Division of Agricultural Sciences
UNIVERSITY OF CALIFORNIA

POISONOUS HEMLOCKS

THEIR IDENTIFICATION AND CONTROL

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CALIFORNIA AGRICULTURAL
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CIRCULAR 530

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THEIR IDENTIFICATION AND CONTROL

THE poisonous plants referred to in this publication as "hemlocks" are members of the carrot or parsley family, Umbelliferae, and should not be confused with true hemlocks, which are coniferous trees of the pine family, Pinaceae. Poisonous hemlocks are of two genera: *Conium* (Poison Hemlock), and *Cicuta* (Water Hemlock). They have a general family resemblance to one another but are not closely related; their toxic properties and effects are different, they present different problems to the livestock industry, and they have different diagnostic features.

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WARNING

2,4-D is classified as an injurious material by the State Department of Agriculture, and before it can be purchased or used a permit must be obtained from the County Agricultural Commissioner. It should be used with care and at a time and in such a manner that it will not drift to other plants or properties and cause injury to susceptible plants or result in an illegal residue on other food or feed crops.

THE GROWER IS RESPONSIBLE for residues on his own crops as well as for problems caused by drift of a chemical from his property to other properties or crops.

Fig. 1. Mature plants of water hemlock (*Cicuta*).

General Characteristics of Umbelliferae

The family Umbelliferae, which includes poison hemlock, also includes carrot, celery, and parsnip, and herbs such as parsley, anise, dill, caraway, and coriander. The leaves are usually much divided and fern-like, and are alternately arranged along the stem; in some members of the family (carrot and poison hemlock, for example) the first year's leaves are in a basal tuft. The base of the leaf-stalk is usually somewhat enlarged and partly surrounds and clasps the stem. The numerous, small flowers are borne in umbrella-shaped clusters (umbels). A circle of bracts (small, leaf-like structures) called an involucre is usually present around the base of the umbel (fig. 11*c*).

The small, dry fruit of these hemlocks often shows distinctive features which can serve as characters for identification. In order for a botanist to make a positive identification on an unknown species of Umbelliferae it is usually necessary to have the mature fruit for examination. Although illustrations of the fruits of all groups discussed herein are included to aid the reader, more emphasis is placed on other identification features for two reasons: most livestock losses from hemlocks occur long before mature fruits develop and the rancher cannot wait 2 or 3 months for an identification, and because mature fruits are generally small, a strong magnifying glass or a good hand-lens is required in order to study them. Fortunately, *Conium* and *Cicuta* show good diagnostic features in other organs much easier to observe.

WATER HEMLOCK (*Cicuta*)

How to Recognize Water Hemlock

There are two similar water hemlock species in California: western water hemlock (*Cicuta douglasii*) and salt-marsh water hemlock (*Cicuta bolanderi*). They are smooth, erect perennials, 3 to 8 feet tall, with hollow stems, and short, thickened, basal rootstocks (fig. 1). In large mature plants, the rootstock is divided internally into a series of hollow chambers by cross-partitions which are readily apparent when the rootstock is cut open lengthwise (fig. 2*a*). When this is done, drops of a yellowish, oily liquid ooze out upon the cut surface, and in a matter of minutes the liquid turns reddish, and then reddish-brown. This liquid, which has a distinctive, aromatic odor, contains the poison of the plant—a resinous substance called cicutoxin which is soluble in organic solvents but not in water.

The leaves are large and much divided, and are once, twice, or three times pinnately compound. The individual leaflets (the ultimate divisions of the leaf) are lance-shaped, and have regularly serrate margins (fig. 2*b*). Also, the leaflets show a distinctive venation pattern: the secondary veins usually extend from the midrib out to the notches between the marginal teeth (fig. 2*c*), whereas in most other genera in the family the secondary veins run out to the tips of the teeth. Water hemlock does not have a circle of bracts surrounding the base of the umbel as in most members of the family; only one or two small bracts may sometimes be found. The numerous, small, white flowers are grouped in compound umbels. The fruits, which are about ⅛″ to 3/16″ long, are dry when fully ripe and each splits readily into two halves (a characteristic of the whole family). Fruits are broadly oval, or roundish and slightly flattened (fig. 2*d*).

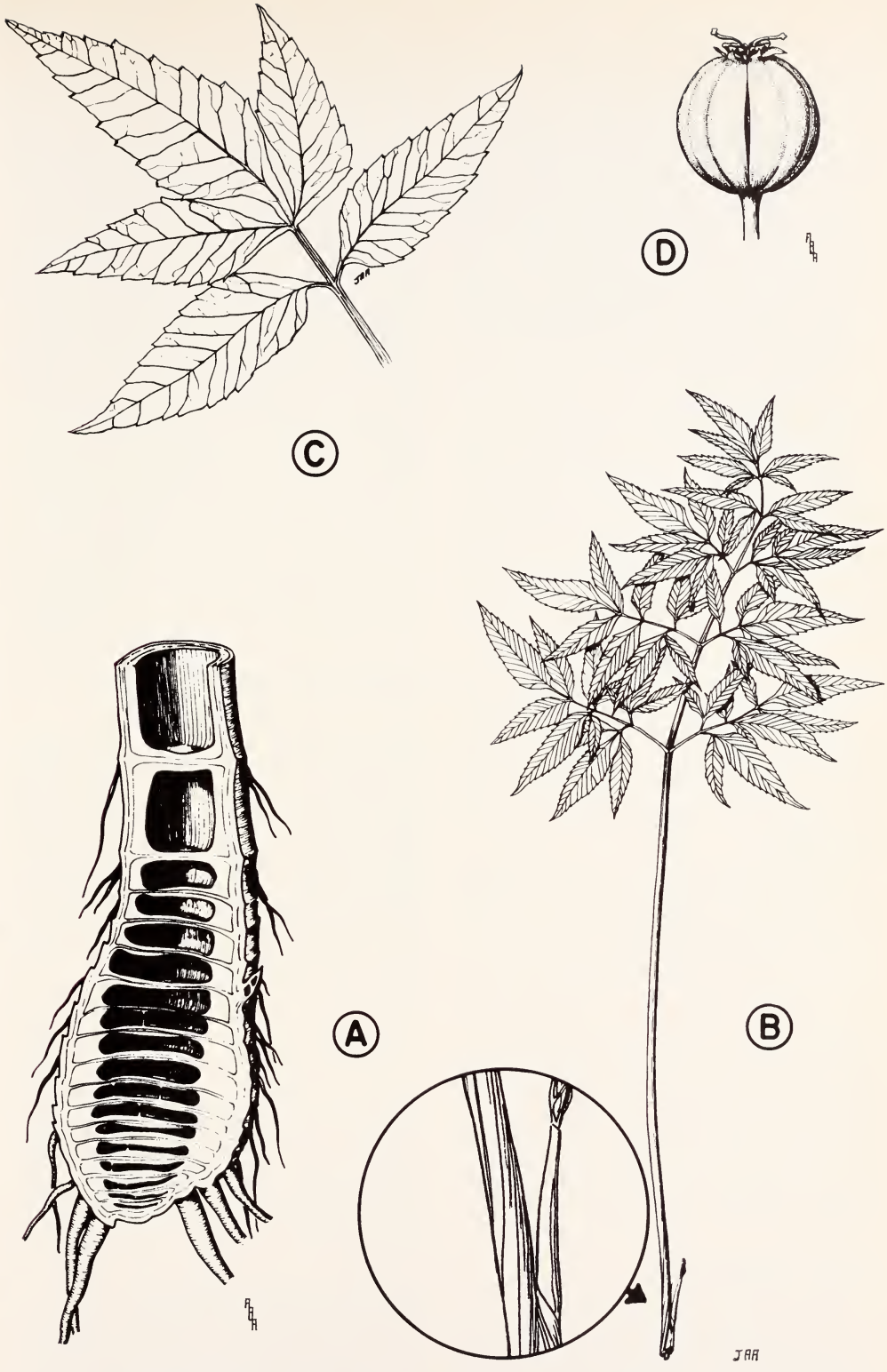

Fig. 2. Water hemlock (*Cicuta*). A—rootstock cut lengthwise, 80 per cent actual size; B—leaf, 25 per cent actual size; C—leaflets, showing distinctive venation pattern, 80 per cent actual size; D—fruit, 7 times actual size. Inset is actual size.

Where Water Hemlocks Grow

Water hemlocks are restricted to wet habitats—marshy areas, the borders of streams, lakes, etc. Salt-marsh water hemlock is found in salt marshes along the coast in central and southern California, or in brackish marshes around the various arms of San Francisco Bay. Western water hemlock occurs throughout most of the state from sea level to elevations of 7,500 feet or more.

Poisonous Properties

The rootstocks of these plants are extremely poisonous: two to six rootstocks (½ to 1 pound) can kill a mature cow in as little as an hour. Dried rootstocks are as poisonous as fresh ones. All animals (including man) are poisoned if they eat enough *Cicuta*, but cattle are most often grazed in areas where *Cicuta* grows and are more likely to pull up the rootstocks from wet ground. The young leaves of *Cicuta* also contain cicutoxin, and early in the growing season may cause livestock losses. As the leaves expand, however, the poison becomes less concentrated, and consequently mature leaves rarely cause poisoning.

Cases of livestock loss from eating *Cicuta* have been fairly common in California. The most serious occurrence to come to our attention in recent years was during the winter of 1961–62, when twenty-seven cattle died on a ranch in Del Norte County. These animals had been feeding on swampy land which had been cleared and seeded to grass; it is probable that *Cicuta* was the cause of death, as the area was found to be heavily infested with the plant and pieces of its rootstock were found in the rumen of two of the dead animals.

Signs of Poisoning

Cicuta produces such a rapid death that in most cases illness will not be observed. Animals may be found dead near the source of the plant, and diagnosis is based on finding that the plant has been eaten and perhaps finding parts of the rootstocks in the rumen or paunch.

The first signs of poisoning may be seen from 10 to 60 minutes after the plant is eaten. The animal walks stiffly and acts uneasy. The eyelids may begin to twitch. In a few minutes the muscles of the neck begin to twitch and may cause the head to jerk; soon many muscles are twitching, and the animal may appear to be jumping up and down. As the muscles continue to contract the animal falls down, goes into violent convulsions, and fights for its breath. The legs are flung about wildly, the neck may be arched down between the legs or pulled backwards, and the third eyelid is frequently pulled over the eyeball. The mouth and face become contorted and violent chewing motions occur with frothing at the mouth. Periodically, the animal will relax and lie quietly for a moment, but a slight noise or touch will start the convulsions again.

If the animal falls down and goes into convulsions it will die within 15 to 30 minutes after it has shown marked signs of poisoning. An autopsy of the dead animal will not give much help unless parts of *Cicuta* are found in the rumen—the poison affects the brain so quickly that no lesions are produced. Animals that have eaten only small amounts of *Cicuta* may show mild signs and live.

Treatment

Because there is no specific antidote for *Cicuta* poisoning, and because death usually occurs too quickly for anyone to treat the animal, *prevention is the only hope in controlling losses from poisoning.* The rancher must recognize the plant and eliminate it, or keep livestock away from it.

Controlling Water Hemlock

It is often possible to reduce water hemlock infestation and improve growth of more desirable forage species by drying

the soil. This may be done by levelling, improving drainage, and realigning ditches; rootstocks brought to the surface should be removed before they can be eaten by livestock.

Hand-grubbing of scattered plants, mechanical cultivation, and chemical sprays, can control the pest. Hand-grubbing or digging is usually done in small areas in the spring when soil is moist; plants can often be pulled from moist soil with a minimum of digging. Care should be taken to remove all the rootstocks in the soil, as remaining pieces can sprout and form new plants; rootstocks should be placed in bags or boxes and carried from the field to be dried and burned. Larger infestations may be plowed and thoroughly harrowed several times with a spring-tooth harrow to drag the rootstocks to the surface. The exposed rootstocks should be collected, dried, and burned as described above.

2,4-D sprays have given good control, using 2 pounds of 2,4-D per acre in sufficient water to give complete wetting of the water hemlock's foliage; a low-volatile ester of 2,4-D, or an amine formulation with an added wetting agent, can be used. Spraying should be done in late spring or early summer when the plant is growing vigorously but before its seeds mature. Grasses are not damaged by 2,4-D—they will usually fill in spaces occupied by the hemlock and so help prevent regrowth and reinfestation. A follow-up treatment on regrowth in the fall or the following spring should be planned; spot spraying of any water hemlock appearing in subsequent years should keep the area free of this pest.

Other Umbelliferae Which May Be Confused With Water Hemlocks

The following plants, which commonly occur in wet habitats, may be confused with water hemlock. However, none of them has the same combination of characteristics so distinctive of *Cicuta*: the chambered rootstock in large, mature plants; the oily, aromatic liquid exuding from cut surfaces of the rootstock; the secondary veins of the leaflets running to the notches between the teeth rather than into the teeth; and the lack of a circle of bracts at the base of the umbel.

Water parsnip, *Sium suave* (fig. 3). This plant is more similar to water hemlock and can be more readily confused with it than can any of the others listed below. Its leaves are only once pinnately compound (fig. 3*a*), however, while water hemlock leaves are usually two or three times pinnately compound (fig. 2*b*). The venation pattern of the leaflets is quite different; the secondaries are rather weak and irregular and do not extend directly to the margin (as in *Cicuta*) but become lost in a network of small veinlets (fig. 3*b*). Unlike *Cicuta*, a definite circle of small bracts occurs at the base of the umbel.

Water parsnip grows in marshes and along sloughs from central California northward into British Columbia. Although reportedly toxic to livestock, there appear to be no authentic cases of its having caused livestock loss.

Water parsley, *Oenanthe sarmentosa* (fig. 4). Water parsley is a lower-growing plant than water hemlock, and is commonly 2 to 4 feet tall. The stems are softer and more succulent than those of water hemlock; the leaflets are more coarsely toothed and often deeply cleft or divided (fig. 4*b*), unlike the evenly serrate leaflets of water hemlock. Mature fruit is $\frac{3}{16}$ of an inch or less in length, barrel-shaped to cylindrical, and has conspicuous elongated styles (fig. 4*c*).

Water parsley grows mainly along the coast from southern California into

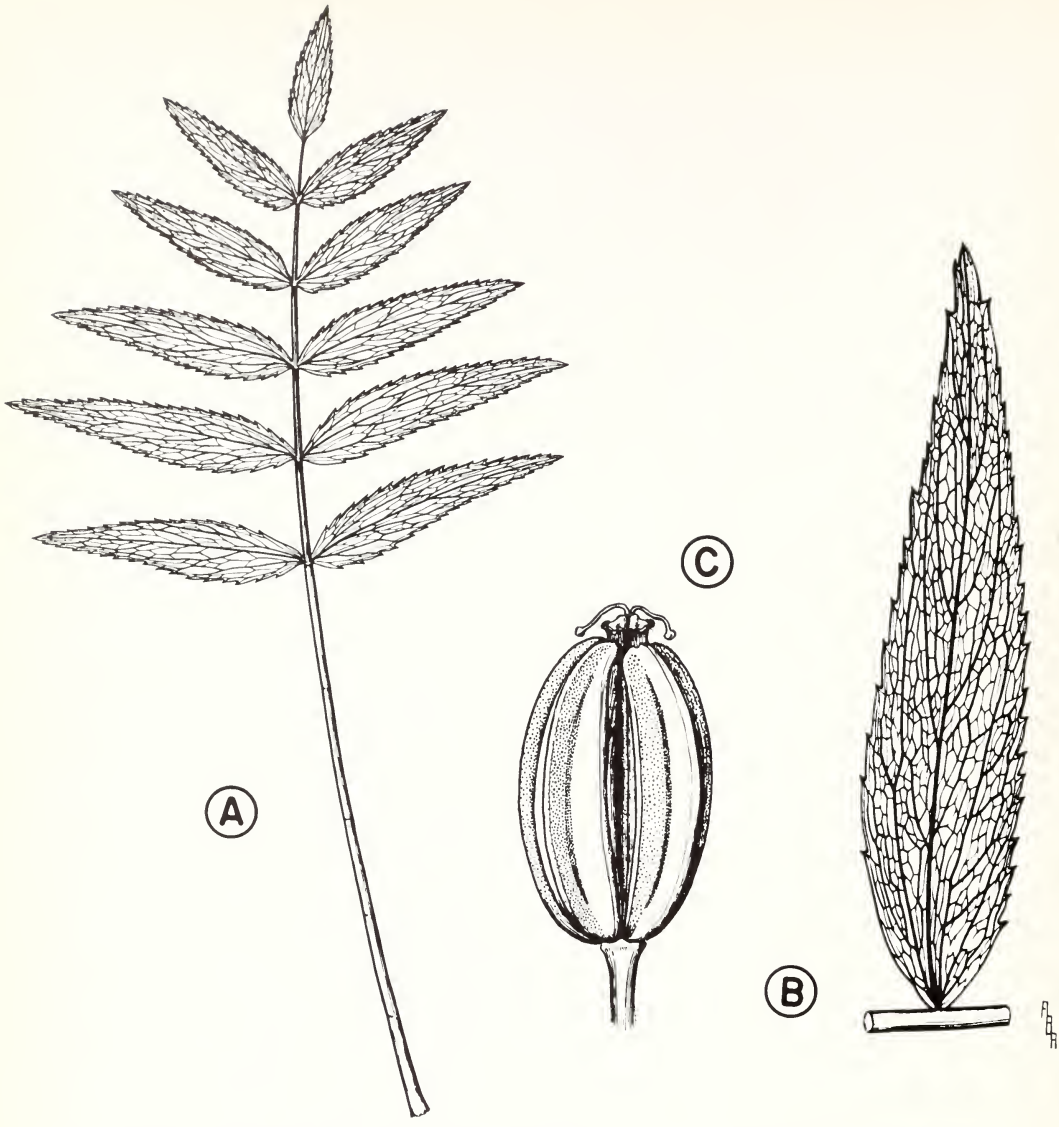

Fig. 3. Water parsnip (*Sium suave*). A—leaf, 25 per cent actual size; B—leaflet, showing venation pattern, 80 per cent actual size; C—fruit, 14 times actual size.

Canada, and in the northern Sierra Nevada.

Cut-leaved water parsnip, *Berula erecta* (fig. 5). This plant is 10 inches to 30 inches tall, and has leaves only once pinnately compound, whereas those of water hemlock are two or three times pinnately compound. A circle of small bracts occurs at the base of the umbel, further distinguishing it from water hemlock.

Cut-leaved water parsnip grows in marshes and along sluggish streams throughout most of California.

White heads, *Sphenosciadium capitellatum* (fig. 6). An erect plant 3 to 5 feet tall. Similar in a general way to water hemlock, it differs in a number of re-

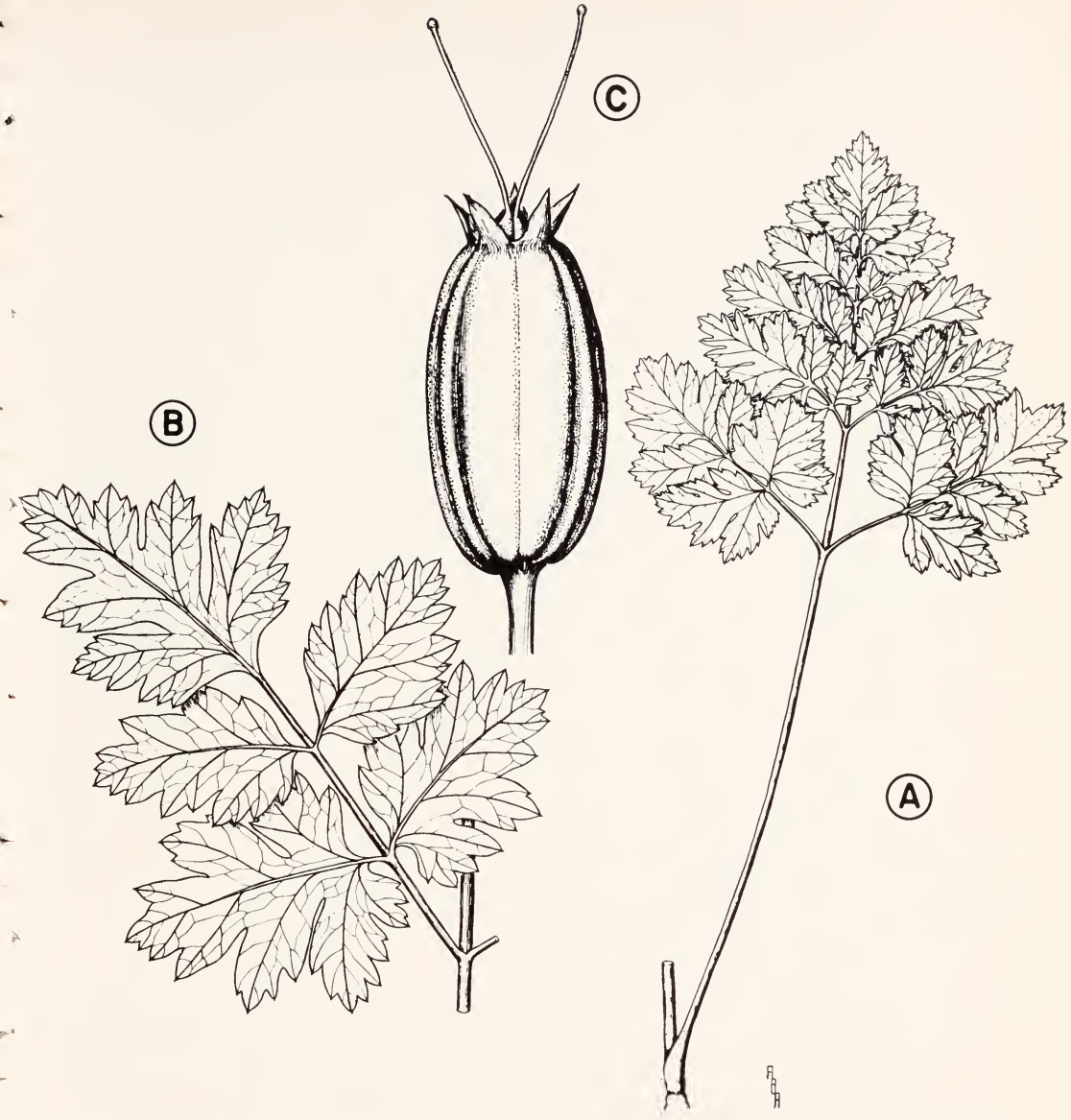

Fig. 4. Water parsley (*Oenanthe sarmentosa*). A—leaf, one-third actual size; B—leaflets, 75 per cent actual size; C—fruit, 12 times actual size.

spects. The base of the leafstalk of the upper leaves is enlarged, and has an inflated appearance; the leaflets are usually more irregularly toothed than those of water hemlock, and the inconspicuous secondary veins run into the teeth rather than to the notches between the teeth. The umbel is finely woolly, unlike water hemlock, and the flowers are in dense ball-like heads (fig. 6*c*). The fruit is flattened, and has a narrow marginal wing on either side (fig. 6*d*).

White heads occurs along streams and in swampy places in the mountains of

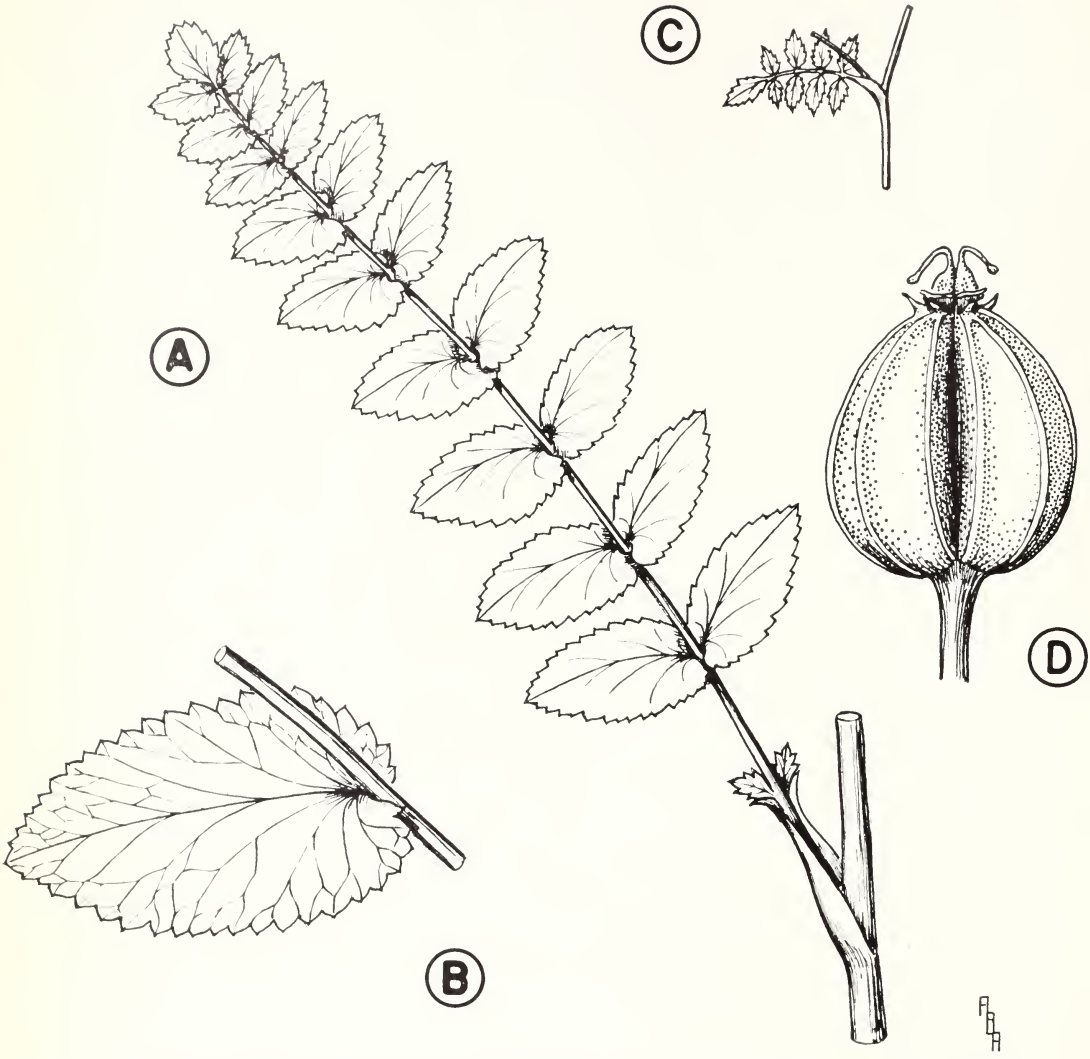

Fig. 5. Cut-leaved water parsnip (*Berula erecta*). *A*—leaf, 60 per cent actual size; B—leaflet, slightly enlarged; C—upper leaf, 60 per cent actual size; D—fruit, 18 times actual size.

California, at altitudes ranging from 3,000 to 10,000 feet.

Angelica, *Angelica* species (fig. 7). Some species are somewhat similar to water hemlock, and a few occur in wet habitats. Individually, they differ from water hemlock in various ways, but in all of them the fruit is conspicuously different, having thin flattened margins on either side (fig. 7*c*).

Fig. 6. White heads (*Sphenosciadium capitellatum*). A—leaf, 25 per cent actual size; B—leaflets, 80 per cent actual size; C—flower cluster, two-thirds actual size; D—fruit, 9 times actual size.

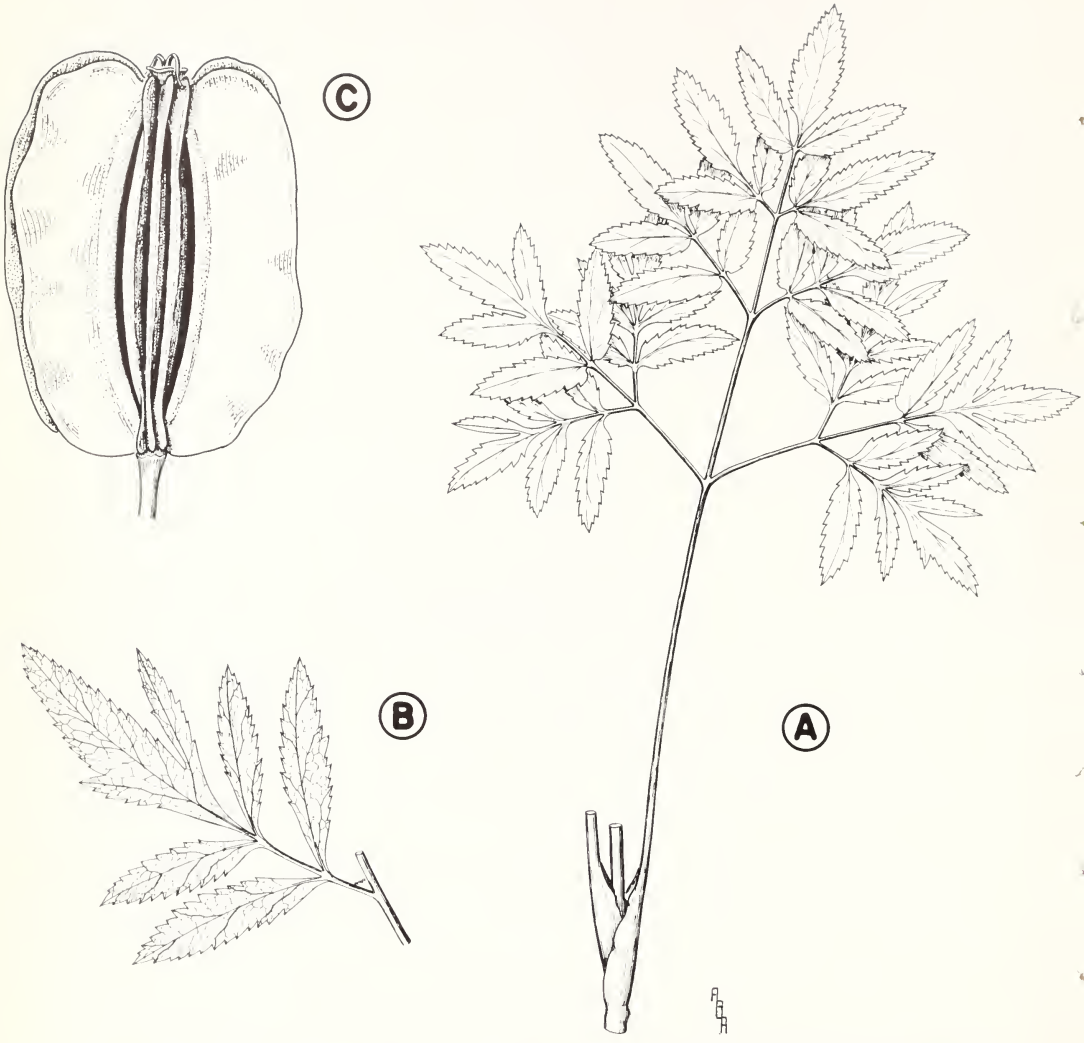

Fig. 7. Angelica (*Angelica*). A—leaf, 25 per cent actual size; B—leaflets, half size; C—fruit, 7 times actual size.

POISON HEMLOCK (*Conium*)

How to Recognize Poison Hemlock

There is only one species of poison hemlock in California, *Conium maculatum* (fig. 8), a branching biennial commonly 4 to 6 feet tall, but sometimes attaining a height of 10 feet. It has a long, white, often-branched tap root; the stem is stout, hollow, smooth, erect, and marked with reddish-purple spots (fig. 9)—the spotted stem is one of its most distinctive features. Lower leaves are 1 to 2 feet long or more, much dissected, and fern-like. The small, white flowers are arranged in open, compound umbels, 3 inches or less across. A circle of small, simple bracts surrounds the base of the umbel (fig. 10*c*). The small fruits are oval, and when dry have ribs that are minutely but distinctly (under a magnifying glass) wavy or undulating (fig. 10*d*). Like water hemlock, the fruit splits into two halves when fully ripe.

Where Poison Hemlock Grows

Poison hemlock, a native of Europe, occurs at lower elevations throughout much of California. Unlike the water hemlocks it is not semi-aquatic, and although frequently found in moist ground it may thrive in fairly dry soil.

Poisonous Properties

Conium has been recognized as a poisonous plant for many centuries. Its poisonous principle (consisting of several alkaloids) is found in the green leaves and stems and the fruit of the plant. Owing to the volatile character of the poisons this hemlock largely loses its toxicity on drying. Thus, hay containing *Conium* is not dangerous.

The plant is rarely eaten, but if wholesome forage is lacking livestock may eat the young foliage with fatal results. In rare instances, the small seed-like fruits may occur as an impurity in grain in sufficient quantity to poison livestock fed on it. *Conium* is not nearly as dangerous as *Cicuta* because the animal must eat 1 to 2 per cent of its body weight to produce poisoning, and even then the animal may recover if given proper care.

Signs of Poisoning

Poisoning signs appear 2 to 4 hours after eating the plant. *Conium* affects the animal's brain; the animal loses strength, its hind legs buckle beneath it, and it staggers and falls. It may get up again with difficulty, or it may stay down. The front legs soon become paralyzed and the animal appears drowsy and goes into a coma. An animal may be down and paralyzed for a day or two and still recover. Death can occur in 5 to 10 hours after these signs are noted, and autopsies reveal nothing significant.

Treatment

There is no specific antidote for *Conium* poisoning, but keeping prostrate animals shaded or warm and providing feed and water will save most of them. Laxatives may help to remove the material from the rumen; *do not drench an animal in a coma, as a fatal pneumonia may be produced.*

Controlling Poison Hemlock

Poison hemlock occurs in wet *and* in drier portions of fields. If the area is wet, improved drainage may help the growth of desirable pasture plants but will not eradicate the poison hemlock. However, frequent close mowing will eliminate an infestation by preventing seed formation. Close mowing also reduces the amount of green vegetation available for grazing, and the dried mowed material rapidly loses its toxicity.

Poison hemlock can also be controlled by spraying with 2,4-D in late spring while the plants are growing vigorously

Fig. 8. Mature plants of poison hemlock (*Conium maculatum*).

Fig. 9. Spotted stem of poison hemlock (*Conium maculatum*).

(old, dry plants are not controlled by this treatment). Ester or amine formulations of 2,4-D, at 2 pounds per acre in sufficient water to give thorough wetting, will give control. Some re-treatment is usually necessary because of missed plants, new seedlings, or regrowth; in heavy infestations, treatment each spring for several years is necessary for complete eradication. Improvement of desirable forage plants through pasture management, fertilization, irrigation, or drainage will help to prevent reinfestation.

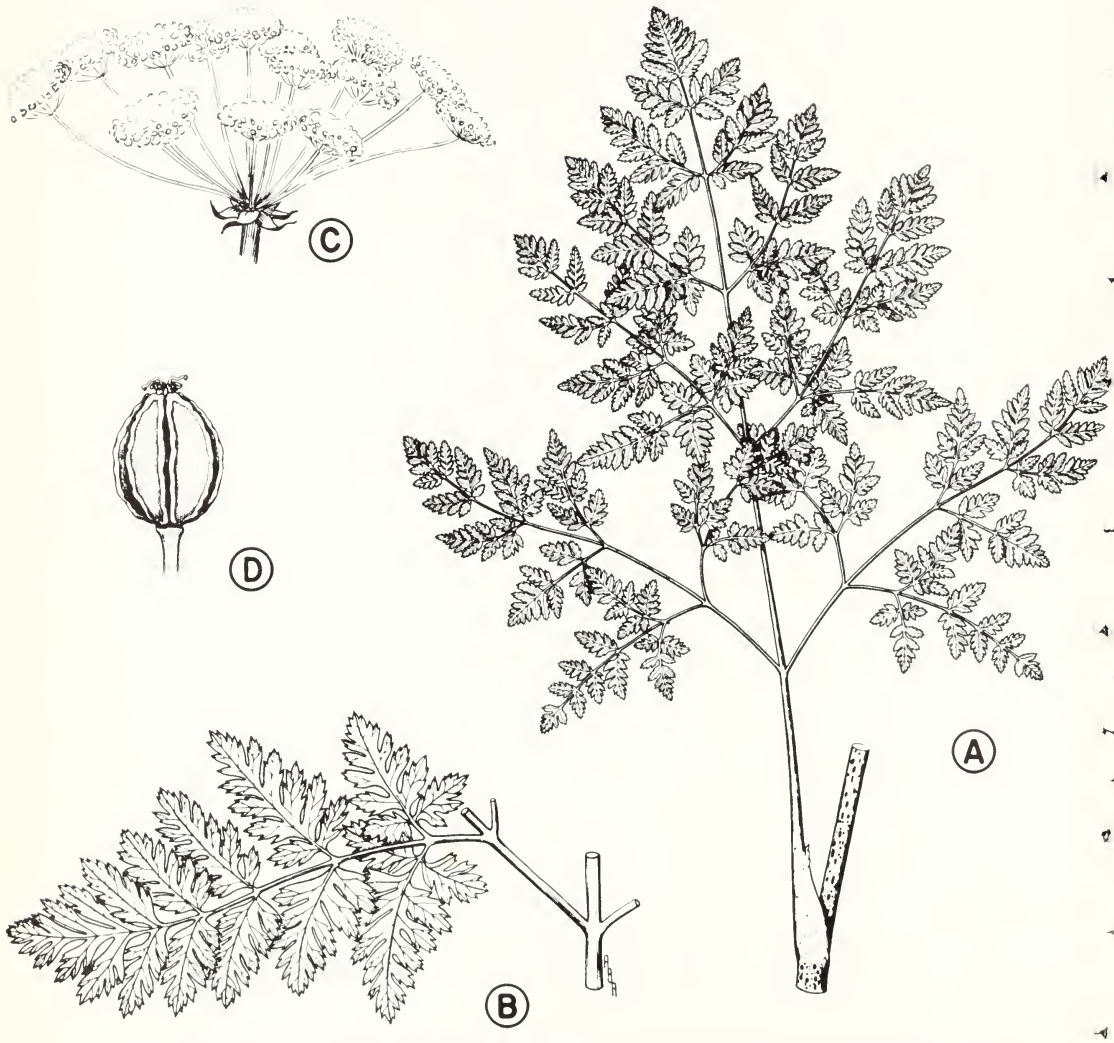

Fig. 10. Poison hemlock (*Conium maculatum*). A—leaf, 20 per cent actual size; B—portion of leaf, one-third actual size; C—flower cluster, actual size; D—fruit, 6 times actual size.

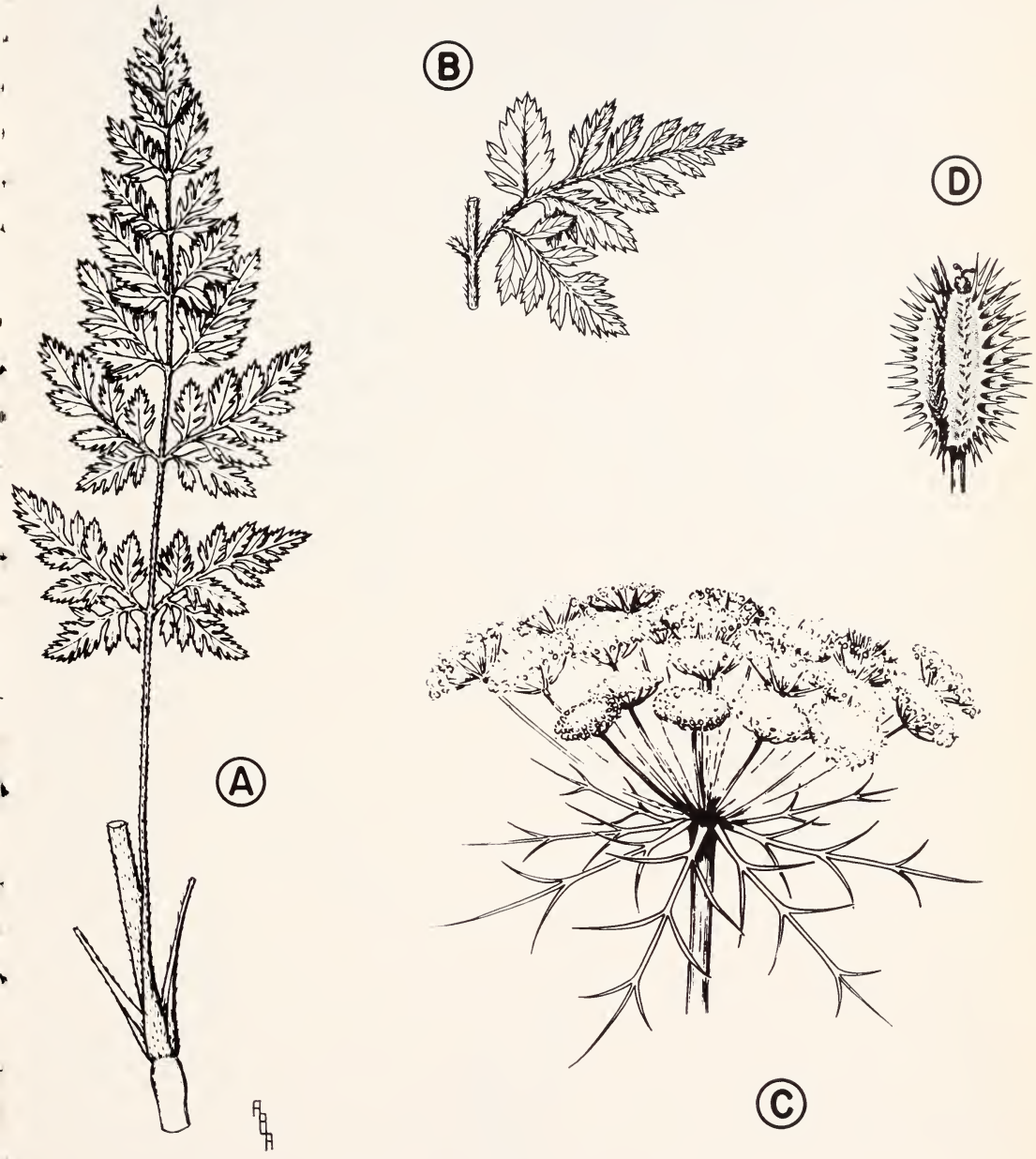

Fig. 11. Wild carrot (*Daucus carota*). A—leaf, half size; B—portion of leaf, two-thirds actual size; C—flower cluster with involucre at its base, two-thirds actual size; D—fruit, 7 times actual size.

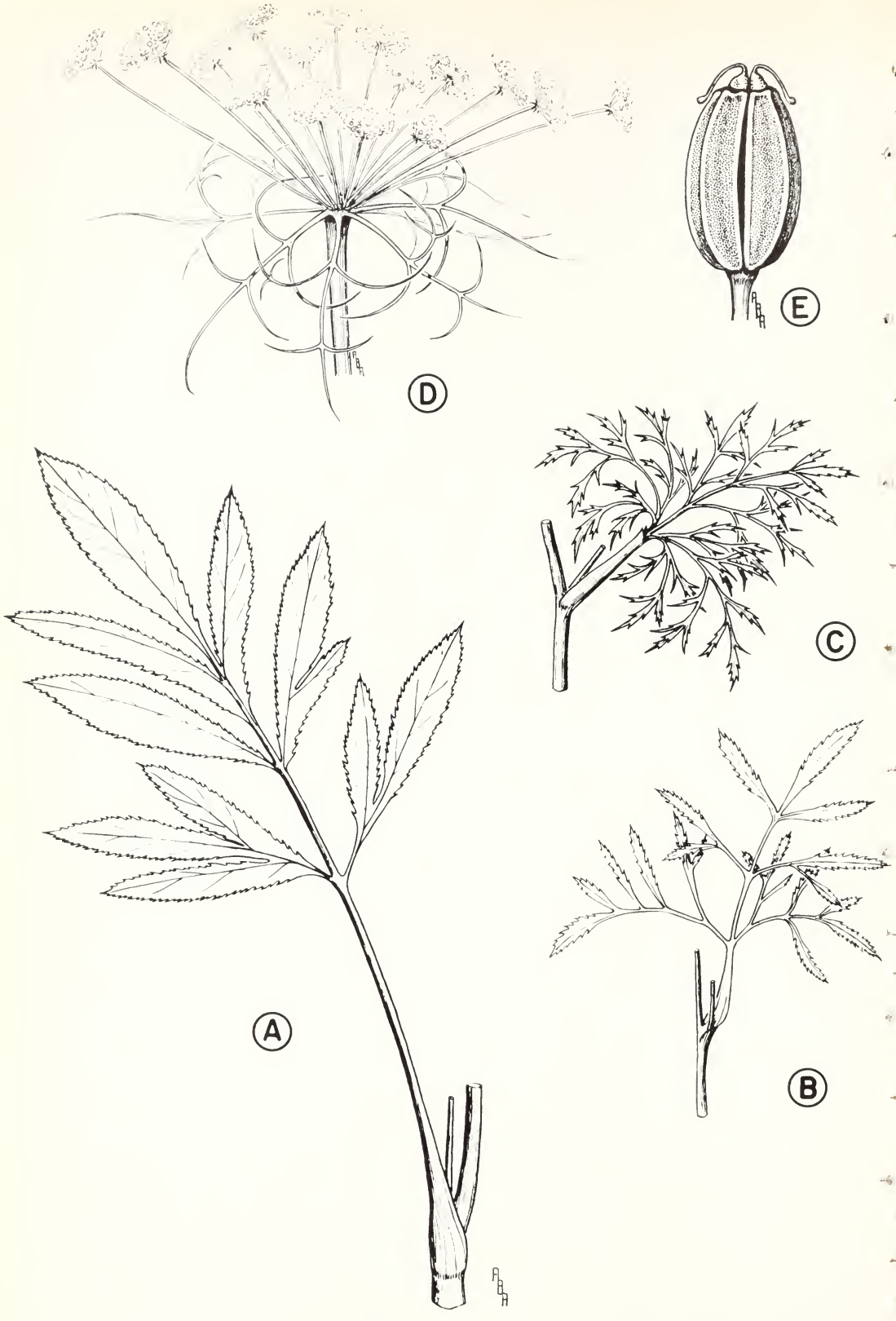

Fig. 12. Bishop's weed (*Ammi majus*). A—lower leaf, 60 per cent actual size; B—leaf midway up the stem, 60 per cent actual size; C—upper leaf, 80 per cent actual size; D—flower cluster showing involucre, actual size; E—fruit, 11 times actual size.

Other Umbelliferae Which May Be Confused With Poison Hemlock

The following plants could be confused with poison hemlock, although they do not possess the combination of characters distinctive of poison hemlock: the reddish-purple spotting on the stems, the circle of small, simple bracts, and the wavy ribs on the fruit.

Wild carrot, *Daucus carota* (fig. 11). A biennial with finely dissected, fern-like leaves. The stems are usually finely bristly-hairy and the leaves sparsely hairy, whereas poison hemlock is quite smooth, lacking pubescence altogether. The umbel is surrounded by a circle of conspicuous, pinnately divided bracts with elongated, narrow divisions (fig. 11*c*). The small fruits bear conspicuous rows of bristles (fig. 11*d*).

Wild carrot, a native of Europe, has become widespread as a weed in this country. In California, it is sparingly established at scattered localities.

Bishop's weed, *Ammi majus* (fig. 12). An erect biennial, 1 to 2½ feet tall, with smooth, branched stems. The lower leaves (fig. 12*a*) are pinnately compound with lance-shaped leaflets having very finely and sharply serrate margins, quite unlike the leaves of poison hemlock. The leaflets become progressively narrower up the stem (fig. 12*b*), however, and the smaller upper leaves are much more similar to *Conium*, being two or three times pinnately dissected, with narrow divisions (fig. 12*c*). The umbel is surrounded by a circle of conspicuous bracts which are divided into narrow, elongated segments (fig. 12*d*); this feature is quite different from *Conium*.

Bishop's weed, a native of Eurasia, has become sparingly established in California, mainly in Napa and Sonoma counties.

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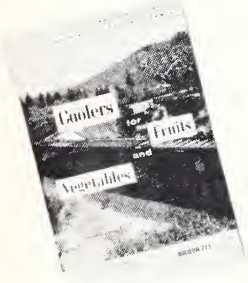

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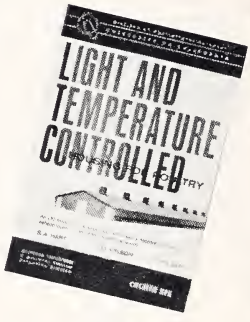

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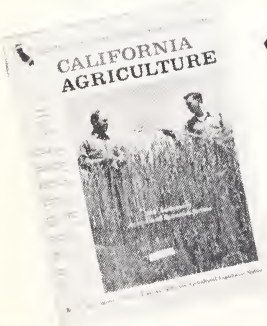

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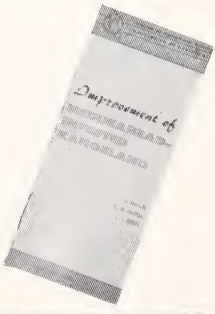

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