Arthropods Associated with Two Crested Wheatgrass Pastures in Central Montana

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Highlight: *Two pastures of crested wheatgrass in central Montana were surveyed for arthropods from May 10 through September 30, 1972, and 1973. A vacuum quick trap and the bagging of individual plants showed that five groups of arthropods were important on the basis of abundance and above-ground biomass: grasshoppers, ants, leafhoppers, thrips, and mites. Adults of the first three groups were identified to species.*

According to Mercer (1938), crested wheatgrass (*Agropyron desertorum* (Fisch.) Schult.) is the most drought-, insect-, and disease-resistant forage and feed crop grown in Montana. Williams and Post (1945) stated there are approximately one million acres of crested wheatgrass in Montana that are used for grazing or for hay. This plant also furnishes a considerable amount of forage on rangeland throughout other parts of the West.

Orthoptera (grasshoppers) have caused considerable damage to crested wheatgrass but at least two other orders of insects contain species which are injurious: Thysanoptera and Hemiptera. Tingey et al. (1972) found thrips (Thysanoptera) on crested wheatgrass, rubber rabbitbrush, big sagebrush, and antelope bitterbrush in Utah; but crested wheatgrass had the most diverse fauna, 12 potentially damaging species. The authors therefore felt that thrips may decrease the grazing potential of stands by limiting the production of the seed required for natural reseeding. Watts (1965) also reported that thrips damaged crested wheatgrass in New Mexico. However, the most important pests of crested wheatgrass belong to the order Hemiptera, the genera *Labops* and *Irbisia* known generally as "black grass bugs" (Knowlton, 1967). For example, Knowlton and Roberts (1971) reported that these insects reduced the amount of feed available for both livestock and certain species of wildlife, impaired the rangeland as a habitat for other species of wildlife, and reduced the watershed capacity of the infested areas. Denning (1948) found that they damaged forage and caused loss of seed in Wyoming. Mills (1939) and Pepper et al. (1953) found the bugs in Montana. Bohning and Currier (1967) and Pepper et al. (1953) reported that crested wheatgrass plants were killed by the black grass bugs.

A study was therefore made to determine whether thrips and black grass bugs were indeed abundant in two crested wheatgrass pastures in central Montana. At the same time, we assessed the abundance of other insects that might limit the growth or seed production of this grass species.

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The authors gratefully acknowledge the Cooney and Kimmel Ranches for use of land and the following taxonomists of the Systematic Entomology Laboratory for insect identifications: T. L. Erwin, J. L. Herring, J. P. Kramer, D. R. Miller, L. M. Russell, D. R. Smith, T. J. Spilman, and W. W. Wirth.

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Manuscript received July 30, 1974.

Methods and Procedures

Two pastures were selected because they had vigorous stands of crested wheatgrass and contained a minimum of other plant species and because they were adjacent to shortgrass rangeland where grasshoppers had previously been numerous. Thus, the effects of grasshopper feeding might be assessed for this plant.

One pasture (CW 1) was located 1.6 km south of Harlowton, Mont., in Wheatland County. The plant species (percent cover) as determined by using a point frame and taking 200 above-ground hits on the first plant species encountered was 39% crested wheatgrass, 10% needleandthread, 2% fringed sagewort, and 6% miscellaneous plants. The recording of 200 ground level hits showed hits on bare ground averaged 65%. The second pasture (CW 2) was located 35.2 km north of Roundup, Mont., in Petroleum County. There 38% of the plants were crested wheatgrass, 3% needleandthread, 2% fringed sagewort, and 3% miscellaneous plants. Hits on bare ground averaged 81%. Both pastures had been seeded many years previously, probably during the 1930's, though the actual date is unknown. Both pastures were also grazed during the two summers; however, CW 1 was lightly grazed and CW 2 was moderately grazed.

Arthropods were collected from both pastures from May 10 through September 30 in 1972 and 1973 every two weeks with a vacuum quick trap (described below). A ½-m^2 cage was attached to a 4.9 m boom that was mounted on a three-wheeled motorcycle. Thus the cage could be released from a height of 2.4 m while the machine was moving along one of the predetermined transect lines. In each pasture, at each sampling date, the cage was dropped 10 times with 15.2 m intervals between drops. Arthropods trapped in the cage were vacuumed into a net placed in a 20.3 cm vacuum hose and were transferred from the net into Berlese funnels that were installed in a van truck. Heating elements in the Berlese funnels and lights used to attract the arthropods were powered by a portable generator and allowed rapid extraction of the arthropods from the soil and plant litter. The first year, the duff from two of the 10 cages were checked by examining it on a paper plate with a magnifying glass for arthropods that had not emerged. The examination revealed that 99% of the arthropods were recovered using the Berlese funnels. Arthropods found to be abundant or to have a large dry weight were separated to species in the laboratory, dried at 60°C, and weighed. The other arthropods were separated to order or group (aphids, mites, spiders, and immature forms).

In addition, on each collecting date, plastic bags were placed quickly over five crested wheatgrass plants selected at random and the plants were cut off at ground level. The plants were then removed from the bag and placed in the Berlese funnels. Arthropods recovered were separated to orders and groups. This showed which arthropods were directly associated with the crested wheatgrass plants.

Results and Discussion

Insect species collected with the quick trap and considered important because of abundance and size are listed in Table 1 along with their biomass and density. The total numbers and density of other insects collected by the quick trap and extracted from bagged plants are shown in Table 2. Only a few adult grasshoppers were collected, mostly from CW 2, but they were the heaviest of the individual insects and also had the greatest biomass per square meter. However, the values for the adult grasshoppers are probably grossly underestimated because the quick trap did not quantitatively sample adult (mobile) grasshoppers. The most abundant insect species were five species of ants, one leafhopper species, and one species of Diptera (Table 1).

The three most abundant groups in descending order of abundance were immature Homoptera (mostly leafhoppers), mites, and thrips. (The species of mites and thrips were not

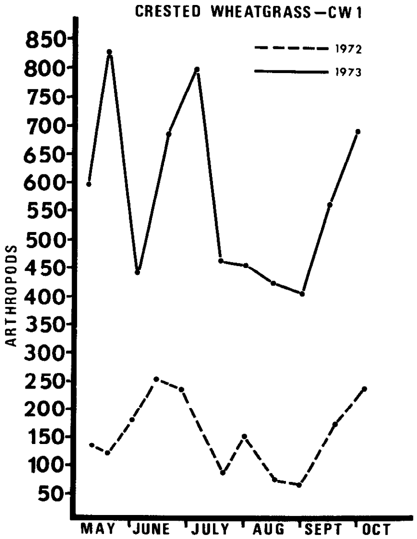

Fig. 1. *Seasonal arthropod density at pasture CW 1 showing total density for 5 square meters on each collecting date.*

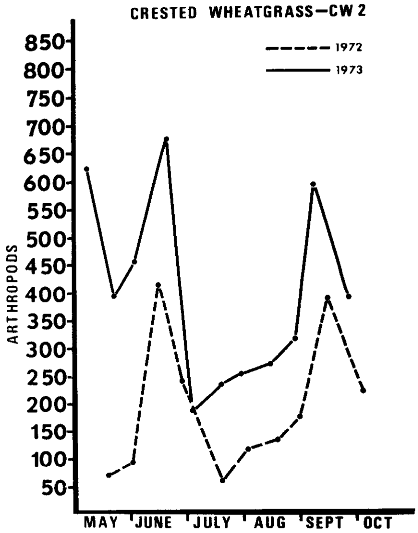

Fig. 2. *Seasonal arthropod density at pasture CW 2 showing total density for 5 square meters on each collecting date.*

Table 1. Density (no./m²) and biomass (mg) of selected adult insect species (large and abundant) collected with the vacuum quick trap from 2 crested wheatgrass fields in central Montana during a 2-year period, 1972–1973.

Identification (order, family, and species)	Number of insects collected by the vacuum quick trap: Pasture CW 1	Pasture CW 2	Total	Avg	Insect weight and biomass (mg): Avg individual dry weight[1]	Avg biomass[2]
Coleoptera						
Anthicidae						
Notoxus calcaratus Horn	27	28	55	0.26	4.90(20)	1.27
Tenebrionidae						
Blapstinus spp.	1	18	19	.09	2.48(10)	.22
Carabidae						
Metabletus americanus Dej.	6	7	13	.06	.30(10)	.02
Diptera						
Ephydridae						
Philygria debilis Loew Lw.	274	58	332	1.54	.66(10)	1.02
Trixoscelididae						
Trixoscelis fumipennis Melander	0	15	15	.07	.34(10)	.02
Hemiptera						
Nabidae						
Nabis americaferus Carayon	14	9	23	.11	1.82(10)	.19
Lygaeidae						
Nysius tenellus Barber	27	122	149	.69	.89(50)	.62
Geocoris bullatus (Say)	6	41	47	.22	.73(50)	.16
Miridae						
Chlamydatus associatus (Uhler)	2	17	19	.09	.20(10)	.02
Irbisia spp.	1	20	21	.10	1.75(3)	.17
Homoptera						
Cicadellidae						
Aceratagallia fuscoscripta Oman	111	236	347	1.61	.41(50)	.66
Hardya dentata (Osborn & Ball)	20	3	23	.11	.29(20)	.03
Cuerna alpina Oman & Beamer	2	23	25	.12	1.98(10)	.23
Hebecephalus truncatus Beamer & Tuthill	35	28	63	.29	.37(10)	.11
Psyllidae						
Aphalara artemisiae Foerst.	59	69	128	.60	.08(50)	.05
A. veazei Patch	1	37	38	.18	.19(30)	.03
Cercapidae						
Philaronia bilineata (Say)	1	16	17	.08	3.27(10)	.26
Hymenoptera						
Formicidae						
Tapinoma sessile (Say)	823	28	851	3.96	.15(50)	.59
Formica lasioides Emery	120	53	173	.80	.35(50)	.28
Myrmica americana Weber	97	92	189	.88	.89(50)	.78
Leptothorax rugatulus Emery	113	54	167	.78	.03(50)	.02
Lasius crypticus Wilson	369	196	565	2.63	.20(50)	.53

Table 1 continued

Identification (order, family, and species)	Number of insects collected by the vacuum quick trap: CW 1	CW 2	Total	Avg	Insect weight and biomass (mg): Avg individual dry weight[1]	Avg biomass[2]
Orthoptera						
Acrididae						
Aeropedellus clavatus (Thomas	5	2	7	.03	36.93(5)	1.20
Ageneotettix deorum (Scudder)	0	9	9	.04	26.78(8)	1.12
Arphia pseudonietana (Thomas)	0	1	1	.01	82.40(1)	.38
Hadrotettix trifasciatus (Say)	0	1	1	.01	146.95(1)	.68
Hesperotettix viridis (Thomas)	0	3	3	.01	82.15(1)	1.15
Melanoplus gladstoni Scudder	0	2	2	.01	90.14(2)	.84
M. infantilis Scudder	10	17	27	.13	46.18(10)	5.80
M. occidentalis (Thomas)	0	1	1	.01	132.50(1)	.62
M. packardii Scudder	0	3	3	.01	117.53(2)	1.64
M. sanguinipes (F.)	0	17	17	.08	65.68(9)	5.19
Metator pardalinus (Saussure)	0	1	1	.01	227.86(1)	1.06
Psoloessa delicatula (Scudder)	2	0	2	.01	27.85(2)	.26
Spharagemon equale (Say)	0	2	2	.01	228.26(1)	2.12
Trachyrhachys kiowa (Thomas)	0	1	1	.01	52.99(1)	.25

[1] The number of parenthesis is the number of specimens weighed to obtain average.
[2] Average biomass/m^2 is obtained by multiplying the average individual dry weight by the average number/m^2.

determined.) Grasshopper nymphs were also present in fairly high numbers, 2.45/m^2, and were undoubtedly the most important in terms of potential forage loss and biomass.

The seasonal pattern of the total arthropod density for CW 1 and CW 2 is shown in Figures 1 and 2, respectively. Total density was higher in the spring and fall and lower during the summer months of July and August during 2 years at both locations. This pattern is probably the result of species adaptation to the short, hot, dry summer common to the plains area of Montana. Also, arthropods were more abundant in both pastures in 1973.

A total of 13,998 arthropods were collected from both CW 1 and CW 2 for an average of 65.11 arthropods per square meter. This figure is probably lower than the actual population density since some arthropods escaped as the sampling cage dropped and many small ones such as mites, thrips, and aphids could not be vacuumed loose from the growing plants. When

Table 2. Additional arthropods (order or group) collected (no./m^2) with the vacuum quick trap or extracted from crested wheatgrass plants in 2 fields in Montana during a 2-year period, 1972–1973.

Order or group	Common name	Stage of development	Number of arthropods extracted from crested wheatgrass plants: CW 1	CW 2	Total	Avg no./plant	Number of arthropods collected with a vacuum quick trap[2]: CW 1	CW 2	Total	Avg/m^2
Acarina	Mites	Nymphs & adults	2240	2600	4840	24.20	953	1493	2446	11.38
Aphidae	Aphids	Nymphs & adults	78	185	263	1.32	87	139	226	1.05
Araneida	Spiders	Nymphs & adults	25	25	50	.25	182	194	376	1.75
Coleoptera	Beetles	Adults	27	86	113	.57	78	85	163	.76
Collembola	Springtails	Nymphs & adults	11	13	24	.12	245	22	267	1.24
Diptera	Flies	Adults	12	10	22	.11	180	110	290	1.35
Hemiptera	Bugs	Adults	2	18	20	.10	37	44	81	.38
Hemiptera	Bugs	Nymphs	12	8	20	.10	146	266	412	1.92
Homoptera	Leafhoppers, etc.	Adults	5	7	12	.06	88	74	162	.75
Homoptera	Leafhoppers, etc.	Nymphs	694	1983	2677	13.39	2218	1315	3533	16.43
Hymenoptera	Ants, wasps, bees	Adults	75	100	175	.88	163	140	303	1.41
Lepidoptera	Moths & butterflies	Adults	4	3	7	.04	23	27	50	.23
Neuoptera	Lacewings, etc.	Adults	0	1	1	.01	1	1	2	.01
Orthoptera[1]	Grasshoppers	Adults	2	4	6	.03	–	–	–	–
Orthoptera	Grasshoppers	Nymphs	1	3	4	.02	82	444	526	2.45
Psoceptera	Psocids	Adults	14	58	72	.36	0	0	0	.00
Thysanoptera	Thrips	Adults	53	36	89	.45	18	4	22	.10
Thysanoptera	Thrips	Nymphs	957	715	1672	8.36	902	457	1359	6.32
Misc. larva	Coleoptera) Diptera) Lepidoptera)	Immature	164	149	313	1.57	243	181	424	1.97
Total			4376	6004	10380	51.90	5646	4996	10642	
Total of specimens from Table 1							2126	1230	3356	
Total and average specimens collected.							7772	6266	13998	65.11

[1] All adult grasshoppers (Acrididae) collected by the vacuum quick trap are included in Table 1.
[2] A total of 100 m^2 was sampled on CW 1 and 105 m^2 on CW 2 during the 2-year period.

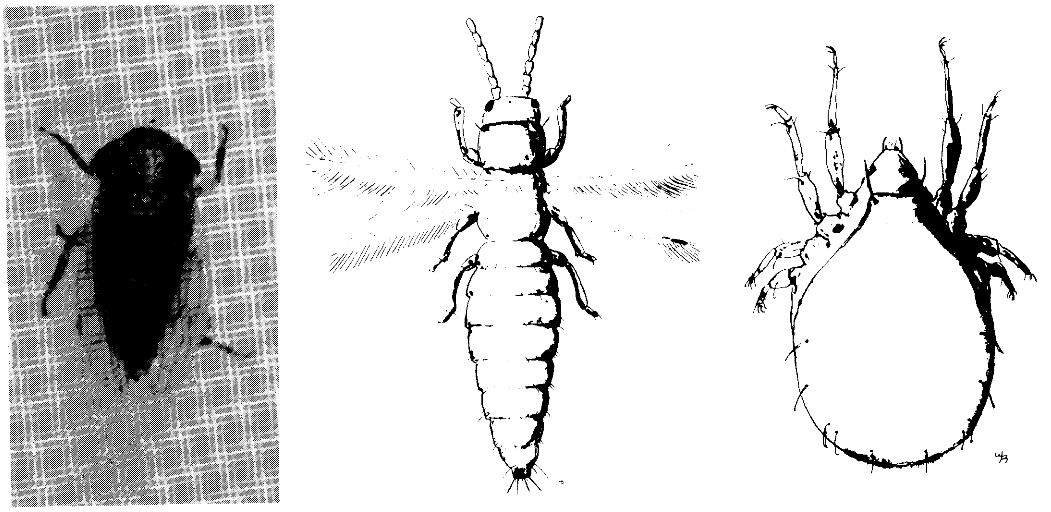

Fig. 3. *Representative arthropods of important groups found on crested wheatgrass pastures and actual size given in mm: A) Leafhopper (*Aceratagallia fuscoscripta*) (Oman) 3.0 mm; B) Thrip (Thripidae) 1.0 mm; C) Mite (Oribatid) 0.4 mm.*

individual plants were placed in the Berlese funnels, an average of 43.76 arthropods per plant were obtained from CW 1 and 60.04 arthropods per plant from CW 2. These figures indicate that many small arthropods remained in flowers, seed heads, and leaf sheaths during the vacuuming process. The mites were by far the most numerous group collected using plastic bags and made up 47% of the total arthropods extracted. Immature Homoptera, mostly leafhoppers, were the most numerous insect group and immature thrips the next most numerous group collected using plastic bags.

During the 2-year period, only a few specimens of *Irbisia* were collected, one from CW 1 and 20 from CW 2, all of which were collected in May and June. No specimens of *Labops* were collected in either year. No visible damage to the crested wheatgrass was produced by *Irbisia* or any of the other arthropods present.

Therefore, on the basis of abundance and biomass, at least five groups of arthropods were associated with or have influence on crested wheatgrass in Montana: ants (Subfamily: Formicinae), leafhoppers (Cicadellidae), grasshoppers (Acrididae), thrips (Thysanoptera), and mites (Acarina). Representatives of three of these groups are shown in Figure 3. Ants, because they do not feed on this plant, probably have a minimum effect on the growth of the plant, but any of the other four groups could drastically affect either forage production or seed yield.

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THESIS: COLORADO STATE UNIVERSITY

A Matrix Model of a Rangeland Grazing System, by Keith Allen Redetzke. PhD, Range Science. 1973.

Data from long-term grazing intensity studies were used to develop a model capable of predicting the response of plant cover and animal production to variations in weather and grazing pressure for different soil types. The system was described by a set of matrix equations, with specific transition matrices for each combination of soil type, grazing intensity, and weather category. Model verification and validation tests were done with data from a study having replicated grazing treatements. In a management application exercise, the probability of weather categories occurring was used to solve the predictive equations of the model for the expected next season values of revenue return and ground cover of major forage species for applications of light, moderate, and heavy grazing. A successional theory exercise was done to experiment with the model as a means of testing current hypotheses and developing new concepts of grassland succession.