1968-08-01

Thrips of the sagebrush-grass range community in West-Central Utah

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THRIPS OF THE SAGEBRUSH-GRASS RANGE COMMUNITY IN WEST-CENTRAL UTAH

A Thesis

Presented to the

Department of Zoology and Entomology

Brigham Young University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

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August 1968

This thesis, by Ward M. Tingey, is accepted in its present form by the Department of Zoology and Entomology of Brigham Young University as satisfying the thesis requirement for the degree of Master of Science.

Typed by Llona Moyes

ACKNOWLEDGMENTS

This study was supported, in part, by an Intermountain Forest and Range Experiment Station grant (No. 12-11-204-31) to the Department of Zoology and Entomology, Brigham Young University, Provo, Utah, for ecological studies in the sagebrush-grass range community of Utah. Gratitude is expressed to Neil C. Frischknecht and the Intermountain Forest and Range Experiment Station for their support and use of their facilities at the Benmore Experimental Range. I also wish to thank the Department of Zoology and Entomology at Brigham Young University for use of their facilities at Provo.

I am especially indebted to Dr. Clive D. Jorgensen for suggesting the range entomology study and assisting me in the field program. He has also been of much assistance in offering advice and criticisms throughout my undergraduate and graduate training at Brigham Young University.

I would also like to thank Dr. Stephen L. Wood for his advice and suggestions throughout the writing of this thesis and his support during my training here and Dr. Wilford M. Hess for reading and making suggestions concerning my thesis. I am especially indebted to Mr. Tokuwo Kono at the California Department of Agriculture, Dr. J. G. Watts at New Mexico State University, and Miss Kellie O'Neill (Entomology Research Division, USDA) for their help in identifying the thrips species.

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INTRODUCTION

Among the important natural resources of Western North America are the vast range or grazing areas. According to Manis (1967), over 185 million acres of rangeland in this region are currently grazed. He stated that maintaining these rangelands at a productive level is critical to the economy of this entire area. The largest and most economically important rangelands in Western North America are the sagebrush-grass (Artemisia tridentata Nutt.-Agropyron spp.) areas of the Intermountain West, with over 100 million acres being grazed. He also feels that increased demands to support more big game and livestock will be placed upon the Intermountain range community in southeastern Oregon, southern Idaho, southeastern Wyoming, western Colorado, Utah, Nevada, and northeastern California as the human population of the United States increases.

Most attempts to increase the carrying capacity of sagebrush-grass rangelands have emphasized the re-seeding of desirable plants in the disturbed[1] areas (Bleak, et al., 1965; Plummer, et al., 1955; Stoddart, 1946). Few attempts have been made to understand the organisms and mechanisms behind the growth and maintenance of range communities. Manis (1967) stated that range forage plants should be viewed as any other agricultural crop and managed accordingly.

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[1]Disturbance may be caused by numerous factors such as overgrazing, fire, and erosion, but in this paper it usually refers to overgrazing.

Humphrey (1962) stated that management of rangelands should be based upon an understanding of the needs of individual species and their interactions with other organisms. The bionomics, then, of each interacting species is of prime importance in helping to improve the present ranges and restore those we have already depleted.

Since rangelands are important to the economy of Western North America, the role of insects in range communities should be studied. Insects aided by their inherent high reproductive capacity, rapid dispersal, and sometimes rapacious appetites are important associates of most plant communities and may ultimately determine the survival of a potential host plant. In the sagebrush-grass community where disturbances frequently occur simultaneously with drouth, insects may be the major factor in tipping the balance toward increased plant mortality. Knowlton (1966) summarized the importance of certain agricultural pests in Utah rangelands. Jorgensen and Tingey (1968) and Manis (1967) reported research on some range-damaging insects, e.g. gall-formers, defoliators, and borers, etc.

The Thysanoptera associated with the sagebrush-grass range community are poorly known. Knowlton and Thomas (1933) suggested that damage to range plants by thrips is more general in Utah than has usually been supposed although specific studies emphasizing thrips biology and ecology in sagebrush-grass rangelands have not been reported. In fact, Watson (1923) failed to list any thrips as occurring in Utah, but Knowlton and Thomas (1933) reported twenty-two species from the state, ten years later. This list grew to forty-seven species with a state-wide survey reported by Bailey and Knowlton (1949). Many of these forty-seven species live in association with

plants which occur on sagebrush-grass ranges. It would seem desirable, therefore, in adding to our knowledge of sagebrush-grass rangelands, to understand more of the biology and ecology of range thrips.

This research provides a list of thrips associated with three predominant and economically important shrubs of the sagebrush-grass range community; namely big sagebrush (A. tridentata), rubber rabbitbrush (Chrysothamnus nauseosus (Pall.) Britt.), antelope bitterbrush (Purshia tridentata (Pursh) DC), and a widely re-seeded range grass, crested wheatgrass (Agropyron cristatum (L.) Gaertn.); their host distributions, habitat distributions, and peaks in seasonal abundance in Utah (Fig. 1-4).

Fig. 1. View of typical Agropyron cristatum stand in the study area.

Fig. 2. View of typical Artemisia tridentata stand in the study area.

Fig. 3. View of typical Chrysothamnus nauseosus stand in the study area.

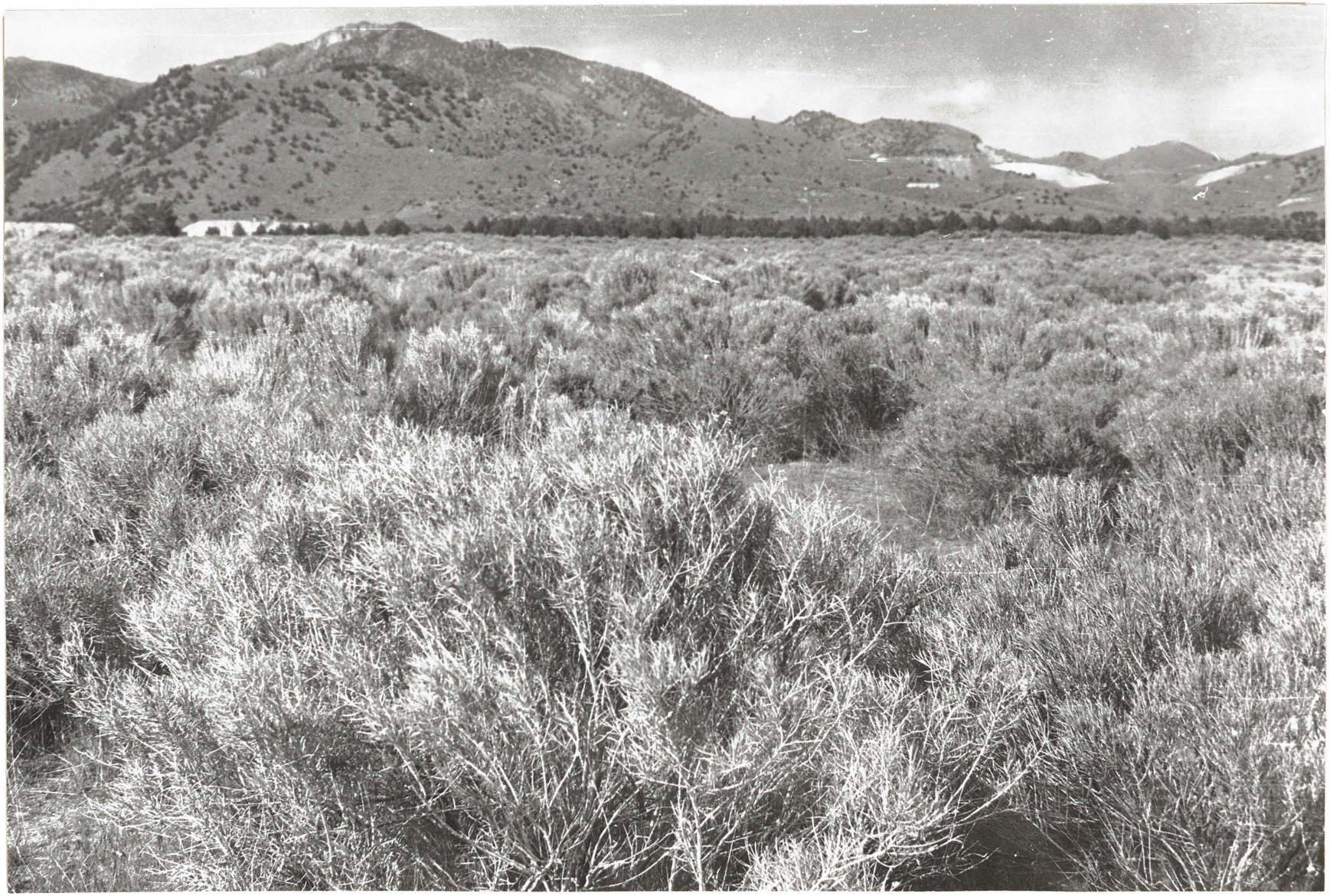

Fig. 4. View of typical Purshia tridentata stand in the study area.

DESCRIPTION OF STUDY AREAS AND METHODS

Description of Study Sites

Sixteen permanent study sites were selected near the southeastern corner of Tooele County, Utah at an elevation of about 1,737 m (5, 700 ft) (Fig. 5). This is a spring-fall[2] range, with average annual precipitation of 33 cm (13 inches), bounded on the north by salt-desert winter range and on the south by the mountainous summer range of the Sheeprock Mountains. The sixteen permanent study sites were selected and divided into four groups of four each. Each group corresponded to one of the four hosts, with four different collecting sites (replications) for each host.

Agropyron cristatum. Site 1 is a predominantly crested wheatgrass stand in pasture No. 27 at the Benmore Experimental Range which is located 8.0 km (5 miles) south of Vernon, Tooele Co., Utah. Site 2 is a crested wheatgrass stand co-dominant with A. tridentata in an unfenced range at the Benmore Experimental Range. Site 3 is a predominantly crested wheatgrass range where sagebrush has been removed and grass drilled. This area is located 25.7 km (6 miles) west of Eureka, Juab Co., Utah. Site 4 is an almost pure stand of crested wheatgrass in a Utah State University experimental pasture located

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[2]Due to heavy winter snowfall, these ranges are most conveniently grazed from spring to fall.

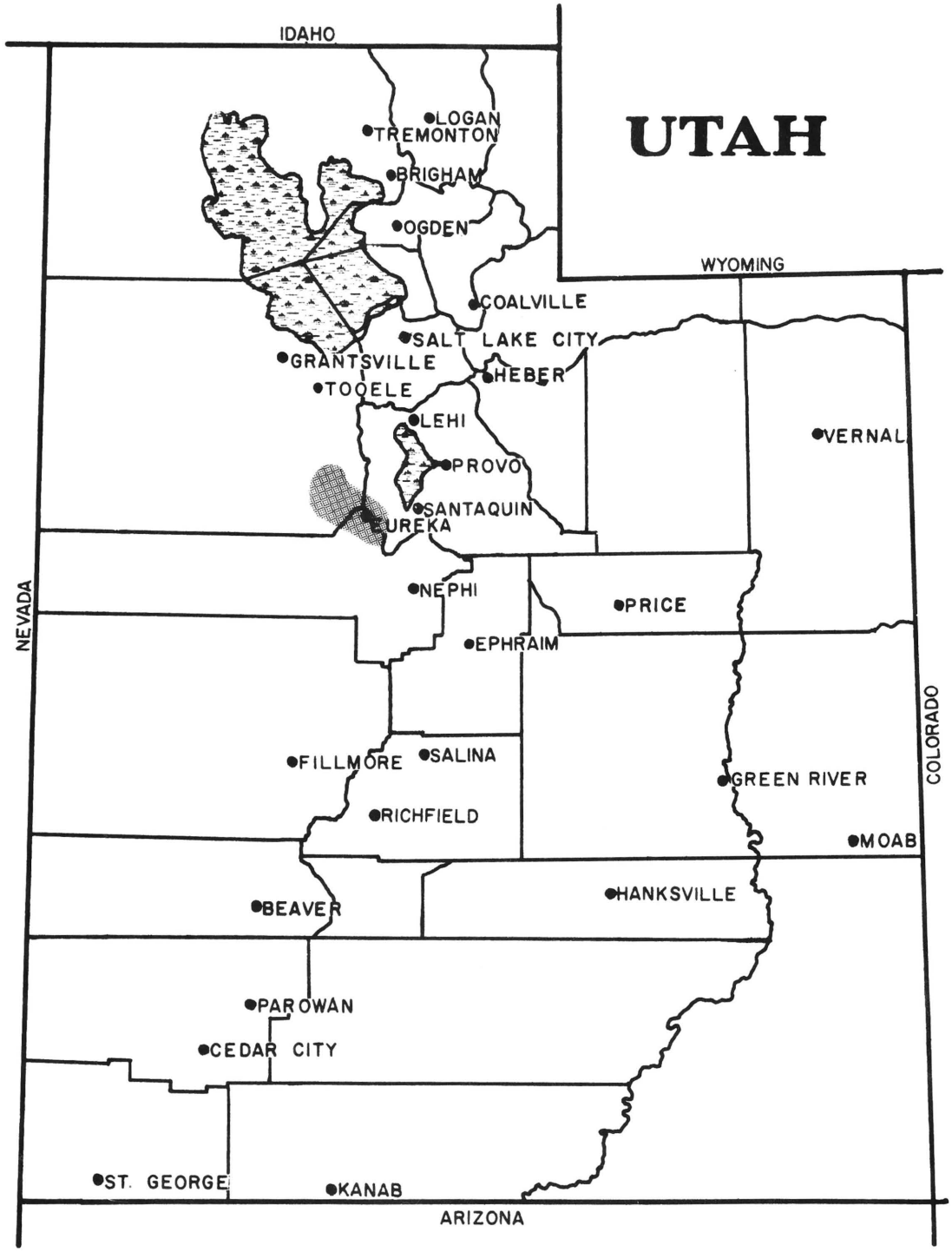

Fig. 5. Map of Utah with shaded portion representing the study area.

9.7 km (6 miles) south of Eureka.

Artemisia tridentata. Site 5 is a predominantly sagebrush stand in pasture No. 2 at the Benmore Experimental Range. Site 6 is a sagebrush stand co-dominant with crested wheatgrass in an unfenced range at the Benmore Experimental range. Site 7 is an almost pure stand of extremely vigorous sagebrush located 11.3 km (7 miles) west of Eureka. Some plants in this stand are over six feet tall. Site 8 is a stand of rather poorly-looking sagebrush co-dominant with P. tridentata located 4.8 km (3 miles) south of Eureka.

Chrysothamnus nauseosus. Site 9 is a stand of vigorous although gall-infested rabbitbrush most predominant in swale areas of pasture No. 19 at the Benmore Experimental Range. Site 10 is a stand of vigorous rabbitbrush located in a swale of an unfenced range at the Benmore Experimental Range. Site 11 is an extremely vigorous roadside stand of rabbitbrush co-dominant with greasewood (Sarcobatus vermiculatus (Hook.) Torr.) located 4.8 km (3 miles) north of Vernon. Site 12 is an almost pure stand of dense rabbitbrush in an experimental Utah State University pasture with little additional cover other than cheatgrass (Bromus tectorum L.) located 9.7 km (6 miles) south of Eureka.

Purshia tridentata. Site 13 comprises an area of scattered small bitterbrush plants, most dense on hillsides located 8.0 km (5 miles) west of Eureka. Site 14 is a stand of poorly-looking bitterbrush co-dominant with big sagebrush located 4.8 km (3 miles) south of Eureka. Site 15 is a particularly vigorous and dense hillside

bitterbrush stand located 4.8 km (3 miles) east of Eureka. Site 16 is another hillside stand of vigorous bitterbrush growing upon old mine tailings 8.0 km (5 miles) east of Eureka.

Sampling Methods

Sixty-five sweeping and Berlese collections were made throughout the summers (June through September) of 1966 and 1967 from the study sites. Material to be treated with the Berlese funnel was handled in two ways: (a) the foliage and inflorescence were excised from the host plant with as little disturbance to the resident insects as possible and placed in an ordinary brown paper bag which was then immediately sealed, (b) litter beneath the host plants was removed to the soil layer and the material placed in a paper bag as before and sealed. In each case, the material was then placed in Berlese funnels to a uniform depth of about three inches for 48 to 56 hours. Thrips were collected in AGA solution, a preservative especially adapted for Thysanoptera. This solution is a mixture of 8 parts 95% EtOH, 5 parts distilled water, 1 part glycerin, and 1 part glacial acetic acid.

Mounting Techniques

Thrips were mounted singly on slides with their appendages extended to facilitate examination. Specimens were first cleared in a cold (4°C) lactophenol solution (50 parts 85% lactic acid, 25 parts phenol, 25 parts distilled water) for periods up to three weeks. This cold treatment was necessary since clearing at room temperature or above frequently resulted in ruptured specimens. Hoyer's mounting media (a mixture of 200 g chloral hydrate, 30 g gum arabic, 50 ml

distilled water, and 20 ml glycerin) was used as the mounting agent because specimens could be mounted directly from AGA without first dehydrating them. Thrips were mounted dorsoventrally and oven-dried for 24 hours at 55°C.

RESULTS

Sixty-five collections made during the summers of 1966 and 1967 yielded 13 known and three undescribed species in eight genera and four undescribed species in three additional genera (Fig. 6). Of these 20 species, F. occidentalis was found most commonly, i.e. it occurred in 21 out of the 65 collections. Frankliniella minuta and Sericothrips n. sp. #2 were also widespread with 12 and 13 occurrences, respectively. The remaining 17 species occurred in lesser numbers of collections.

Nine species were recorded exclusively on one host while only one species was collected from all four hosts. Nine species were found exclusively on the foliage of their respective hosts, three exclusively from litter, and seven from both habitats. Agropyron cristatum had the greatest number (12) of species associated with it, A. tridentata had 10, C. nauseosus had nine, while P. tridentata had only three (Table 1).

An arbitrary occurrence level of at least 5% (4 collections) of the 65 collections was thought necessary for numerical analyses to be meaningful in determining host and habitat preferences, and peaks in seasonal abundance. For this reason, A. duvali, A. tricolor, A. rufus stylifera, C. aculeatus, C. simplex, Frankliniella n. sp. #2, H. sonorensis, Haplothrips n. sp., Leptothrips n. sp., and R. corni which did not occur in at least 5% of the collections were not included in the following host, habitat, and seasonal occurrence analyses.

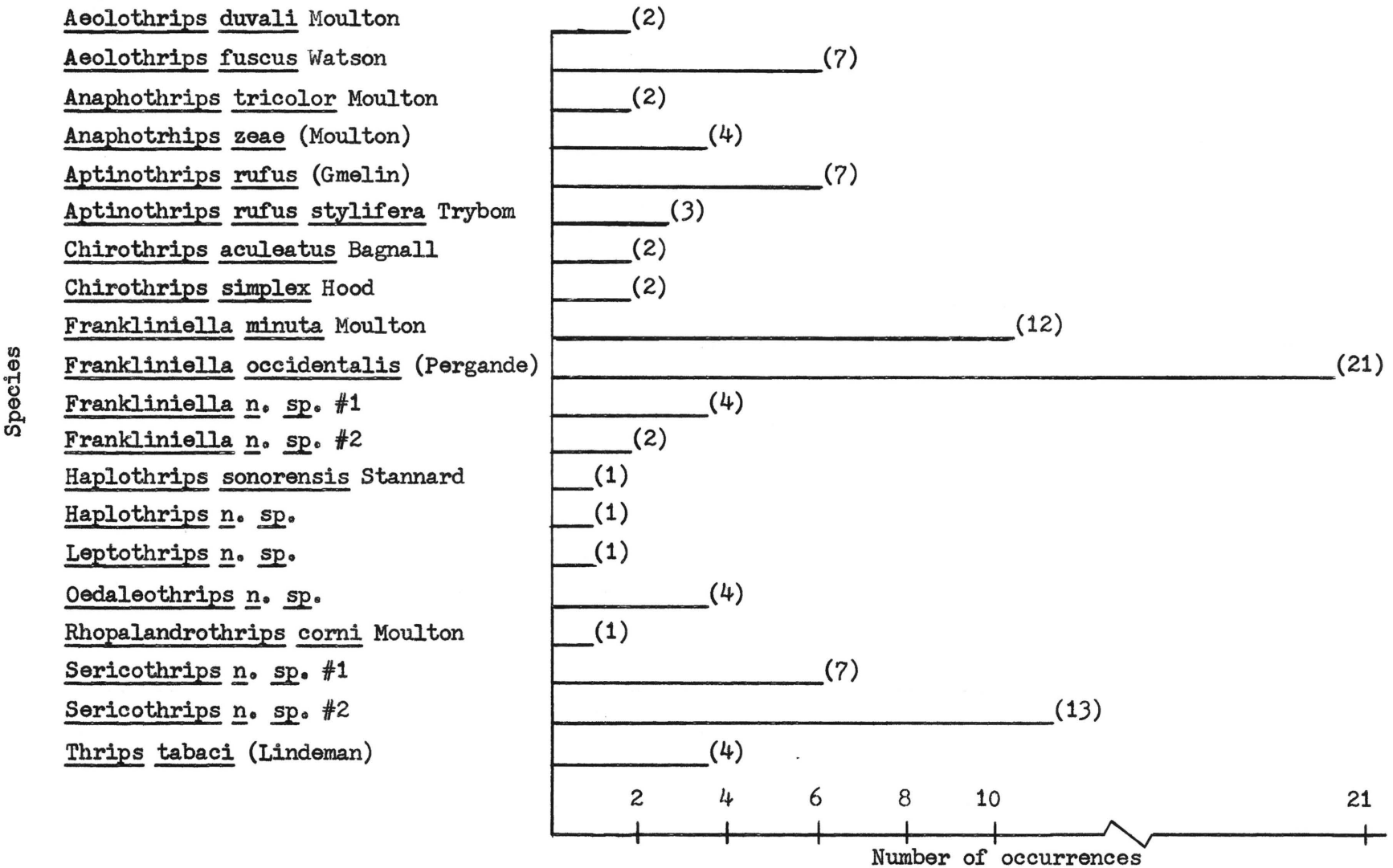

Fig. 6. Total number of occurrences on all four hosts.

Table 1. Total number of thrips species occurrences per host and habitat.

Species	Agropyron cristatum		Artemisia tridentata		Chrysothamnus nauseosus		Purshia tridentata	
	Foliage	Litter	Foliage	Litter	Foliage	Litter	Foliage	Litter
Aeolothrips duvali[c]	1	0	0	0	1	0	0	0
Aeolothrips fuscus[a,c]	0	0	0	0	7	0	0	0
Anaphothrips tricolor[c]	1	0	1	0	0	0	0	0
Anaphothrips zeae[a,e]	3	1	0	0	0	0	0	0
Aptinothrips rufus[e]	3	0	1	1	2	0	0	0
Aptinothrips rufus stylifera[e]	1	1	0	0	0	1	0	0
Chirothrips aculeatus[a,c]	1	0	0	0	0	0	0	0
Chirothrips simplex[a,c]	2	0	0	0	0	0	0	0
Frankliniella minuta[c]	0	0	5	0	7	0	0	0
Frankliniella occidentalis[b,c]	1	0	5	1	13	0	0	1
Frankliniella n. sp. #1[c]	1	0	3	0	0	0	0	0
Frankliniella n. sp. #2[a,c]	0	0	3	0	0	0	0	0

Table 1 (continued)

Species	Agropyron cristatum		Artemisia tridentata		Chrysothamnus nauseosus		Purshia tridentata	
	Foliage	Litter	Foliage	Litter	Foliage	Litter	Foliage	Litter
Haplothrips sonorensis[a,d]	0	1	0	0	0	0	0	0
Haplothrips n. sp.[a,d]	0	1	0	0	0	0	0	0
Leptothrips n. sp.[a,c]	0	0	1	0	0	0	0	0
Oedaleothrips n. sp.[e]	1	2	0	0	0	1	0	0
Rhopalandrothrips corni[a,d]	0	0	0	0	0	0	0	1
Sericothrips n. sp. #1[e]	0	0	5	1	1	0	0	1
Sericothrips n. sp. #2[e]	0	0	2	1	7	3	0	0
Thrips tabaci[c]	0	0	2	0	2	0	0	0

[a]Found exclusively on one host.

[b]Found on all four hosts.

[c]Found exclusively on foliage of hosts.

[d]Found exclusively on litter of hosts.

[e]Found in both habitats.

Host Preference

Aeolothrips fuscus and A. zeae, while they did meet the required 5% occurrence, were collected from only one host and their preference is therefore established. In the case of thrips which occur on more than one host, however, the question of preference requires a more thorough analysis. Percentage occurrence values were calculated in order to examine host preferences among thrips with several hosts (Table 2). Crested wheatgrass was the preferred host of A. rufus and Oedaleothrips n. sp., rubber rabbitbrush the preferred host of F. occidentalis and Sericothrips n. sp. #2, big sagebrush the preferred host of Sericothrips n. sp. #1, but F. minuta, Frankliniella n. sp. #1 and T. tabaci showed little selectivity among their respective hosts.

Habitat Preferences

Since each habitat is dependent upon its associated hosts, a thrips' habitat preferences must be studied in terms of its hosts. Table 3 presents habitat percentage occurrence values for each thrips per each of its hosts per total of its hosts. Aptinothrips rufus, for example, occurred on foliage in 100% of its collections from crested wheatgrass, on foliage in 50% of its collections from sagebrush, and on foliage in 100% of its collections from rabbitbrush. It occurred in litter from sagebrush, but in only 50% of its collections. Total percentage occurrence is greater for foliage (83) than for litter (17). Clearly, A. rufus preferred the foliage habitat, as did F. minuta, F. occidentalis, Frankliniella n. sp. #1, Sericothrips n. sp. #1, Sericothrips n. sp. #2, and T. tabaci. Oedaleothrips n. sp. was the only thrips found to favor the litter habitat.

Table 2. Percentage occurrence of thrips species per hosts.

Species	Percentage occurrence[a]			
	Agropyron cristatum	Artemisia tridentata	Chrysothamnus nauseosus	Purshia tridentata
Aptinothrips rufus	30[b]	9	7	---
Frankliniella minuta[c]	---	23	18	---
Frankliniella occidentalis	10	27	45[b]	25
Frankliniella n. sp. #1[c]	10	17	---	---
Oedaleothrips n. sp.	30[b]	---	3	---
Sericothrips n. sp. #1	---	27[b]	3	---
Sericothrips n. sp. #2	---	17	34[b]	---
Thrips tabaci[c]	---	9	7	---
Total Host Collections	10	22	29	4

[a]Percentage occurrence equals number of thrips species occurrences per total host collections.

[b]Preferred host.

[c]A preferred host could not be determined.

Table 3. Habitat percentage occurrence of thrips species per hosts.

Species and Habitat	Percentage occurrence				
	Agropyron cristatum	Artemisia tridentata	Chrysothamnus nauseosus	Purshia tridentata	Total
Aeolothrips fuscus					
Foliage	----	----	100	----	100[a]
Litter	----	----	00	----	00
Anaphothrips zeae					
Foliage	75	----	----	----	75[a]
Litter	25	----	----	----	25
Aptinothrips rufus					
Foliage	100	50	100	----	83[a]
Litter	00	50	00	----	17
Frankliniella minuta					
Foliage	----	100	100	----	100[a]
Litter	----	00	00	----	00
Frankliniella occidentalis					
Foliage	100	84	100	00	71[a]
Litter	00	16	00	100	29
Frankliniella n. sp. #1					
Foliage	100	100	----	----	100[a]
Litter	00	00	----	----	00

Table 3 (continued)

Species and Habitat	Percentage occurrence				
	Agropyron cristatum	Artemisia tridentata	Chrysothamnus nauseosus	Purshia tridentata	Total
Oedaleothrips n. sp.					
Foliage	25	---	---	---	25
Litter	75	---	---	---	75[a]
Sericothrips n. sp. #1					
Foliage	---	84	100	---	92[a]
Litter	---	16	00	---	8
Sericothrips n. sp. #2					
Foliage	---	67	70	---	68[a]
Litter	---	33	30	---	32
Thrips tabaci					
Foliage	---	100	100	---	100[a]
Litter	---	00	00	---	00

[a]Preferred habitat.

Peaks in Seasonal Abundance

In order to gain a better understanding of each thrips abundance during the summer months of June, July, August, and September, seasonal incidence of occurrence values were calculated (Table 4). For example, eight collections (x) were made from the hosts and habitats of A. fuscus during the month of June. Since four collections (y) of A. fuscus were made during June, the incidence of occurrence (y/x) for June is .50. Examining the values for July (.13), August (.26), and September (00), it was found that June had the highest values and therefore was the period of greatest abundance. Thrips tabaci and Frankliniella n. sp. #1 were also early summer thrips, most of their collections being made in June. Anaphothrips zeae, A. rufus, and Sericothrips n. sp. #1 and #2 were most abundant on their hosts in July while F. minuta, F. occidentalis, and Oedaleothrips n. sp. were most common in September.

Table 4. Seasonal incidence of occurrence of thrips species.

Species	June			July			August			September		
	x[a]	y[b]	y/x[c]	x	y	y/x	x	y	y/x	x	y	y/x
Aeolothrips fuscus	8	4	.50[d]	8	1	.13	7	2	.26	3	00	00
Anaphothrips zeae	5	2	.40	1	1	1.00[d]	4	1	.25	0	--	--
Aptinothrips rufus	19	2	.11	15	4	.27[d]	16	1	.06	6	00	00
Frankliniella minuta	14	1	.07	14	0	00	12	1	.08	6	6	1.00[d]
Frankliniella occidentalis	22	4	.18	15	4	.27	17	2	.12	6	5	.83[d]
Frankliniella n. sp. #1	11	3	.27[d]	7	1	.14	9	0	00	3	0	00
Oedaleothrips n. sp.	13	0	00	9	1	.11	11	3	.27[d]	3	0	00
Sericothrips n. sp. #1	14	1	.07	14	3	.21[d]	12	2	.17	6	0	00
Sericothrips n. sp. #2	14	4	.26	14	5	.36[d]	12	2	.17	6	1	.17
Thrips tabaci	14	3	.21[d]	14	1	.07	12	0	00	6	0	00

[a]Number of collections from hosts.

[b]Number of thrips occurrences among the hosts.

[c]Incidence of occurrence.

[d]Month of peak abundance.

DISCUSSION AND CONCLUSIONS

Each thrips found in this study will be discussed in terms of its known distribution, host and habitat preferences, peak seasonal abundance on its hosts, and any reported damage potential. A listing will also be made of thrips not found in this study but reported from any of the four hosts by other workers.

Aeolothrips duvali

According to Bailey (1957), the geographic distribution of this thrips includes Arkansas, Arizona, California, Colorado, Nevada, New Mexico, Oklahoma, Texas, Utah, and Mexico. In this study, it was collected only twice and was restricted to the foliage and inflorescence of A. cristatum and C. nauseosus. This predominantly southwestern United States inhabiting thrips has been previously reported from Utah on rosin weed (Calycadenia) and other composites by Bailey (1951).

Aeolothrips fuscus

Bailey (1957) listed the geographic distribution of this species as Arizona, California, Nevada, Oklahoma, and Utah. In this study, A. fuscus was highly host-specific to the foliage and inflorescence of rubber rabbitbrush where it was collected most frequently in June although it was present in July and August. This western thrips has previously been reported from Utah on C. nauseosus by Bailey (1951). He also cited collections from Nevada on Chrysothamnus and Oklahoma

on Artemisia.

Anaphothrips tricolor

This thrips, a desert species, has previously been known only from California primarily on Atriplex in late summer and fall (Bailey, 1957). In this study (its first record east of California), it was collected only twice, both times from the foliage and inflorescence of crested wheatgrass and big sagebrush.

Anaphothrips zeae

Bailey (1957) listed the geographic range of this species as Arizona, California, Idaho, Nevada, Oregon, South Dakota, and Utah. In this study, it was restricted to the foliage and inflorescence of crested wheatgrass, where it was most abundant in July. This western United States species has previously been reported from Utah by Bailey and Knowlton (1949), but primarily from agricultural grasses.

Most species of Anaphothrips inhabit grass and sod. According to Bailey (1957), in some seasons when they are very abundant they can cause damage to small grains and grasses, especially those which are densely-cultivated as when grown for seed. Watts and Bellotti (1967) report they found A. zeae on several Agropyron species in New Mexico ranges. Although foliage damage was extensive and affected the general vigor and productivity, they found no direct damage to the inflorescence. Its rather low rate of occurrence in this study indicates that damage to the hosts is probably minimal.

Aptinothrips rufus

Bailey (1957) listed the geographic distribution of this widespread thrips as Europe, India, South America, and from Massachusetts to Oregon. In this study, A. rufus was collected most frequently from the foliage and inflorescence of A. cristatum where it was most abundant in July. It has been recorded previously from Utah by Bailey and Knowlton (1949).

This wingless thrips is found primarily on grasses or in sod. Speyer (1935) lists Agropyron spp. as favorite hosts of A. rufus in Europe. Bailey (1948) found this thrips throughout the year on various grasses and grains in North America. He stated that larvae of this species reach their seasonal peak abundance in May in permanent pastures, lawns, and uncultivated areas. However, since normal cultivation practices keep population numbers down to a minimum and its wingless condition restricts seasonal migrations, this thrips is of little importance in agricultural situations. In rangelands, however, the restricting effects of cultivation are not present and population size could conceivably rise high enough to result in host damage.

Aptinothrips rufus stylifera

Bailey (1957) listed the geographic range of this widespread thrips as Europe, California, Massachusetts, Nevada, New York, Utah, and Wyoming. A. rufus stylifera (distinct from A. rufus because of its two rather than one segmented antennal style) was collected only three times in this study. Its hosts include the foliage, inflorescence, and litter of crested wheatgrass and litter of rubber rabbitbrush.

Chirothrips aculeatus

Bailey (1957) listed the known range of this thrips as Europe, California, Oregon, and Washington. In this study (its first record of occurrence east of the Pacific Coast), C. aculeatus was collected once from the foliage and inflorescence of crested wheatgrass.

The immature stages of all Chirothrips appear to be obligate parasites on various Gramineae (Watts, 1965). Bailey (1948) reported the damage potential of this thrips upon grasses in California where large numbers were evident in the late winter and early spring of 1947. This resulted from reproducing on wild hosts (principally foxtail, Hordeum murinum L.) and subsequent flights of females into grain and seed crop fields caused extensive losses. Experimental plots of fescue (Festuca) were almost totally destroyed. Although this thrips has shown a high damage potential in certain agricultural situations, its low rate of occurrence in this study would suggest that damage to range hosts is likely minimal.

Chirothrips simplex

This species has been reported from Colorado, Illinois, and Nebraska (Hood, 1927). In this study (its first record from Utah), C. simplex was collected twice from the foliage and inflorescence of crested wheatgrass. A search of the literature failed to find any record of its having caused damage to its hosts. A closely related species (Chirothrips falsus Priesner) has caused considerable damage to black grama grass (Bouteloua eriopoda Torr.) seed heads and the fruits and foliage of crested wheatgrass in New Mexico (Watts, 1965).

Frankliniella minuta

Bailey (1957) listed the geographic distribution of this western thrips as Central America, Arizona, California, Hawaii, Montana, Nevada, Oregon, Utah, and Wyoming. In this study, it was confined to big sagebrush and rubber rabbitbrush where the foliage and inflorescence were the preferred habitats. Its peak abundance occurred in September, coinciding with the hosts' flowering periods. This flower thrips seldom attaining high population numbers on its hosts, was considered only a minor agricultural pest in California (Bailey, 1938).

Frankliniella occidentalis

Bailey (1957) listed the geographic range of the widespread western flower thrips as the western parts of Canada, Mexico, and the United States. In this study, it was found on all four hosts although it was most abundant on the foliage and inflorescence of C. nauseosus. It was the most abundant thrips encountered in terms of numbers of occurrences and numbers of individuals. As with F. minuta, this is a late summer species in the range community with its peak abundance in September. It was previously reported from Utah by Knowlton and Thomas (1933) on a variety of hosts including big sagebrush and rubber rabbitbrush.

The western flower thrips is known to inflict serious feeding damage under certain conditions and to be a vector of some plant viruses Ferguson, Furniss, and Basile (1963), in a study involving insects destructive to bitterbrush, found F. occidentalis responsible for more flower damage and subsequent seed loss than any other identified insect.

Bailey (1938) reported severe feeding injury to fruits and foliage of numerous agricultural hosts in California. He also reported its tendency to transmit spotted wilt virus to several crops and fermenting and putrefying microorganisms into fruits such as figs.

Its peak abundance in California on agricultural hosts occurred in May when it often migrated short distances, e.g. from the weedy margins of fields and orchards onto the agricultural hosts. Overwintering forms were commonly found on weeds and ornamentals.

Because of its demonstrated damage potential on certain hosts, the western flower thrips' role in the range community should be thoroughly studied. This thrips may be an important factor in the success or failure of certain range hosts. It is conceivable that excessively high populations on the range might spill over into adjacent agricultural areas, thus fortifying agricultural infestations. It is possible that rangelands may also serve as a reservoir for this thrips when agricultural hosts are not available.

Frankliniella n. sp. #1

This new thrips was confined to the foliage and inflorescence of crested wheatgrass and big sagebrush where it was most abundant in June. On big sagebrush, it was collected only from leaf and stem galls caused by cecidomyiid midges.

Frankliniella n. sp. #2

This new species was collected only twice from the foliage and inflorescence of big sagebrush. One of these collections came from cecidomyiid-induced leaf galls.

Haplothrips sonorensis

This thrips has been reported from California, Idaho, New Mexico, and Utah (Stannard, 1956). In the California, New Mexico, and Utah records, it was taken from ground litter. The Idaho record was collected from leaves of poplar and grasses. In this study, it was found in litter of crested wheatgrass.

Haplothrips n. sp.

This new thrips, probably a Haplothrips, was collected only from litter of crested wheatgrass.

Leptothrips n. sp.

This new thrips was collected only once from the foliage and inflorescence of sagebrush.

Oedaleothrips n. sp.

The genus, Oedaleothrips Hood, has apparently never been reported from Utah. This new species was found to favor litter of crested wheatgrass. It is apparently a late summer species with peak abundance on its range hosts in August.

Rhopalandrothrips corni

This species is known from California, Nevada, Oregon, and Utah (Bailey, 1957). In this study, it was collected just once, from litter of P. tridentata in June. This thrips has previously been reported from Utah on A. tridentata by Bailey and Knowlton (1949), and Bailey (1957) cited a collection in California from Chrysothamnus.

Sericothrips n. sp. #1

This new thrips shows a preference for foliage of big sagebrush. It reaches a peak abundance on its range hosts in July.

Sericothrips n. sp. #2

Although this new species was found most commonly on the foliage and inflorescence of its favored host, rubber rabbitbrush, it was also frequently collected from litter. It reached a peak abundance in July. Because of its relatively high rate of occurrence (13 occurrences) in this study, this thrips should be thoroughly studied to determine its damage potential to range hosts.

Thrips tabaci

According to Bailey (1957), the onion thrips' range is world-wide. While possibly the most common thrips in Utah next to F. occidentalis, it was found on the foliage and inflorescence of only two hosts in this study, big sagebrush and rubber rabbitbrush. It did not show great preference for one host over the other, but was collected most commonly in June. Apparently it is an early summer species without the range of hosts one might expect in sagebrush-grass rangelands. This thrips has been reported from Utah previously on a wide variety of hosts including rubber rabbitbrush (Knowlton and Thomas, 1933). Bailey (1957) reported it from sagebrush in California.

According to Bailey (1938), the onion thrips is the most widely-distributed thrips in the world and has been collected from sea-level to 2743 m (9,000 ft) elevation from several hundred hosts. However,

most of the hosts are incidental on which little or no reproduction takes place. Knowlton (1932) attributed moderate to severe damage to onions in Utah in 1931 to this thrips. Like the western flower thrips, T. tabaci transmits plant diseases, notably pineapple yellow spot and spotted wilt (Bailey, 1938). He found its peak abundance in California on agricultural hosts from June to midsummer with overwintering forms common on weeds and ornamentals. Although he found the onion thrips utilizing wild hosts for resting, feeding, and overwintering, little reproduction occurred on other than its primary host. Populations of this thrips on range hosts, therefore, may not be self-sustaining. Its low rate of occurrence in this study suggests it probably causes minimal damage to its range hosts and the sagebrush-grass rangelands do not constitute a significant threat to agriculture as a reservoir of the onion thrips.

A number of thrips not found in this study have been reported by other workers from several of the hosts sampled. The following is a list of these thrips with their associated hosts: Artemisia tridentata --Anaphothrips obscurus (Muller), Frankliniella moultoni Hood, Frankliniella tritici (Fitch), Haplothrips mali (Fitch) (Knowlton and Thomas, 1933), and Odontothrips loti (Haliday) (Bailey and Knowlton, 1949); Chrysothamnus nauseosus--Aeolothrips fasciatus (L.) (Knowlton and Thomas, 1933), Sericothrips chrysothamni Hood (Bailey, 1957), and Thrips abdominalis (D. L. Crawford) (Bailey and Knowlton, 1949).

Three species of thrips (A. zeae, A. rufus, F. occidentalis) found in this study have been reported as damaging to the specific or related hosts sampled in this study (Watts and Bellotti, 1967; Speyer, 1935; Ferguson, Furniss, and Basile, 1963). Further studies

emphasizing life history and biology of range thrips are required to determine the damage potential of each. The fact that A. cristatum, the basis of productivity in sagebrush-grass rangelands in Utah, had the greatest number of associated thrips species (some of them potentially damaging), should be warning that grass-inhabiting thrips in particular should be thoroughly studied in the range community. It is possible that they may decrease the grazing potential of grass ranges by limiting the production of seed required for natural re-seeding.

Six thrips (A. zeae, A. rufus, C. aculeatus, F. minuta, F. occidentalis, T. tabaci) have been reported in the literature as producing damage to agricultural crops (Bailey, 1938; Bailey, 1948; Bailey, 1957). Further studies emphasizing the population dynamics of these thrips on the range are needed to understand the relationships between the respective range and agricultural hosts. That rangelands possibly serve as reservoirs of thrips' infestations has economic significance to agriculture.

Of the species not now known to be damaging to their hosts, Sericothrips n. sp. #2 had such a high rate of occurrence in this study that further studies should explore its biology and ecology.

SUMMARY

Summer sampling from three native shrubs and one introduced grass in sagebrush-grass rangeland of central Utah, resulted in twenty species of Thysanoptera. Seven of these twenty (Frankliniella n. sp. #1, Frankliniella n. sp. #2, Haplothrips n. sp., Leptothrips n. sp., Oedaleothrips n. sp., Sericothrips n. sp. #1, Sericothrips n. sp. #2) are undescribed while three of the twenty (A. tricolor, C. aculeatus, C. simplex) are new to Utah. The fact that almost 40% of the thrips found were undescribed supports the contention that our present knowledge of rangeland thrips is meager.

Thrips which occurred in at least 5% of the collections and which were found on more than one host, or more than one habitat, were analyzed to determine host preferences, habitat preferences, and peaks in seasonal abundance. Anaphothrips zeae, A. rufus, and Oedaleothrips n. sp. were found to prefer crested wheatgrass. Sericothrips n. sp. #1 was found to prefer big sagebrush while rubber rabbitbrush was the preferred host of A. fuscus, F. occidentalis, and Sericothrips n. sp. #2. Frankliniella minuta, Frankliniella n. sp. #1, and T. tabaci showed little selectivity among their respective hosts. All the thrips in the above listing except Oedaleothrips n. sp. preferred the foliage and inflorescence habitat. Three species (A. fuscus, Frankliniella n. sp. #1, T. tabaci) were early summer thrips with peaks of abundance in June, four species (A. zeae, A. rufus, Sericothrips n. sp. #1, #2) were mid-summer thrips with peaks of abundance in July, and three

species (F. minuta, F. occidentalis, Oedaleothrips n. sp.) were late summer thrips with peaks of abundance in September.

Thrips which did not occur in at least 5% of the collections and therefore were not anlyzed to determine host and habitat preferences and seasonal abundances include: A. duvali, A. tricolor, A. rufus, stylifera, C. aculeatus, C. simplex, Frankliniella n. sp. #2, H. sonorensis, Haplothrips n. sp., Leptothrips n. sp., and R. corni.

Six species (A. zeae, A. rufus, C. aculeatus, F. minuta, F. occidentalis, T. tabaci) found in this study have been previously reported as injurious to certain range and agricultural hosts. Further studies are needed to clarify their roles in the rangeland community. Sericothrips n. sp. #2 had a rate of occurrence in this study so high that it warrants further study.

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THRIPS OF THE SAGEBRUSH-GRASS RANGE COMMUNITY IN WEST-CENTRAL UTAH

An Abstract of a Thesis

Presented to the

Department of Zoology and Entomology

Brigham Young University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

Ward M. Tingey

August 1968

ABSTRACT

Three predominant and economically important shrubs of the sagebrush-grass range community in Utah, namely big sagebrush (Artemisia tridentata Nutt.), rubber rabbitbrush (Chrysothamnus nauseosus (Pall.) Britt.), antelope bitterbrush (Purshia tridentata (Pursh) DC), and a widely re-seeded range grass, crested wheatgrass (Agropyron cristatum (L.) Gaertn.) were sampled during the summers of 1966 and 1967, and yielded twenty species of thrips. Three species (Anaphothrips tricolor Moulton, Chirothrips aculeatus Bagnall, Chirothrips simplex Hood) were new distributional records for Utah. Seven species (Frankliniella n. sp. #1, Frankliniella n. sp. #2, Haplothrips n. sp., Leptothrips n. sp., Oedaleothrips n. sp., Sericothrips n. sp. #1, Sericothrips n. sp. #2) were undescribed. Six species (Anaphothrips zeae (Moulton), Aptinothrips rufus (Gmelin), Chirothrips aculeatus Bagnall, Frankliniella minuta Moulton, Frankliniella occidentalis (Pergande), Thrips tabaci (Lindeman) had previously been reported as injurious to various range and agricultural hosts. The remaining species included: Aeolothrips duvali Moulton, Aeolothrips fuscus Watson, Aptinothrips rufus stylifera Trybom, Haplothrips sonorensis Stannard, and Rhopalandrothrips corni Moulton. Host preferences, habitat preferences, and peaks in seasonal abundance were determined for each thrips whenever possible.