

Grasshopper Habitat

Most grasshopper species are able to successfully occupy a wide variety of prairie types throughout North America (Onsager 1998). The pestiferous rangeland grasshopper species of the Northern Plains have extensive distribution across the regions grassland prairies; with 100% of the species inhabiting the mixed grass prairie, 91% of the species inhabiting the short grass prairie, 70% of the species inhabiting the tall grass prairie, 70% of the species inhabiting the sandhills prairie, and 61% of the species inhabiting the bunch grass prairie.

The grassland conditions in which a grasshopper species performs best and develops the highest population densities is considered to be the preferred habitat. Nine (39%) of the pestiferous rangeland grasshoppers prefer habitat with short grass areas mixed amongst many open bareground patches. The short grass areas can be located on dry upland sites dominated by blue grama and upland sedges or sites with mid and tall grass species heavily grazed to a short stature. Ten (43%) of the pestiferous rangeland grasshoppers prefer habitat with areas that have a mixture of mid and short grasses interspersed among numerous bareground patches. Four (17%) of the pestiferous rangeland grasshoppers prefer habitat with deteriorated mid and tall vegetation on moist meadows, invaded by weeds, and containing many open bareground patches. All of these preferred grassland habitat conditions are abundantly present within all of the regions prairie types.

The universally important habitat characteristic is the numerous open bareground patches. Pestiferous grasshoppers need the bareground patches for egg pod deposition sites and for basking in unobstructed sunlight to raise their body temperatures to optimal levels. Twenty two (96%) of the pestiferous rangeland grasshoppers deposit their egg pods in bareground patches (table 7). Only one (4%) of the grasshoppers deposit their egg pods into vegetation crowns.

The depth of deposition of the egg pods is a characteristic of a grasshopper species. Three (13%) of the pestiferous rangeland grasshoppers deposit their egg pods at shallow depths. Nine (39%) and eleven (48%) of the pestiferous rangeland grasshoppers deposit their egg pods at medium and deep depths, respectively (table 7). The egg pods deposited at shallow depths should have the advantage of location and accumulate degree days of heat more rapidly than the egg pods deposited at deeper depths; thus the shallow deposited egg pods

should have more rapid embryonic development and earlier hatch. The three grasshopper species that deposit their egg pods at shallow depths hatch with the early group during mid to late May. Three grasshopper species that deposit their egg pods at medium depths and four grasshopper species that deposit their egg pods at deep depths also hatch with the early group (table 7). Two grasshopper species that deposit their egg pods at a medium depth and a deep depth, respectively, hatch with the very early group during late April to early May (table 7). This information indicates that the depth of egg deposition is not the most important factor that determines the rate of embryonic development and when the eggs will hatch.

Twenty (87%) of the pestiferous rangeland grasshoppers of the Northern Plains deposit their egg pods at medium and deep depths (table 7). The deeper depths provide greater protection from cold air temperatures during the winter. The greater protection from cold air temperatures provided by deeper egg pod depths must give northern grasshoppers greater advantages and increased survival rates than the more rapid accumulation of degree days of heat provided by shallow egg pod depths.

Twelve (52%) of the pestiferous rangeland grasshoppers hatch before early June; 2 (9%) hatch very early during late April to early May, and 10 (43%) hatch early during mid to late May. Ten (43%) of the pestiferous rangeland grasshoppers hatch after early June; 7 (30%) hatch intermediate during early to mid June, and 3 (13%) hatch late during mid to late June. One (4%) of the pestiferous rangeland grasshoppers overwinter in a late nymphal stage, deposit egg pods at a medium depth, and hatch very late during mid to late July in the same growing season that they were laid (table 7).

Before the end of a six year study on the effects of grazing management on grasshopper habitat and densities, Onsager (1998) was able to distinguish that the pestiferous grasshopper species that hatched after early June declined from a population at greater rates than the pestiferous rangeland grasshopper species that hatched before early June following the implementation of a biologically effective grazing management practice, the twice-over rotation system, that had reduced the size and number of bareground spaces in their habitat. Onsager (1998) suspected that lower fecundity in the later hatching grasshoppers

was of greater importance in the more rapid decline in density than lower survival rates.

Twenty three (100%) of the pestiferous rangeland grasshoppers bask on bareground areas to accumulate thermal heat from unobstructed sunlight and also to take advantage of the additional rays reflected off the nearby bare soil for the purpose of increasing their body temperature to optimal levels. Three (13%) grasshoppers also climb vegetation too heights that receive direct sunlight as another primary basking site (table 8). Basking in vegetation is less effective than basking on bareground.

Twenty three (100%) of the pestiferous rangeland grasshoppers conduct some or most of their daily activities of courting, mating, pottering, and resting on bareground. Nine (39%) grasshoppers also conduct some of their daily activities in vegetation (table 8).

Fourteen (61%) of the pestiferous rangeland grasshoppers are graminivorous and eat mostly grasses, two (9%) grasshoppers are mixed feeders and eat both grasses and forbs, and seven (30%) pestiferous grasshoppers are polyphagus and eat many different kinds of food plants usually in the percentage of abundance. Eleven (48%) of the pestiferous rangeland grasshoppers have also adapted to eating agricultural crops (table 8). Most of the

pestiferous rangeland grasshoppers, 16 (70%), prefer to feed by climbing on the food plant. Seven (30%) of the grasshoppers prefer to feed on the food plant from the ground (table 8).

Fifteen (65%) of the pestiferous rangeland grasshoppers are geophilous; they bask and conduct most of their daily and nightly activities on the ground. Two (9%) of the pestiferous rangeland grasshoppers are phytophilous; they bask on the ground and in vegetation and conduct most of their daily and nightly activities on or in vegetation. Six (26%) of the pestiferous rangeland grasshoppers bask on the ground and conduct their daily and nightly activities on the ground or in vegetation.

Reduction of the number and size of the bareground areas in pestiferous rangeland grasshopper habitat reduces the number of days and the hours per day that grasshopper thermoregulation of body temperature reaches or stays at their optimal level. Metabolic rates and processes are reduced, digestion rates are diminished, food intake is decreased, and growth and development are slowed down resulting in higher mortality of juveniles, fewer adults fledge, maturation of adults is lengthened, the time period for egg production is shortened, the quantity of viable eggs deposited is reduced, causing decreased grasshopper densities and lower grasshopper populations (Onsager 1998).

Table 7. Pestiferous rangeland grasshopper egg hatch period, egg pod habitat, and egg pod depth.

Pestiferous Rangeland Grasshoppers	Hatch Group	Hatch Start	Hatch Duration weeks	Egg Pod Site Habitat	Egg Pod Depth		
					7-12 Shallow	mm 13-24 Medium	25-38 Deep
Aer cla	Very Early	E May	3-4	Bareground, near roots		X	
Age deo	Early	M May	4-6	Bareground, near grass	X		
Amp col	Early	M-L May	4-5	In vegetation crown	X		
Aul ell	Early	M May	3-4	Bareground	X		
Aul fem	Intermediate	E Jun	2	Bareground, near grass		X	
Cam pel	Early	M-L May	2-5	Bareground, near roots			X
Cor occ	Early	M May	4	Bareground, near grass			X
Enc cos	Intermediate	E-M Jun	6-8	Bareground, near grass		X	
Eri sim	Very Late	M-L Jul	4	Bareground		X	
Mel biv	Early	M-L May	4-6	Bareground, near roots			X
Mel con	Very Early	L Apr-E May	4	Bareground, near grass			X
Mel dif	Intermediate	M Jun	2	Bareground, near roots			X
Mel fem	Intermediate	E Jun	7-8	Bareground, near sod			X
Mel gla	Late	M-L Jun	1-2	Bareground, near sod		X	
Mel inf	Early	L May-M Jun	3	Bareground, near grass			X
Mel occ	Early	M May	3-4	Bareground		X	
Mel pac	Early	M May-E Jun	5	Bareground		X	
Mel san	Early	M-L May	3-6	Bareground, near roots		X	
Met par	Intermediate	E Jun	1	Bareground, near grass			X
Ope obs	Late	E-L Jun	2-4	Bareground, near grass		X	
Phl qua	Intermediate	E-M Jun	2-3	Bareground, near grass			X
Pho neb	Late	M-L Jun	4+	Bareground, near grass			X
Tra kio	Intermediate	E-M Jun	2-4	Bareground, near grass			X

Information from Cushing 1993, Pfadt 1994.

Table 8. Activity sites and preferred food plants of pestiferous rangeland grasshoppers.

Pestiferous Rangeland Grasshoppers	Basking Site	Daily Activity Site	Feeding Position	Food Plants			
				Grass	Forbs	Poly	Ag Crop
Aer cla	Bareground	Bareground	Ground	G			X
Age deo	Bareground	Bareground	Ground	G			
Amp col	Bareground	Vegetation/Ground	Ground	G			
Aul ell	Bareground	Bareground	Vegetation	G			
Aul fem	Bareground	Bareground	Ground/Vegetation	G			
Cam pel	Bareground	Bareground	Vegetation	G			X
Cor occ	Bareground	Ground/Vegetation	Vegetation	G			
Enc cos	Bareground	Bareground	Vegetation/Ground	G			X
Eri sim	Bareground	Bareground	Ground	G			
Mel biv	Bareground	Ground/Vegetation	Ground/Vegetation			P	X
Mel con	Bareground	Ground/Vegetation	Ground/Vegetation			P	X
Mel dif	Bareground	Ground/Vegetation	Vegetation/Ground			P	X
Mel fem	Bareground	Ground/Vegetation	Vegetation			P	X
Mel gla	Bareground	Bareground	Vegetation			P	X
Mel inf	Bareground	Ground/Vegetation	Ground	G	F		
Mel occ	Bareground	Bareground	Vegetation	G	F		
Mel pac	Bareground	Bareground	Ground			P	X
Mel san	Ground/Vegetation	Bareground	Vegetation			P	X
Met par	Bareground	Bareground	Ground/Vegetation	G			
Ope obs	Vegetation/Ground	Vegetation/Ground	Vegetation/Ground	G			
Phl qua	Bareground	Bareground	Vegetation	G			
Pho neb	Vegetation/Ground	Vegetation/Ground	Vegetation	G			X
Tra kio	Bareground	Bareground	Ground	G			

Information from Mulkern et al. 1969, Pfadt 1994.