

flow, every colony from which a strong enough to have ten full brood." He suggests this as a European foulbrood will make no that having resistant stock, the solves itself into those measures entering, spring protection and an

ered in a colony it must be care- is spreading or whether the bees If the disease is spreading in a is to be avoided.

out the larvae dead of European l rearing and, further, that the ay be retained without danger of

he colony be headed by a disease- sufficiently balanced to carry on d supply. A heavy feeding will s well known that a honey flow

o create a period when no brood e and thus aid in balancing the sisting the bees in cleaning up. upon the severity of the disease ean-up.

d colonies be cleaned up rapidly s important to keep them strong

#### ERADICATION

t of production are brought out 25 per cent of our profits go to re, encouraging to see California ng to initiate disease eradication ort of their association to obtain t everyone take a hand in this and assist in obtaining research ry, which later should determine winter losses and keeping our evention strength. This assist- of production.

rawn from Dept. Bul. 810 and by Loraine N. Todd.

e data have been freely drawn

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## GOAT GRASS—A WEED PEST OF THE RANGE

By W. C. JACOBSEN, State Department of Agriculture

### INTRODUCTION

SINCE California is famous for the variety of agricultural crops produced, made possible because of the wide range of soil types and climate, it likewise presents many favorable situations for pests, not the least of which are noxious weeds. From past experience in numbers of new weeds found each year, we can expect to find others in new locations, because somewhere in the length and breadth of the state a suitable habitat can be found for these generally aggressive types of plants. A thoroughly suitable home is not so discriminately sought by the weed members of plant families as by cultivated crop plants. Greater attention to the inspection of incoming seed shipments and limiting by regulation certain types of imported agricultural seeds will undoubtedly help appreciably in reducing the numbers of new weeds which might become established each year.

The classification of a new plant into the category of a noxious weed shortly after its discovery in a new territory is not always a simple matter, especially when its previous history is little known or if it is not sufficiently distributed and established to have proven itself. Into this general group we can place "goat grass," reported in 1927 by H. L. Leonard, horticultural commissioner of Calaveras County. The infestation, which served as the basis of his report, placed this weed in a comparatively localized infestation, apparently known in the locality for some time but more or less concealed by the landowner, who thought he had found a new and fine forage crop for his stock. This infestation had all the earmarks of becoming considerably greater in area, since the plant appeared to be thrifty and able to crowd out other range forage plants; hence plans for control measures were made.

It was new until determined by Professor P. B. Kennedy, agronomist at Berkeley, as being *Aegilops triunciales* on the basis of specimens furnished him ten years previously by Geo. P. Weldon, then deputy state horticultural commissioner, who reported it from near Clarksville, El Dorado County, in 1917. This report indicated that the weed had been present fully 75 miles north of the Calaveras infestations for at least thirteen years, since it had been known there for three

years, having become a serious pest in a wheat crop. This record did not come to light in files of the Department of Agriculture because at that time weed control was not among our programs.

Investigation of literature revealed it to be an Old World species, recently used extensively by the U. S. Department of Agriculture, Office of Cereal Crops and Diseases, in hybridization studies with wheat, to which grain it is closely related. Professor Kennedy refers to it in one of his reports as "wild wheat."



Fig. 5. *Aegilops triuncialis*, an annual grass of the barley tribe closely related to wheat. A noxious weed in this state.

Determination of another species of this same genus, namely, *Aegilops ovata*, found in June, 1928, in Mendocino County, was made by the Seed Laboratory of the U. S. Bureau of Plant Industry at Washington.

Perhaps for its persistence and outstanding appearance in late spring and early summer, this grass gained for itself its position as a weed, for its green color made it especially apparent when most other range

plants had passed into straw color of summer weather. Were it not for this characteristic it might have been obscure for a longer time.

#### APPEARANCE

The two species of *Aegilops* now known as grasses, ranging in height from eight to ten feet upon the aridity and depth of soil. They are both hairy. Both have long awns (20 to 30 times the lowest bracts on the spikelets) *triuncialis* while *ovata* has from four to seven. They are on slender heads, while *ovata* has the thicker head. As a general rule, the spikelets are filled or matured, giving a slender base of the head, often lending a slender appearance to *ovata*. (Characteristic of these two species is the entire head. This drops to the ground when carried by water or in the hair and seed.)

The seed itself is a small grain, not unlike a wheat kernel, differing in that the awn and kernel adhere tightly.

In the late spring and early summer, the green patches, stand out green against the brown awns showing a conspicuously green color to the wind.

This grass is of the barley tribe (Hymenopetalae) very near relationship to this grain and has been reported in hybridization experiments. It is a hardy or drought-resistant grain and has been reported to have crossed naturally with wheat in portions of its native range in the Old World.

#### SOURCE

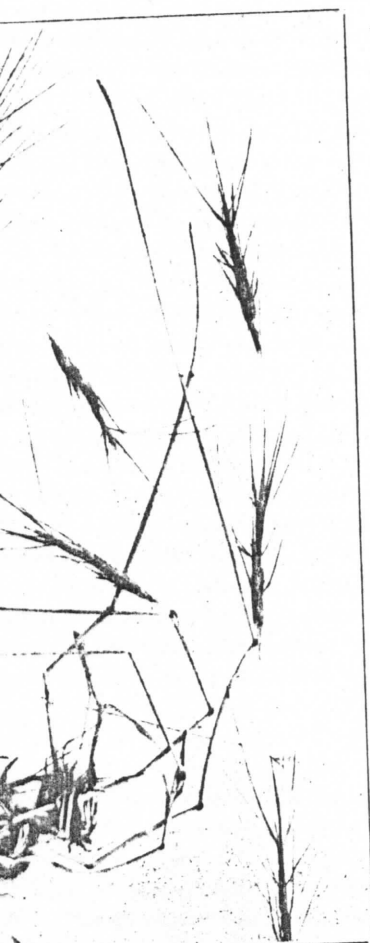
There have been noted about one hundred species of this genus growing wild in southern Europe and Africa, extending as far east as Afghanistan. Its introduction into California from some of these Old World countries was made by the genus (*Ae. cylindrica*) has been reported in the same way in the wheat fields, and in the wheat seed from Russia.

So far, only the two species above mentioned have been introduced into California. On the basis of the California records it has been introduced in the wool of the sheep and has been dispelled by finding it over its earlier history.

#### DISTRIBUTION

At the present time *Ae. triuncialis* is found in the upper reaches of Deer Creek, where it is a state highway to Placerville, westward to Placerville, thence spottedly south along

in a wheat crop. This record did not appear in the Department of Agriculture because it was not among our programs. It is now considered to be an Old World species, and the U. S. Department of Agriculture, in hybridization studies with wheat, has related it to wheat. Professor Kennedy refers to it as wheat."



Annual grass of the barley tribe closely related to wheat in this state.

of this same genus, namely, *Aegilops* sp. was found in Mendocino County, was made by the U. S. Bureau of Plant Industry at Wash-

ing its outstanding appearance in late spring and for itself its position as a weed, especially apparent when most other range

plants had passed into straw color or had been dried up by the summer weather. Were it not for this characteristic, it may have remained obscure for a longer time.

#### APPEARANCE

The two species of *Aegilops* now known in California are annual grasses, ranging in height from eight inches to two feet, depending upon the aridity and depth of soil. The leaves are narrow and slightly hairy. Both have long awns (20 to 25 mm. long) on the glumes, (the lowest bracts on the spikelets) *trunciales* having two or three such awns while *ovata* has from four to seven. The former has three to six spikelets on slender heads, while *ovata* has three to five on a somewhat stockier, and thicker head. As a general rule, only the two or three lower spikelets are filled or matured, giving a slightly enlarged appearance at the base of the head, often lending a somewhat distorted appearance in *ovata*. Characteristic of these two species is the breaking off of the entire head. This drops to the ground, to be blown by the wind or carried by water or in the hair and wool of live stock.

The seed itself is a small grain, not unlike a small (sometimes shriveled) wheat kernel, differing in that the glume or lowest bracts on the kernel adhere tightly.

In the late spring and early summer the plants, if in any sizable patches, stand out green against the sear hillsides, with the reddish brown awns showing a conspicuously darkened surface when waved by the wind.

This grass is of the barley tribe (*Hordeae*), quite close to wheat. Its very near relationship to this grain readily explains its use by investigators in hybridization experiments to determine if perhaps a more hardy or drought-resistant grain could be developed by crosses. It is reported to have crossed naturally with wheat in the more eastern portions of its native range in the Old World.

#### SOURCES

There have been noted about one dozen species comprising this genus growing wild in southern Europe, western Asia, and northern Africa, extending as far east as Afghanistan and Turkestan. Apparently its introduction into California came with shipments of seed from some of these Old World countries, since another member of this genus (*Ae. cylindrica*) has been reported as a weed pest from Oklahoma and Kansas in wheat fields, apparently having been imported in wheat seed from Russia.

So far, only the two species above mentioned have been found in California. On the basis of the Calaveras infestation, it was presumed to have been introduced in the wool of imported rams, but this thought has been dispelled by finding it over a far wider expanse with considerably earlier history.

#### DISTRIBUTION

At the present time *Ae. trunciales* is known to be distributed from the upper reaches of Deer Creek, where this stream is crossed by the state highway to Placerville, westward to Clarksville in El Dorado County, thence spottedly south along Deer Creek and across the hills



to Sloughhouse on the Cosumnes River. There appears to be more or less of a gap between this group of infestations until Calaveras County is reached, where it is found abundantly in spots throughout its southwestern portion, extending over into eastern San Joaquin County and northwestern Stanislaus County.

*Ac. ovata* has been reported from one section in the vicinity of Twin Rocks in Mendocino County. It is quite possible that additional infestations may be found on further survey.

#### NOXIOUS CHARACTERS

Early report from Calaveras County indicated that mechanical injury to sheep and hogs was severe, because the reverse hooks on the heads made it even more active in penetrating clothing and wool than was the case even with foxtail. Apparently, however, the injury to live stock is of less consequence than its ability to crowd out other valuable forage. Stock feeding in the vicinity of patches of this grass seem to specifically avoid it and apparently the only time when it is utilized for feed is in its very young stages.

Cronenmiller, associate range examiner for the U. S. Forest Service, estimates that heavy infestation may depreciate the capacity of the range from 50 to in excess of 75 per cent. This being true, there are hundreds of thousands of acres of good foothill range land adaptable for this plant which now serve as valuable grazing areas for cattle and sheep. Undoubtedly, its undesirable qualities are such that it should be curbed if any practical and satisfactory means are available.

Its habit of growth in dry shallow soils or in brushy margins or rocky soils makes this weed extremely difficult of access for control measures. It apparently can be spread by cattle, horses, and sheep by becoming attached to the fetlocks, tails or wool. Spread along certain creeks is indicative of its transportation by water, especially when in flood proportions. Winds blow it along bare ground, although if any appreciable obstruction were encountered it would undoubtedly lodge.

#### CONTROL MEASURES

With the early knowledge of a localized infestation in one valley in Calaveras County, plans were made for an eradication campaign, but further survey indicated its distribution so widespread that probably only control could be hoped for except in areas where the infestation was still light or centralized. Deep interest on the part of woolgrowers and cattlemen indicated that they would exert every effort to have it stamped out even in heavy and scattered infestations, in order to preserve valuable forage plants.

In San Joaquin County only a limited infestation was found scattered over several thousand acres of range land, apparently carried in by sheep. Intensive control measures were undertaken by Horticultural Commissioner Mahoney and his entire staff of inspectors. The entire infested acreage was handpicked when the plant was still green, resulting in the recovery of three grain sacks full of goat grass plants. In Stanislaus County, under the supervision of Commissioner Hamlin, areas where the weed was extensive were cut and burned or plowed. In

Calaveras County, with the assistance along roadways and live stock resulting in destroying the viability of green patches was followed. This is a satisfactory measure for taken in time to preclude seeding, or cutting for hay of cereal crops, acreages.

If foxtail and broncho grass have stock men, they have just cause to the same or possibly worse caliber

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#### CONTROLLING PLANTS

A. C. FLAHERTY, Senior Quarantine Supervisor

THE MANNER of spread of well be segregated into two the normal activities in Nature resulting from the activities of man spread." In any program aimed success will be dependent upon retardation natural dissemination; therefore both must be considered.

#### NATURAL FACTORS

Comparatively speaking, nature certain limits by such barriers as stretches of land barren of hosts, as the oceans which separate the limits insect pests may enlarge the wing or hopping; or some are borne carried by rivers or streams and insects such as the scale pests, are carried by birds or other larger insects. In the same natural factors are responsible important agent as a carrier of organisms, particularly bacteria, and animals and, as in the case of insects often responsible for the long distance.

Usually it is not possible to eliminate responsible for insect or disease distribution

There appears to be more or less infestations until Calaveras County is reached in spots throughout its southeastern San Joaquin County and

the section in the vicinity of Twin Lake. It is quite possible that additional infestations may occur.

#### CHARACTERS

It is indicated that mechanical injury to the reverse hooks on the heads of clothing and wool than was formerly, however, the injury to live stock is not so great. The ability to crowd out other valuable patches of this grass is apparently the only time when it is in its early stages.

Manager for the U. S. Forest Service, to appreciate the capacity of the land. This being true, there are some foothill range land adaptable for grazing areas for cattle and horses. The qualities are such that it should be a satisfactory means are available.

on dry soils or in brushy margins or in places difficult of access for control. Spread by cattle, horses, and sheep, on fetlocks, tails or wool. Spread by transportation by water, especially in winds blow it along bare ground, and in some instances where it was encountered it would

#### ASURES

Localized infestation in one valley in California for an eradication campaign, but it is not so widespread that probably it is not in areas where the infestation is of interest on the part of woolgrowers. It would exert every effort to have it eradicated infestations, in order to pre-

Localized infestation was found scattered in some land, apparently carried in by sheep. It was undertaken by Horticultural staff of inspectors. The entire plant was still green, resulting in full of goat grass plants. In the opinion of Commissioner Hamlin, the grass was cut and burned or plowed. In

Calaveras County, with the assistance of Commissioner Leonard, infestations along roadways and live stock driveways were sprayed with oil, resulting in destroying the viability of the seed. In other spots cutting of green patches was followed. Results obtained are indicative that this is a satisfactory measure for the suppression of the weed when taken in time to preclude seeding. Fallowing in grain land, cultivation or cutting for hay of cereal crops undoubtedly are necessary in planted acreages.

If foxtail and broncho grass have been considered weed pests by live-stock men, they have just cause to believe that another weedy grass of the same or possibly worse caliber is added to the list.

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### CONTROLLING PLANT PEST SPREAD

A. C. FLEURY, Senior Quarantine Supervisor, State Department of Agriculture, Sacramento.

THE MANNER of spread of pests injurious to agriculture might well be segregated into two divisions—that spread resulting from the normal activities in Nature or "natural spread," and that resulting from the activities of man or what might be termed "artificial spread." In any program aimed at control of plant pest spread, success will be dependent upon retarding or preventing both artificial and natural dissemination; therefore conditions affecting or influencing both must be considered.

#### NATURAL SPREAD

Comparatively speaking, natural spread is slow and is confined to certain limits by such barriers as deserts, mountains or other wide stretches of land barren of hosts, and by large bodies of water such as the oceans which separate the several continents. Within these limits insect pests may enlarge their range of activity by flying, crawling or hopping; or some are borne long distances by winds; many are carried by rivers or streams and in some instances the smaller insects, such as the scale pests, are carried on the feet or bodies of animals, birds or other larger insects. In the case of plant diseases, practically the same natural factors are responsible for spread. Wind is a most important agent as a carrier of plant disease. Many plant disease organisms, particularly bacteria, are disseminated by insects, birds and animals and, as in the case of insect spread, rivers and streams are often responsible for the long distance distribution of a plant disease.

Usually it is not possible to effectively control all natural factors responsible for insect or disease distribution. For that reason, when