

Viability of Medusa-Head (*Elymus caput-medusae* L.) Seed Collected in Idaho

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Medusa-head (*Elymus caput-medusae*), an annual grass with undesirable forage qualities, is presently estimated to occur on approximately 190,000 acres of rangeland in Idaho. This plant is a serious problem in Gem, Payette, and Washington Counties in southwestern Idaho, where it occurs in extensive stands and grows almost to the total exclusion of other species. Spot infestations have been reported in five other counties in this part of the state and in two counties in north-central Idaho.

The long-awned seed is easily carried for great distances by man, machinery, and animals. Seed can be transported in the coat or fleece of animals and also in the digestive tract. Lehrer and Tisdale (1956) report that germinable seeds of medusa-head were recovered in fecal material for a period of four and nine days after ingestion by rabbits and sheep, respectively. The ease with which the seed can be transported poses a threat to many additional thousands of acres of annual type rangelands now free of medusa-head.

Preliminary studies on the phenology and competitive ability of the plant were reported in an earlier paper by Sharp and Tisdale (1952). Since the publication of that paper, germination tests of medusa-head collected from a number of locations and under a variety of conditions have been conducted. It is the purpose of this paper to report the results of these tests as a basis for further studies of the plant and for the formulation of a control program.

Description

In Idaho medusa-head is normally a fall germinating annual.

Germination occurs in October or November as moisture becomes available from fall rains. Leaf development of several inches may be produced before cold weather stops the growth process. In the spring growth is resumed, but the plant matures two or three weeks later (late June or early July) than cheatgrass (*Bromus tectorum*). Flowering occurs in early June, and by July the seed has matured. Unlike cheatgrass, medusa-head seed persists in the head until fall.

The area of main infestation in southwestern Idaho lies in a pre-

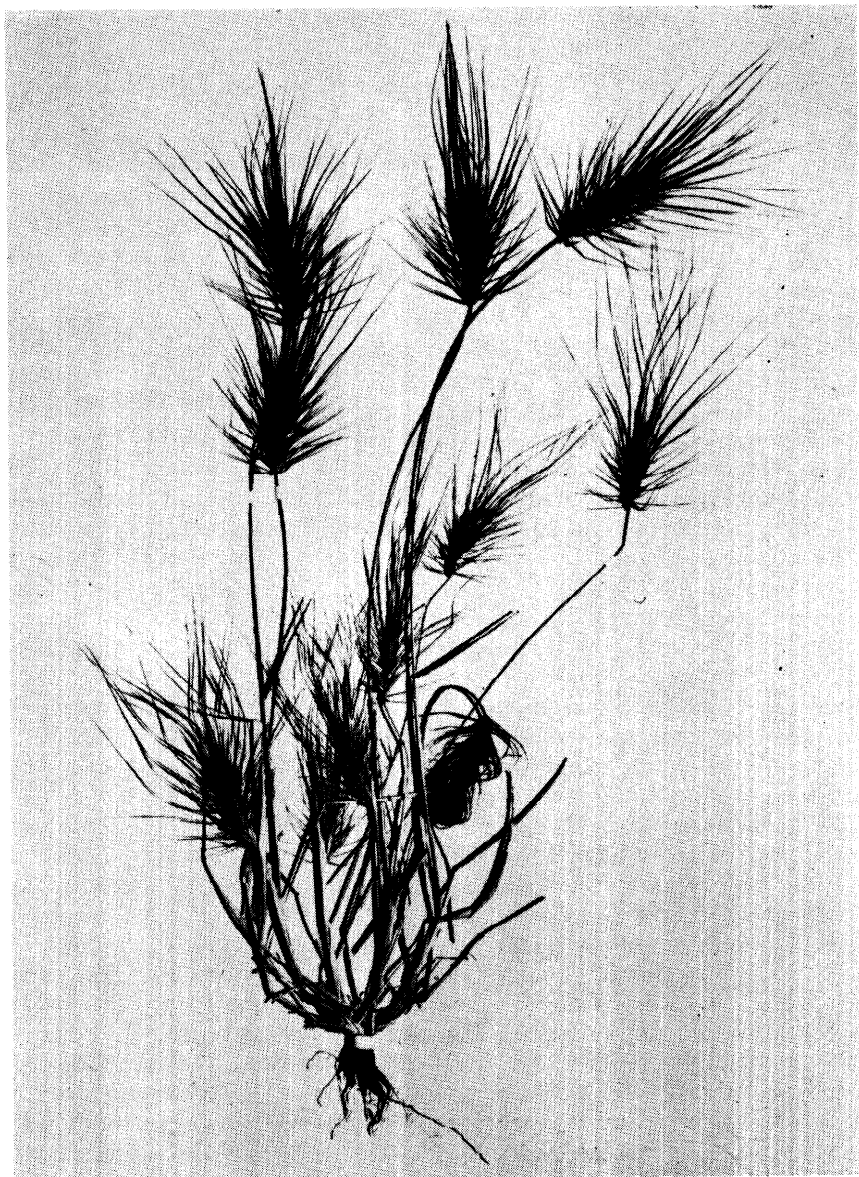


FIGURE 1. Individual plant of medusa-head.

precipitation zone ranging from 10 to 20 inches annually. Examination of relatively undisturbed stands of vegetation in this foothill region indicates that the climax vegetation consisted, in the main, of a sagebrush-grass cover with a good complement of perennial grasses and forbs. Prior to invasion by medusa-head, however, the cover had deteriorated to an annual type of vegetation with a predominance of cheatgrass. Medusa-head occupies a variety of soil types in southwestern Idaho. It is found growing on heavy clays, on well developed loam soils, and on scablands. The plant appears to be associated with a stage of deterioration in plant cover, rather than with any particular soil type.

The plant is a strong competitor with other annuals. Furbush (1953) states that as early as the 1930's this species was taking over extensive areas in northern California and crowding out more desirable annual species. The species replaced by medusa-head in California were mainly annual grasses and legumes. In Idaho, medusa-head is replacing cheatgrass primarily. Observations indicate that perennial grasses are effective barriers to the spread of this noxious annual.

Sharp and Tisdale (1952) found that within three year's time medusa-head became the dominant plant on an area formerly dominated by cheatgrass and other annuals. The aggressive nature of medusa-head is indicated by the number of plants able to grow in a limited area. Counts made in 1950 gave results of 1,500 to 2,000 plants per square foot on a valley bottom soil of moderate depth, and 500 plants per square foot on scabland soil. The average number of seeds per head was 8.7 and 5.6, respectively. In dense stands the plants usually produce one seed head per plant. Where the stand has been thinned and competition among plants is not too great, the number of culms commonly increases to three to five per plant.

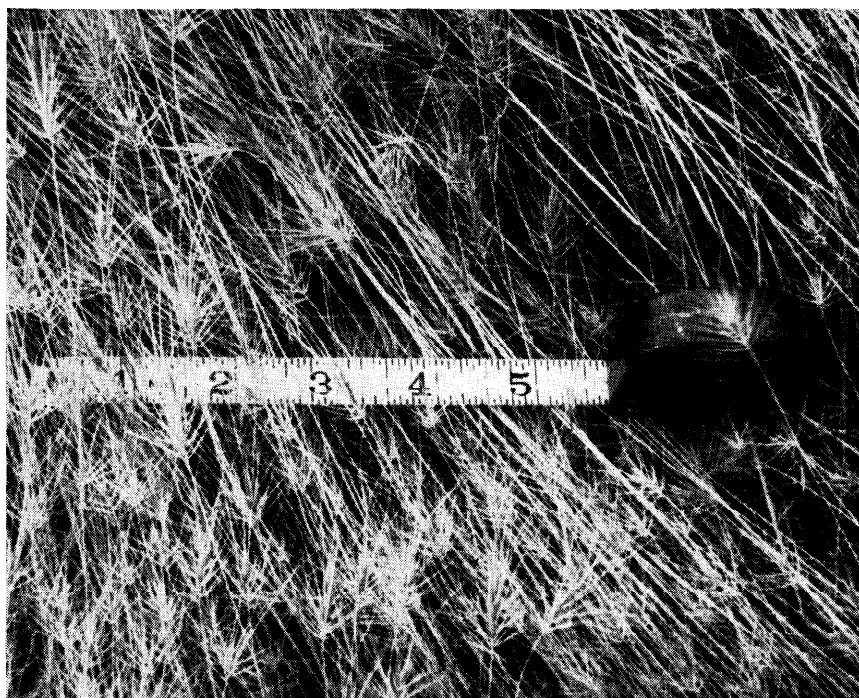


FIGURE 2. The dense growth of medusa-head results in the almost complete exclusion of other species from the extensive stands of this noxious annual grass.

In one rare instance a plant produced 133 seed heads.

Germination Studies

Period of Viable Seed Production

During the 1952 and 1953 growing seasons, seed of medusa-head was collected from three areas at periodic intervals to determine at what time in the post-flowering stage of the plant the seed becomes viable. Collections were made at approximately weekly intervals in the two years at a location on the north side of the Clearwater River valley in north-central Idaho. The collection area is located in Nez Perce County and is on a southeast slope at approximately 2,400 feet elevation. The site is in the *Agropyron-Poa* zone (Daubenmire, 1942). The native bunchgrasses of the area (principally bluebunch wheatgrass, *Agropyron spicatum*) have been replaced by annual brome grasses (*Bromus* spp.), fox-tail fescue (*Festuca megalura*), medusa-head, and goatweed (*Hypericum perforatum*), a noxious perennial forb.

Weekly collections were made

north of Emmett in Gem County in southwestern Idaho during June of 1952. The collection area is located on gently rolling terrain at an elevation of approximately 2,600 feet. The present vegetation is primarily medusa-head with some cheatgrass, common sunflower (*Helianthus annuus*), and tall willow herb (*Epilobium paniculatum*).

Infrequent collections were also made during 1952 in the Crane Creek area of Washington County. This site has somewhat more favorable growing conditions than the site in Gem County. It is situated at approximately 3,500 feet elevation. The vegetation is primarily medusa-head with some perennial grasses (*Sitanion hystrix* and *Poa secunda*), annual bromes, and annual forbs. The climax vegetation consisted of sagebrush-grass with a predominance of bluebunch wheatgrass.

Four replications of 100 seeds each from samples collected on various dates at each site were germinated in the laboratory at room temperatures ranging from 70° to

Table 1. Germination percentages of medusa-head seed collected at various dates on Coyote Grade, Nez Perce County, Idaho. Period of germination trial was 28 days in 1952 and 21 days in 1953.

Stage of Plant Development	1952 Collection		1953 Collection	
	Date	% Germ.	Date	% Germ.
<i>Pre-anthesis.</i> Plant green except for lower leaves and stem, head partially in sheath.	*	*	5/31	0.0
<i>Milk stage.</i> Plant similar to above except head is completely clear of sheath.	*	*	6/6	0.25
<i>Milk to early dough.</i> Stem dry about 1/2 its length, remainder of plant green.	*	*	6/23	8.0
<i>Early dough.</i> Similar to above.	*	*	6/27	12.0
<i>Mid-dough.</i> Stems nearly dry to head, awns and glumes green, lemmas with slight reddish to brownish tinge.	6/7	74.0	7/5	78.0
<i>Late dough.</i> Stem dry to head, awns and glumes greenish and fading to brownish color, lemmas brown.	6/16	92.0	7/11	97.0
	6/22	95.0	*	*
<i>Seed ripe.</i> Stems pale straw color, awns and glumes brownish to straw color, lemmas brown.	7/6	93.0	7/27	94.0
<i>Seed ripe.</i> Similar to above but awns and glumes continuing to fade to straw color.	7/14-8/21	90-96	*	*
<i>Seed ripe.</i> Whole plant straw colored in appearance.	9/6-9/17	89-94	9/1	98.0

*Collections not made.

90° F. Each replication of seed was placed between 3- by 10-inch strips of blotter and kept moist during the period of trial. Germination tests were conducted six to eight months after collecting dates, during which times the seed had been stored at room temperature under dry conditions.

A summary of the results obtained for the site located in Nez Perce County is presented in Table 1. Comparable germination results were obtained with samples collected three to four weeks later in 1953 than in 1952. The spring months in 1953 were cooler and delayed plant maturity. Temperature records at the Lewiston airport, which is a few miles from the site, show that it was three to four degrees cooler during the months of April, May, and June in 1953 than in 1952.

Fairly high germination percentages (74 to 78 percent) were obtained from seed samples collected while there was still a greenish appearance to the heads. The seed at this time was in the mid-dough stage of maturity, and with

the exception of the heads, the entire plant appeared completely cured. Approximately one week later, seed development had advanced to the late-dough stage and the heads had lost their greenish color. Germination percentages at this time increased to more than 90 percent. The germination percentages of seed collected after the late-dough stage remained high, with no significant downward trends through the period of collection.

Germination results obtained from samples collected in southwestern Idaho are presented in Table 2. Medusa-head development

in this part of the state is from one to three weeks later than in north-central Idaho. In all cases high germination percentages were obtained from samples collected after the late-dough stage of seed development was attained.

Seed Burial Study

During the fall of 1954 two replications of 100 seeds each were placed in small baskets made of plastic hardware cloth and buried in the ground at depths of 1/2 inch, 2 inches and 4 inches, in Washington County. The seeds were recovered in December of 1955 for germination trials. Average germination percentages of 10, 9.5, and 11.5 were obtained for the 1/2-, 2-, and 4-inch depths, respectively. Because of the large amount of medusa-head produced annually, even the relatively small germination percentage obtained is significant for it indicates that a fair amount of seed is able to remain viable in the soil for at least one year, if buried by cultural practices or other means.

Soil and Litter Germination Trials

Several collections of surface litter and soil to a depth of 1 to 2 inches were made at various locations in 1953 and 1954. Most of the collections were obtained prior to the production of seed by medusa-head for that year. Where collections were made after seed heads had been produced, the heads were removed from the surface before taking the sample. In no case had seed shattered from the heads of the plants at the time of collection.

The numbers of seedlings of medusa-head and other annuals

Table 2. Germination percentages of medusa-head seed collected in Gem and Washington Counties in southwestern Idaho in 1952 and 1953. Period of trial was 28 days in 1952 and 21 days in 1953.

State of seed development	Gem County				Washington County			
	1952		1953		1952		1953	
	Date Coll.	% Germ.	Date Coll.	% Germ.	Date Coll.	% Germ.	Date Coll.	% Germ.
Early dough	6/7	38.0	*	*	*	*	*	*
Mid-dough	6/13	79.2	*	*	*	*	*	*
Late dough	6/21	90.7	7/9	80.0	7/7	91.0	7/9	91.5
Ripe seed	6/28	93.5	9/21	81.5	7/21	87.0	*	*

*Collections not made

Table 3. Emergence of medusa-head and other annuals from surface material (6" by 6") collected from various locations in 1953 and 1954.

Location	Date of Collection	Number of Plants Emerging	
		Medusa-head	Other Annuals
Gem County, S-1	5/6/53	17	41
Gem County, S-2	5/7/53	38	12
Washington County	5/7/53	161	9
Nez Perce County	5/31/53	7	22
Nex Perce County	6/2/54	32	5
Gem County	6/24/54	120	5
Washington County	6/24/54	113	0

that emerged during the period of trial are given in Table 3. These results indicate that large numbers of viable seeds are carried over for at least one year in the litter and topsoil. The other annuals consisted primarily of cheatgrass and foxtail fescue. It was not determined what percentage of these plants were from current year's seed. Carryover, however, of viable cheatgrass seed has been reported as uncommon in northern Idaho and southeastern Washington (Hulbert, 1955).

It was noted that the amount of viable seed of medusa-head carried over was related directly to the amount of medusa-head litter. The converse of this appeared to be true for other annuals. Accumulation of 3 to 5 inches of medusa-head litter is not uncommon in southwestern Idaho.

Burned Seed Trials

Burning of medusa-head stands as a means of control has been tried with some success in California. Furbush (1953) cites the case of one burn in June of 1948 in which medusa-head was almost completely eliminated in 1949. The area was still relatively free of the plant in 1951. However, burning has not been widely adopted as a method for medusa-head control in California.

Medusa-head seed from both scorched and unburned heads was collected from an area that was burned in June of 1950. Tests in the laboratory resulted in 0 percent and 87 percent germination, respectively. Four replications of 100 seeds each for the two treatments were used. The fire had

consumed the awns and charred the tips of the lemmas of seeds from the scorched heads. The unburned seeds showed no sign of damage, although the culms were burned nearly to the heads by the fire.

Surface samples, 12 inches by 6 inches by 1 inch, were obtained from three plots that were experimentally burned in Gem County on July 6, August 6, and September 11 of 1953. Germination of these samples produced 2, 2, and 8 plants, respectively. Samples of burned seed from these plots did not germinate. Because the samples from the plots were not replicated the values presented do not necessarily indicate the true emergence of germinable seeds for the three burning dates. The important thing is that all of the viable seeds were not destroyed by fire, and sufficient seed remained to reinfest a burn area.

Discussion

The large areal extent and the type of terrain infested with medusa-head in Idaho make formulation of control methods difficult. Control is further complicated by the persistent nature of the species. Its large annual production of viable seed, the ability of seed to maintain viability in the litter and soil for one year at least, and its superior competitive ability over most annual species, make replacement of medusa-head with desirable species extremely difficult. Although burning destroys many viable seeds, sufficient numbers remain uninjured and the reduction in density is only temporary. The area is soon reoccupied by medusa-

head with a density as great as before burning. Burning may also destroy seed of desirable species and weaken perennial species that are present. It appears that burning alone will not be an effective method of control but may be important, if supplemented by other means.

Summary

This paper reports the results of seed viability and germination tests of medusa-head, an undesirable winter annual grass now infesting approximately 190,000 acres of rangeland in Idaho. At present this species is largely confined to ranges formerly occupied by native perennials, and more recently by annuals, especially cheatgrass.

Medusa-head produces a large amount of seed annually, and fairly high viability is attained even when seed is collected while the heads still retain a greenish color. Carryover of viable seed in both litter and soil is shown to occur for one year at least. Fire-damaged seed from burned areas did not germinate in the laboratory, but substantial numbers of undamaged seeds from the burned areas germinated readily.

Acknowledgment

The authors are grateful to John E. Rinard of the Soil Conservation Service for his cooperation and assistance in gathering information for this paper.

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