were detected from cattle dung in the same pasture. The difference is attributable to the fact that their sample size was very small compared with that in our detailed survey.

Of 20 major species which had a mean coverage of more than 0.1%, 90% were detected as seeds in cattle dung (Table 1). These species of seeds were not digested completely after they passed through the digestive tract of cattle. *Cirsium tanakae* and *Viola mandshurica* seeds were not detected in cattle dung, because the former is unpalatable to cattle and the latter can not be grazed by cattle due to its small size (our field observation).

The species composition and density of seeds in cattle dung differed among the three sampling seasons (table 1). In addition, the number of species and density in spring were lower than those in summer and autumn. Seeds of the six most prevalent species in terms of coverage (*Z. japonica*, *P. pratensis*, *Veronica onoei*, *Rumex acetosella*, *Carex nervata* and *Trifolium repens*), were detected in cattle dung during the growing season.

We conclude that it is possible for major species (e.g., *Z. japonica*) to invade another grasslands (for example, *M. sinensis* grassland) and pastures by means of cattle dung.

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Table 1 - Seed density of spermatophytic species in cattle dung in spring (mid June), summer (early August) and autumn (late September) in *Z. japonica* pasture.

Species*	Mean coverage** (%)	Spring (N/100gDM)	Summer (N/100gDM)	Autumn (N/100gDM)
Zoysia japonica	93.2	28.3	480.4	605.2
Poa pratensis	37.2	0.3	18.6	8.5
Veronica onoei	15.2	0.2	83.2	75.2
Rumex acetosella	4.7	0.2	42.8	15
Carex nervata	4.6	0.2	3.8	0.7
Trifolium repens	4.4	0.1	23.6	9.2
Phleum pratense	4		1.7	
Lotus corniculatus	4		4.2	3.8
Dactylis glomerata	3.7		0.8	0.3
Potentilla freyniana	1		2.7	0.6
Thymus quinquecostatus	1		0.1	0.1
Hydrocotyle ramiflora	0.7		185.7	52.4
Sanguisorba officinalis	0.4		0.1	
Agrostis clavata	0.4	0.1	5.8	1.2
Prunella vulgaris	0.3		0.1	
Cirsium tanakae	0.3			
Festuca ovina	0.2		3.6	2.7
Solidago virga-aurea	0.2			0.5
Luzula capitata	0.2	1.7	0.3	
Viola mandshurica	0.2			

*Species with mean coverage of more than 0.1%
**see text