

附录 I 苜蓿草地不同景观处理小区昆虫群落变化与恢复种的物种组成及个体数 (平均值 ± 标准差)

Appendix I Composition of insect species and individuals in the experimental alfalfa plots of habitat loss and fragmentation (Mean ± SD)

物种 Species		90% 丢失 90% loss		80% 丢失 80% loss		70% 丢失 70% loss		50% 丢失 50% loss		20% 丢失 20% loss		对照 Control
		破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	
苜蓿斑蚜 <i>Therioaphis trifolii</i>	处理 Treatment	12.8±6.9*	14.5±8.3*	11.7±3.7**	16.9±9.7**	18±5.9**	10.2±5.1**	15.3±5.4**	13.3±3.2**	11.2±6.5**	10.1±5.2**	8.6±3.1
	恢复 Restoration	4.5±4.2**	6.5±7.5**	4.2±4.4**	9.4±5.05**	6.3±8.1**	10.4±7.2**	6.5±4.1**	12.5±8.8**	6.3±5.8	6.5±2.7	12.8±5.5
苜蓿蓟马一种 <i>Thysanoptera</i> sp.	处理 Treatment	21.2±5.3**	17.0±3.1**	24.2±5.6**/	22.0±6.1**	27.1±3.7**	21.1±3.8**	29.7±4.1**	22.8±5.8**	29.9±3.6**	20.4±5.5**	30.8±3.1
	恢复 Restoration	25.4±7.3**	29.5±5.8**	39.1±5.2	40.5±7.6	31.3±7.9**	33.6±8.4**	34.7±7.5**	38.8±11.2**	37.2±8.2	37.07±6.5	29.5±5.8
大青叶蝉 <i>Cicadella viridis</i>	处理 Treatment	—*	1.5±2.1*	—	4.0±4.2	—	1.0±1.4	4.5±0.7	3.0±2.8	4.0±4.2*	2.0±1.41	2.0±3.4
	恢复 Restoration	10.5±14.9**	4.0±1.41**	3.0±1.41*	0.5±0.71*	—*	2.0±2.83*	2.5±3.5*	1.0±1.4*	46.5±60.1*	12.5±17.6**	25.0±6.7
苜蓿夜蛾 <i>Heliothis dipsacea</i>	处理 Treatment	6.0±3.4**	12.0±5.6**	9.5±2.1*	12.0±1.4*	15.5±0.7	11.0±1.4	16.5±2.12**	8.5±2.1**	10.5±6.3**	18.5±7.78**	19.0±12.2
	恢复 Restoration	11.5±11.4	8.5±6.3	4.5±6.3*	0.5±0.7*	11.0±14.1	4.0±1.4	12.0±15.5*	9.0±12.7*	3±1.41**	18.0±9.9**	24.0±5.6
豌豆蚜 <i>Aphis craccivora</i>	处理 Treatment	13.0±2.8**	35±14.1**	17.0±8.4**	30±12.5**	21.5±0.7**	43.0±1.4**	22.5±7.7**	37.5±6.3**	16±14.14**	30.5±13.4**	—
	恢复 Restoration	66.0±33.9**	56±33.9**	32.5±23.3**	45.5±2.1**	33.5±33.1**	51.5±12.0**	66.5±26.1**	71.5±38.8**	122.0±94.4**	103.0±19.8**	1.0±1.4
苜蓿盲蝽 <i>Adelphocoris lineolatus</i>	处理 Treatment	50.5±28.9**	73.5±84.1**	119.0±7.1**	74±38.1**	146.0±84.8**	105.0±87.7**	201.5±53.0**	100.0±86.2**	109.0±91.0**	80±7.07**	30.0±12.9
	恢复 Restoration	27.0±8.5**	13.0±5.6**	33.5±31.8**	63.5±21.9**	26.5±2.1*	21.0±16.9*	48.0±22.6	44.5±57.2	19.5±6.3	20.5±0.7	72.0±9.8
苜蓿象甲 <i>Hypera postica</i>	处理 Treatment	0.5±0.7	—	—	—	0.5±0.71	0.5±0.7	0.5±0.7	—	1.5±0.7*	—*	141.0±10.7
	恢复 Restoration	0.5±0.7	1.5±0.7	0.5±0.7	0.5±0.7	0.5±0.7**	3.0±2.1**	0.5±0.7	1.5±2.1	1.0±1.4	4.0±2.4	37.0±4.6
黑翅雏蝗 <i>Chorthippus aethalinus</i>	处理 Treatment	27.5±14.8**	—**	—	—	—	—	—	—	—	—	5.0±3.52
	恢复 Restoration	10.0±8.4*	17±2.8*	6±8.4	7.5±4.9	12.0±14.1**	17.5±4.9**	3.5±0.7	15.5±14.8	9.5±0.7**	19.5±9.2**	6.0±6.5
狭翅雏蝗 <i>C. dubius</i>	处理 Treatment	27.5±14.8**	45.0±24.0**	29.5±12.1**	52.5±12.1**	22.5±3.5**	56.0±15.5**	29.0±2.8**	51.5±3.5**	18.0±6.8**	34.5±4.9**	21.0±7.2
	恢复 Restoration	7.5±3.5**	22.0±9.9**	2.5±3.5**	11.0±1.4**	13.0±16.9**	18.0±5.6**	7.0±5.4**	22.5±19.0**	13.0±2.8**	24.0±2.8**	26.0±6.7
白纹雏蝗 <i>C. albonemus</i>	处理 Treatment	1.5±2.1	1.0±1.4	6.5±9.2**	1.5±0.7**	5.0±3.4	1.5±0.7	5.0±5.6**	2.5±0.7**	3.0±2.8*	—*	38.0±12.3
	恢复 Restoration	—	—	—	—	3.0±1.9	1.0±1.4	0.5±0.7	0.5±0.7	0.5±0.71	1±1.4	12.0±6.5

物种 Species		90% 丢失 90% loss		80% 丢失 80% loss		70% 丢失 70% loss		50% 丢失 50% loss		20% 丢失 20% loss		对照 Control
		破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	
		宽翅曲背蝗 <i>Paracryptera meridionalis</i>	处理 Treatment	9.5±10.6*	5.0±2.3*	18.0±18.4	5.0±4.2	8.5±6.36*	7.5±4.9*	6.0±4.2*	10.5±2.1*	
	恢复 Restoration	–	–	0.5±0.7	–	–	0.5±0.7	1.5±0.7*	–*	1.0±1.1	–	–
大垫尖翅蝗 <i>Epacromius coerulipes</i>	处理 Treatment	27.0±8.5**	37.0±31.1**	45.5±30.4*	29.5±7.8*	61.5±47.3**	25.0±15.6**	81.0±49.5**	28.5±9.2**	75.0±89.1**	24.5±13.4**	5.0±6.3
	恢复 Restoration	4.5±0.7**	17.0±16.9**	3.5±3.5	1.5±0.7	8.5±2.1	2.5±3.5	13.5±10.6**	5.5±7.8**	10.5±14.8**	1.5±2.1**	4.0±3.9
高加索黑蚁 <i>Formica transcaucasica</i>	处理 Treatment	–	–	1.0±1.4	–	–**	9.5±7.8**	–	–	–	–	28.0±7.9
	恢复 Restoration	1.0±1.4	1.5±0.7	0.5±0.7	1.0±1.2	–*	1.5±0.7*	–	0.5±0.7	1.0±1.4	3.0±2.83	3.0±3.2
异色瓢虫 <i>Harmonia axyridis</i>	处理 Treatment	–	0.5±0.7	0.5±0.7	0.5±0.7	–	–	0.5±0.7	0.5±0.7	0.5±0.7	1.0±1.4	–
	恢复 Restoration	1.5±2.1	0.5±0.7	–**	4.0±5.4**	–	–	2.0±1.4	1.0±1.4	1.5±2.1	3.0±1.4	–
龟纹瓢虫 <i>Propylea japonica</i>	处理 Treatment	–**	12.0±2.8**	4.5±0.7**	10.5±2.1**	3.5±0.7**	9.5±7.8**	5.5±0.7*	13.0±2.8*	2.5±3.5**	5.0±2.8**	0.7±0.5
	恢复 Restoration	–	–	1.5±2.1	1.0±1.4	5.0±7.2	4.0±2.8	1.0±1.4**	5.0±4.2**	1.5±2.1	2.5±2.1	1.1±0.8
多异瓢虫 <i>Hippodamia variegata</i>	处理 Treatment	–	–	0.5±0.7**	2.5±3.5**	0.5±0.7	0.5±0.7	1.0±1.4	–	–	1.0±1.4	2.0±1.1
	恢复 Restoration	–	–	–	–	–	–	–	–	0.5±0.7	–	2.0±1.4
七星瓢虫 <i>Coccinella septempunctata</i>	处理 Treatment	10.0±9.9	14.0±2.8	12.5±0.7*	17.0±5.6*	13.5±2.1**	19.0±1.4**	22.5±10.6	24.5±4.9	16.0±18.4	16.0±11.3	1.4±1.2
	恢复 Restoration	8.5±3.5*	5.0±7.1*	8.5±2.1*	8.5±3.5*	2.5±2.1**	6.0±1.4**	7.5±0.7	9.0±1.4	6.0±2.8*	6.5±0.7*	1.0±1.4
小姬猎蝽 <i>Nabis mimosiferus</i>	处理 Treatment	11.5±4.9**	27.0±11.3**	7.5±0.7**	24.5±12.1**	12.0±5.6**	41.5±21.9**	5.5±6.4**	42.0±14.1**	2.5±0.7**	8.0±2.8**	21.0±10.8
	恢复 Restoration	19.0±5.6**	17.5±4.9**	19.0±15.6**	28.0±2.8**	18.0±8.5**	38.0±26.9**	29.5±4.9*	31.5±9.2*	29.5±12.0	24.5±13.4	6.0±2.4
黑点食蚜盲蝽 <i>Deraeocoris punctulatus</i>	处理 Treatment	1.5±0.7	1.5±2.1	1.5±2.1	7.5±7.8	3.0±2.8*	5.0±2.8*	5.0±4.2*	6.5±4.9*	–*	1.5±2.1*	38.0±12.3
	恢复 Restoration	2.0±1.4	1.5±0.7	1.0±1.4	–	2.5±0.7	3.5±3.5	2.0±1.4	1.0±1.3	–**	4.5±6.5**	16.0±9.8
中华草蛉 <i>Chrysopa Sinica</i>	处理 Treatment	5.0±0.7*	–*	1.5±2.1*	–*	2.0±1.4*	1.5±2.1*	2.0±1.4*	–*	4.0±5.6**	1.0±1.4**	–
	恢复 Restoration	–	–	–	–	–	–	–	–	–	–	–
梯斑黑食蚜蝇 <i>Melanostoma scalare</i>	处理 Treatment	34.0±22.6**	42.0±26.8**	41.0±14.1	41.0±4.2	43.0±12.7	40.0±7.1	72.5±13.4**	43.5±7.8**	51.0±29.7**	59.5±10.6**	–
	恢复 Restoration	12.0±9.9**	13.5±3.5**	11.5±13.4*	11.0±2.8*	13.5±3.5	7.5±3.5	21.5±20.5**	8.0±7.1**	29.5±13.4**	18.0±5.6**	–

物种 Species		90% 丢失 90% loss		80% 丢失 80% loss		70% 丢失 70% loss		50% 丢失 50% loss		20% 丢失 20% loss		对照 Control
		破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	
		星豹蛛 <i>Pardosa astrigera</i>	处理 Treatment	1.0±1.4	1.5±0.7	–	–	1.0±1.4	2.0±1.4	1.0±0.6*	2.5±3.5*	
	恢复 Restoration	–	–	–	–	–*	0.5±0.7*	3.0±4.2*	–*	1.0±1.4	1.5±0.7	2.0±3.2
三突花蛛 <i>Misumenops tricuspidatus</i>	处理 Treatment	–	–	–	–	–	–	–	–	–	–	1.0±1.4
	恢复 Restoration	–	–	–**	6.5±9.2**	–	4.0±1.4	–**	5.5±0.7**	–**	9.5±2.1**	–
黑腹豹蛛 <i>Lycosa coelestris</i>	处理 Treatment	4.0±1.4	4.0±2.8	3.5±2.1	2.5±2.1	2.5±0.7**	5.0±1.4**	3.5±3.5	3.0±4.2	5.0±4.2**	2.5±3.5**	6.1±3.4
	恢复 Restoration	5.0±7.1	5.0±5.6	2.0±1.4*	6.0±2.4*	2.0±1.4**	6.5±0.7**	6.5±0.7	6.0±5.7	6±8.5**	9.5±2.1**	3.9±2.6
夜蛾瘦姬蜂 <i>Ophion luteus</i>	处理 Treatment	1.5±0.7	–	–	–	0.5±0.7	–	–	–	–	–	–
	恢复 Restoration	–	–	–	–	–	–	1.0±1.4*	–*	–	–	18.0±5.8
舞毒蛾黑瘤姬蜂 <i>Coccygomimus disparis</i>	处理 Treatment	2.5±2.1*	3±2.82*	2.0±1.4**	7.0±1.4**	4±2.8*	5.5±4.9*	8.0±9.9	7.0±1.4	3.5±2.1	1.5±2.1	–
	恢复 Restoration	–	–	–	–	–	–	0.5±0.7	–	0.5±0.7	0.5±0.7	–
姬蜂一种 <i>Coccygomimus sp.</i>	处理 Treatment	8.6±7.6	9.8±5.8	6.8±4.5	7.9±4.5	10.9±8.3*	11.3±8.9*	8.9±6.3*	6.9±5.1*	8.3±6.3	9.2±8.0	4.0±3.5
	恢复 Restoration	9.3±6.0	7.7±4.9**	6.9±4.5**	4.6±3.4	12.6±9.9	13.6±9.7	7.8±6.9**	6.9±5.1**	9.9±7.8	9.2±7.1	–
蚜茧蜂一种 <i>Aphidius sp.</i>	处理 Treatment	6.6±4.4**	8.5±5.9**	6.3±4.2	5.3±4.9	9.3±7.7	9.3±6.8	7.3±4.2	5.3±4.5	7.9±6.1	7.9±5.6	9.0±5.6
	恢复 Restoration	7.5±5.9*	5.3±4.3*	5.6±3.1**	3.6±2.4**	8.6±4.9	8.6±6.3	5.8±4.4**	4.6±3.3**	7.6±5.2	6.2±5.1	8.1±6.2
长背瘦蜂一种 <i>Alloxysta sp.</i>	处理 Treatment	–	–	–	–	1.0±1.4*	–*	–	–	–	–	6.35±4.82
	恢复 Restoration	27.0±5.6**	42.0±7.6**	47.0±2.3**	34.0±5.8**	39.0±2.7**	51.0±9.8**	44.0±8.8	47.0±11.4	38.0±12.3**	59.0±7.6**	5.26±4.5
大牙土天牛 <i>Dorysthenes paradoxus</i>	处理 Treatment	–	–	–	–	–	–	–	–	–	–	3.0±3.1
	恢复 Restoration	–	–	55.0±12.6**	–**	25.0±7.9**	3.0±4.6**	10.0±3.1**	2.0±2.1**	3.0±1.5*	–*	28.0±2.3
白星花金龟 <i>Potosia brevitarsis</i>	处理 Treatment	14.0±6.7*	7.0±2.5*	10.0±2.8*	6.0±7.8*	6.0±3.5	7.0±3.7	1.0±1.4	2.0±4.4	1.0±1.4	4.0±5.4	–
	恢复 Restoration	2.0±2.5*	7.0±4.5*	5.0±3.8**	1.0±1.4**	3.0±1.4	1.0±1.4	4.0±2.8*	1.0±1.4*	2.0±2.4	3.0±2.6	5.0±3.4
克氏侧琵甲 <i>Prosodes kreitneri</i>	处理 Treatment	2.0±1.4	–	1.0±2.1**	5.0±1.4**	1.0±1.4**	5.0±2.5**	5.0±2.3*	2.0±1.4*	1.0±1.4	–	3.0±3.6
	恢复 Restoration	3.0±4.57**	9.0±6.7**	7.0±5.4**	3.0±2.1**	6.0±3.1	5.0±2.3	7.0±4.5	6.0±5.5	9.0±6.5	8.0±6.5	1.0±1.4

物种 Species		90% 丢失 90% loss		80% 丢失 80% loss		70% 丢失 70% loss		50% 丢失 50% loss		20% 丢失 20% loss		对照 Control
		破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	破碎 H=1 Fragmented	连续 H=0 Clumped	
		皱纹蝼甲 <i>Blaps rugosa</i>	处理 Treatment	12.0±10.85	18.0±5.6	21.0±7.8**	12.0±8.6**	23.0±3.8	19.0±3.5	14.0±6.8	4.0±3.4	
	恢复 Restoration	66.0±23.4**	86.0±10.9**	73.0±4.5**	63.0±10.1**	47.0±7.3**	71.0±11.5**	38.0±4.5**	48.0±9.9**	105.0±24.5**	114.0±24.5**	5.0±4.3
直角通缘步甲 <i>Pterostichus gebleri</i>	处理 Treatment	3.0±3.1	–	3.0±1.2	5.0±4.6	3.0±2.4**	–**	4.0±3.5	1.0±0.7	1.0±1.4	–	10.0±7.9
	恢复 Restoration	8.0±5.4	3.0±4.7	10.0±5.5**	2.0±0.7**	9.0±4.5	2.0±1.4	11.0±9.9**	2.0±2.2**	5.0±5.4*	2.0±3.5*	56.0±8.7
短翅伪葬步甲 <i>Pseudotaphoxnus mongolicus</i>	处理 Treatment	–	–	–	–	–	–	–	–	–	–	–
	恢复 Restoration	6.0±2.5*	2.0±1.9*	6.0±4.8	6.0±5.7	–**	7.0±4.1**	11.0±6.2*	7.0±3.2*	–**	5.0±3.6**	4.0±5.3
叶甲一种 <i>Chrysomeloidae</i> sp.	处理 Treatment	–	–	11.0±8.7**	–**	2.0±2.1*	–*	–	–	–	–	–
	恢复 Restoration	–	–	1.0±1.41	–	–	–	2.0±3.45*	–*	–**	4.0±6.75**	1.0±1.4
大黑葬甲 <i>Necrophorus concolor</i>	处理 Treatment	19.0±10.2**	9.0±3.1**	–**	14.0±9.4**	5.0±3.5**	16.0±7.8**	1.0±1.4**	13.0±9.8**	17.0±10.1	17.0±9.7	–
	恢复 Restoration	10.0±5.4	9.0±4.4	1.0±1.4	11.0±4.5	3.0±2.5	12.0±3.4	2.0±2.3*	6.0±5.1*	18.0±5.5*	11.0±3.1*	–
星斑虎甲 <i>Cicindela kaleea</i>	处理 Treatment	19.0±10.2	9.0±3.1	–	14.0±9.4	5.0±3.5	16.0±7.8	1.0±1.4	13.0±9.8	17.0±10.1	17.0±9.7	4.0±2.1
	恢复 Restoration	10.0±5.4	9.0±4.4	1.0±1.4	11.0±4.5	3.0±2.5	12.0±3.4	2.0±2.3	6.0±5.1	18.0±5.5	11.0±3.1	7.0±5.4
物种数 Species	处理 Treatment	27	25	30	26	30	28	29	26	26	25	27
	恢复 Restoration	26	25	26	27	25	31	33	31	31	33	29

处理/恢复: 处理表示苜蓿草地景观处理后昆虫群落各种昆虫种类的个体数, 恢复表示苜蓿草地昆虫群落在恢复过程中各种昆虫种类的个体数

Treatment/Restoration: treatment indicates individuals of different species after habitat loss and fragmentation in experimental alfalfa patches, Restoration indicates individuals of different species in the experimental alfalfa patches of community restoration. * $P < 0.05$, ** $P < 0.0001$.