



Seed preferences of the tropical fire ant, *Solenopsis geminata* in Taiwan

Yu-Chen Chen^a, Wen-Jer Wu^{bc*} and Li-Chuan Lai^{a*}

^a Department of Ecological Humanities, Providence University, Taichung 43301, Taiwan

^b Department of Entomology, National Taiwan University, Taipei 10617, Taiwan

^c Research Center for Plant Medicine, National Taiwan University, Taipei 10617, Taiwan

* Corresponding authors



INTRODUCTION

Solenopsis geminata introduced into central and southern Taiwan over thirty years. This ant species was most common in agricultural fields and weedy habitats in Taiwan. *S. geminata* can act as both an insect predator and a seed harvester. Because of their granivorous habit, *S. geminata* workers were observed to attempt harvesting seeds from numerous plant species. The study was conducted by excavating fire ant nests to find seeds harvested by fire ants. In seed preference experiments, the seed collecting behavior of *S. geminata* was examined by observation. This study suggests that seed preference of the tropical fire ant might play a major role influencing the abundance and composition of the plant community in invaded areas in Taiwan.

RESULTS AND DISCUSSION

1. A total of 37 seed species in 12 plant families were harvested by fire ants from the four counties in Taiwan. We found that *S. geminata* preferentially harvested herb seeds (Figs. 2, 3), especially the Poaceae including 16 species (Table 2).
2. The results showed that grass seeds, such as *Dichanthium annulatum*, *Panicum maximum*, and *Paspalum orbiculare* were readily removed by fire ants. In contrast, fire ants appear to less prefer seeds from forbs, such as *Chamaesyce hirta* (Fig. 4).
3. Seed weight seemed to influence the ant choices. We found that larger seeds were removed by ants more often than smaller ones. Seeds above 0.56 mg were harvested preferentially, but 0.07-0.43 mg seeds were rarely retrieved.
4. This study suggests that seed preferences of *S. geminata* may have impacts on the abundance and composition of the plant community, especially grasses in fields infested with *S. geminata* in Taiwan.



Fig. 2. A large quantity of *Digitaria sanguinalis* seeds and a bit of *Amaranthus patulus* seeds were collected in nest.



Fig. 3. Seeds were removed by *Solenopsis geminata* workers in seed preference experiments.

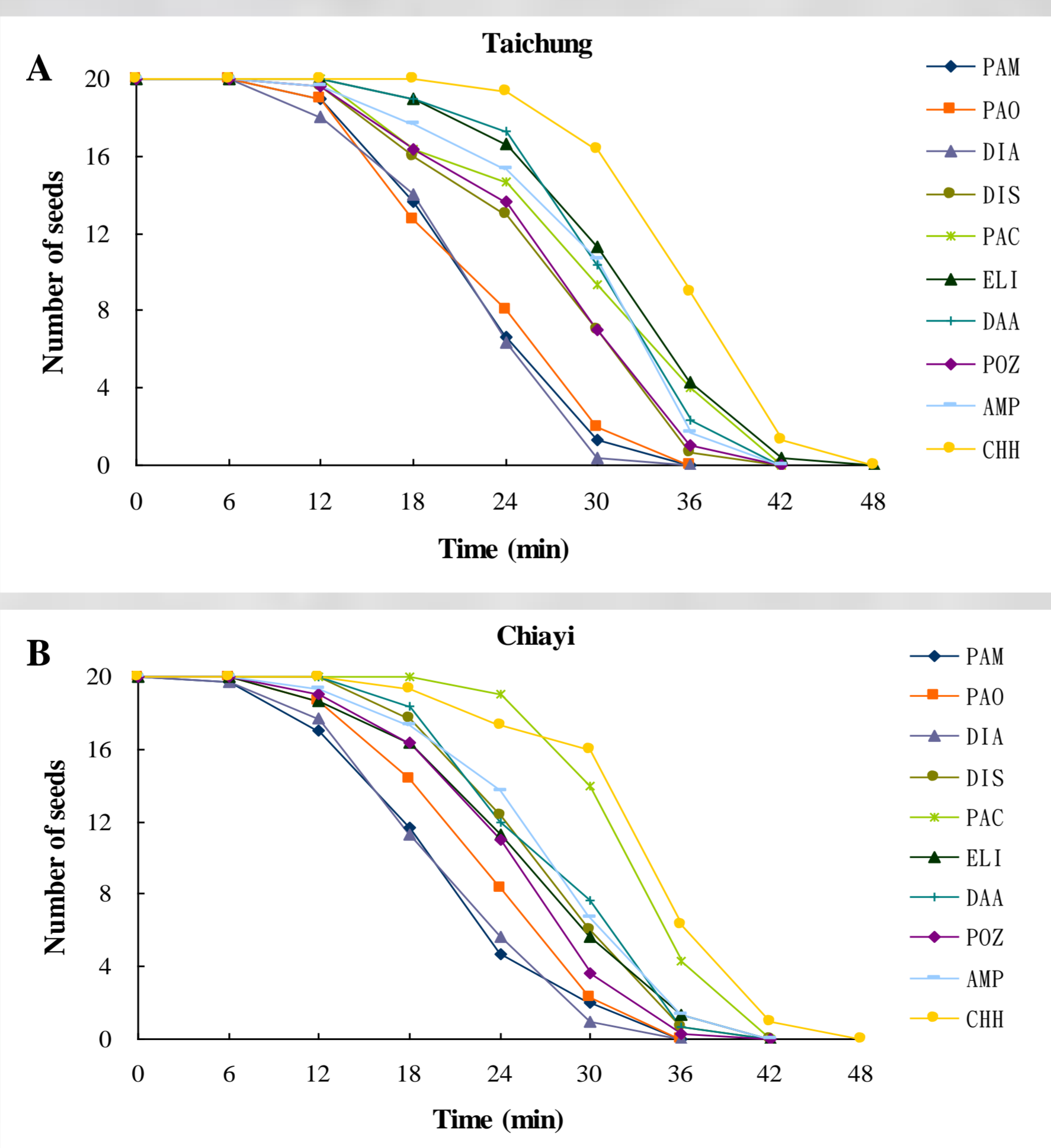


Fig. 4. Removal (number of seeds remaining) in seed preference experiments. (A) Taichung. (B) Chiayi. PAM: *Panicum maximum*; PAO: *Paspalum orbiculare*; DIA: *Dichanthium annulatum*; DIS: *Digitaria sanguinalis*; PAC: *Paspalum conjugatum*; ELI: *Eleusine indica*; DAA: *Dactyloctenium aegyptium*; POZ: *Pouzolzia zeylanica*; AMP: *Amaranthus patulus*; CHH: *Chamaesyce hirta*.

MATERIALS AND METHODS

1. Study sites and plant species

- a. The study sites were located in central (Taichung and Yunlin counties) and southern (Chiayi and Tainan counties) Taiwan.
- b. Twelve colonies of *S. geminata* were excavated to find seeds harvested by fire ants from the four counties. All collected seeds from fire ant nests were sorted and identified to species.

2. Seed preference experiments

- a. The experiments were assessed in the fields of Taichung and Chiayi counties. Three fire ant colonies were conducted in each field.
- b. The common seeds of ten plant species harvested by fire ants from the four counties were offered. Mean seed weight of each plant species was also calculated (Table 1).
- c. Twenty seeds of each of ten plant species were put on the cardboard and covered with the plastic Petri dish. We burned six 0.5 cm holes on the rim of each Petri dish to facilitate movement of ants into and out of the dish. Total 200 seeds were placed approximately one meter from each colony (Fig. 1). Each dish was observed and recorded every 2 min for 1 h.

Table 1. Mean seed weight was calculated in seed preference experiments

Species	Seed weight ^a (mg)
<i>Pouzolzia zeylanica</i>	0.24
<i>Amaranthus patulus</i>	0.27
<i>Chamaesyce hirta</i>	0.07
<i>Dactyloctenium aegyptium</i>	0.28
<i>Dichanthium annulatum</i>	0.56
<i>Digitaria sanguinalis</i>	0.68
<i>Eleusine indica</i>	0.43
<i>Panicum maximum</i>	0.86
<i>Paspalum conjugatum</i>	0.22
<i>Paspalum orbiculare</i>	1.24

^a Mean measures from 100 seeds per species.

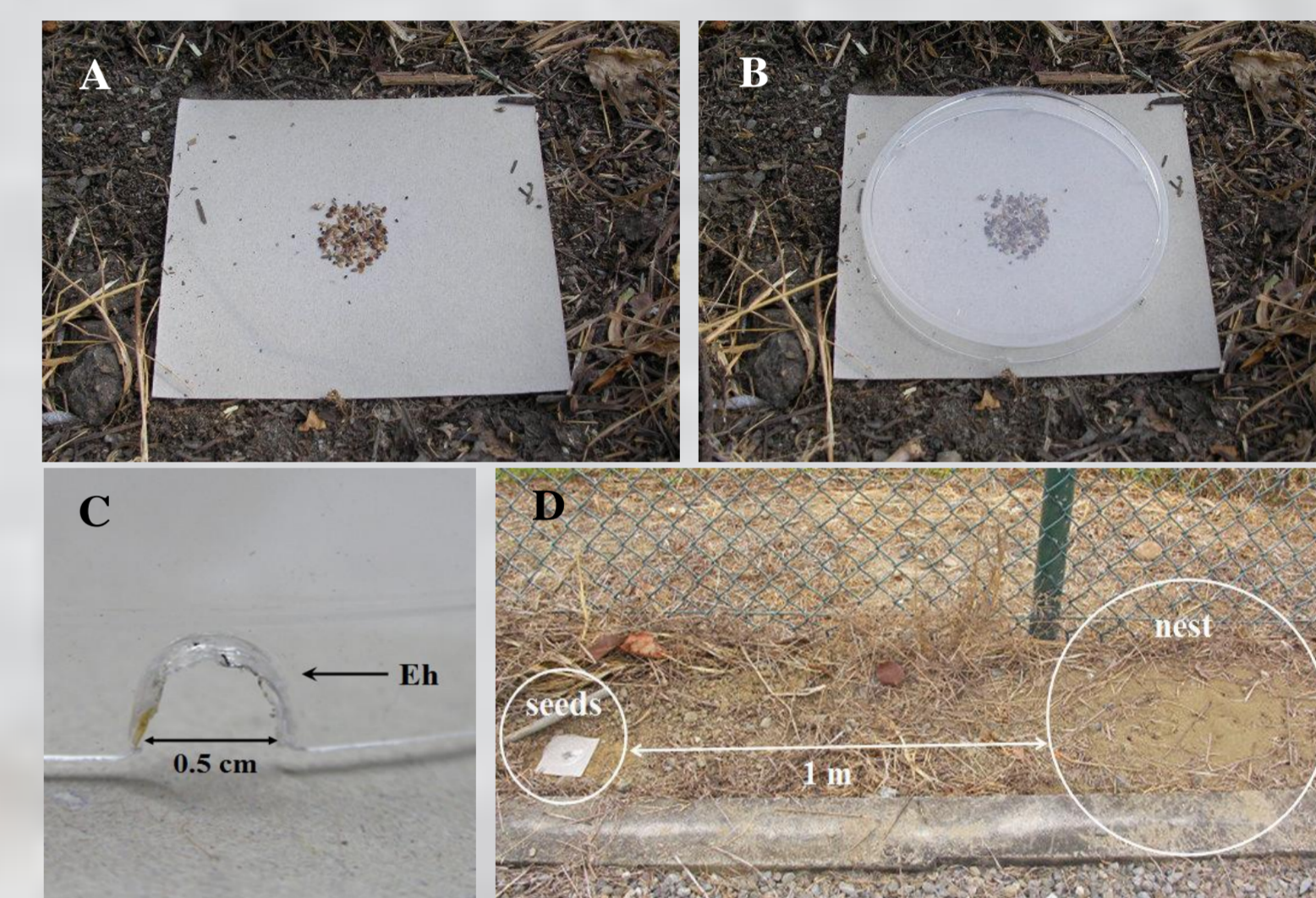


Fig. 1. Seed preference experiments. (A) Placing seeds on the cardboard. (B) Seeds were covered with the plastic Petri dish. (C) The entrance hole (0.5 cm in diameter) on the rim of the Petri dish. (D) The distance is 1 meter between seeds and the fire ant nest. Eh: Entrance hole.

Table 2. Seeds were collected by *Solenopsis geminata* from four areas in Taiwan

Plant families	Species	Areas			
		Taic	Yun	Chi	Tain
Moraceae	<i>Broussonetia papyrifera</i> *	++	+++	++	++
Urticaceae	<i>Pouzolzia zeylanica</i>			++++	
Portulacaceae	<i>Portulaca oleracea</i>		+		
Chenopodiaceae	<i>Chenopodium serotinum</i>			++++	
Amaranthaceae	<i>Amaranthus viridis</i>		++		
	<i>Amaranthus patulus</i>				++++
Fabaceae	<i>Mimosa pudica</i>	+			
	<i>Alysicarpus ovalifolius</i>				++
	<i>Indigofera spicata</i>	+++			
	<i>Indigofera hirsuta</i>				+
Euphorbiaceae	<i>Chamaesyce hirta</i>	+++	++++	++++	+++
	<i>Chamaesyce hyssopifolia</i>			++	
	<i>Chamaesyce prostrata</i>		+++		
	<i>Flueggea virosa</i> *	+	+++		
	<i>Phyllanthus amarus</i>			++	
	<i>Phyllanthus urinaria</i>			++	
Malvaceae	<i>Malvastrum coromandelianum</i>	++			
	<i>Sida cordifolia</i>				+
Convolvulaceae	<i>Ipomoea pes-tigridis</i>				+
Solanaceae	<i>Solanum torvum</i> *	+	+		
Cyperaceae	<i>Cyperus compressus</i>				++
Poaceae	<i>Brachiaria subquadripara</i>	++			++++
	<i>Cenchrus echinatus</i>	+			
	<i>Cynodon dactylon</i>		++		
	<i>Dactyloctenium aegyptium</i>			++	++++
	<i>Dichanthium annulatum</i>			++++	
	<i>Digitaria sanguinalis</i>			+++	++++
	<i>Digitaria violascens</i>	++		++	
	<i>Echinochloa colona</i>	+		++	
	<i>Eleusine indica</i>		++++	+++	+++
	<i>Eragrostis tenella</i>		+++		
	<i>Eriochloa procera</i>			+++	
	<i>Panicum maximum</i>	++++			+++
	<i>Paspalum conjugatum</i>		++++		
	<i>Paspalum distichum</i>	+	+		
	<i>Paspalum orbiculare</i>	+++	+	+	
	<i>Setaria viridis</i>	+++		++	

Taic: Taichung; Yun: Yunlin; Chi: Chiayi; Tain: Tainan. * tree or shrub. + Number of seeds less than 20. ++ Number of seeds between 21 and 100. +++ Number of seeds between 101 and 500. ++++ A large quantity of seeds (> 500).