

3. Distribution and Occurrence of Weeds

IT IS widely held by laymen and professional men alike that weeds, unlike other plants, are capable of growing practically anywhere; if certain weeds do not occur in a specific region, state, or country, it is because they have not yet been introduced there. Some weeds (e.g. crabgrass) are indeed so tolerant of varying climatic and local ecological conditions as to lend considerable credence to this belief. But it is not correct. Weeds are like other plants. Each kind will succeed only within a certain range of environmental conditions. For some kinds of weeds this range is narrow or restricted; for others it is exceedingly broad.

Weeds and other wild species have natural means of distributing themselves: wind, water, seeds passed through digestive tracts of animals, etc. Man is an additional distributional and most important agent for those plants which grow in agricultural areas. In his agricultural seed, feeds, with his implements, etc., he has distributed seeds of weeds to all areas of the world. Those weeds which have become established in specific regions are those which are adapted. The ability to grow and reproduce under particular environmental conditions is the basic factor underlying the distribution and occurrence of weeds.

The above concerns the occurrence of weeds on a regional rather than a local basis. Weeds may be absent from limited areas, e.g. specific farms, either because (1) they have not yet been introduced to the area involved, or have been introduced and successfully eradicated, or (2) because they are not adapted to grow there.

Also, the above does not deny that new weeds still occasionally show up in the United States, or that weeds new to certain states are intermittently reported. But these are exceptions to the general rule. Furthermore, many "new" weeds are not new. Some, limited in distribution, have doubtless been present many years before their discovery. Some are merely waifs, species sporadically reported which are too poorly adapted to reproduce and maintain themselves. Other so-called new weeds represent a plant response to changed environmental conditions. For example, it has been alleged that numerous weeds, not previously known, have invaded many of the western ranges. Most of the species involved had been around for many years but occupied relatively limited habitats and were not frequently observed. With the weakening

and destruction of the native grass stands due to continued overgrazing, vast areas were opened up into which the weeds spread and multiplied.

REGIONAL DISTRIBUTION OF WEEDS

Regions of the world which have similar climates and in which similar crops are grown usually possess many weed kinds in common. The weeds of the central and eastern United States are much the same as those in temperate western Europe. Many Mediterranean weeds do well in California. Tropical agricultural areas possess similarities in their weed floras. But within these gross areas of adaptation we are woefully short of information concerning the distributional and environmental vagaries of specific weeds.

American botanists have studied the distribution and to a lesser degree the climatic requirements of many native wild plants and trees. For many of these the distributional limits are so well known that they can be drawn rather accurately on a map. The possibility of occurrence in a given county or town can often be indicated. This can be done for very few weeds; the prejudice that weeds can grow anywhere seems to have discouraged pertinent studies. For example, we know that Canadian thistle (*Cirsium*) and quackgrass (*Agropyron*) are weeds of more temperate and humid climates, but we can, in no way, indicate their precise distributional tolerance. Neither do we know exactly why Canadian thistle, for example, will not thrive in the South. On the other hand, Bermuda grass (*Cynodon*) and Johnson grass (*Sorghum*) are southern weeds. They do not extend North because the overwintering rootstocks are killed by low winter temperature. But the critical temperatures are not known nor are other factors which may limit the occurrence of these plants; likewise, their actual total range in the United States can only be estimated. Our knowledge of the distributional peculiarities of most weeds is in a similarly generalized stage.

Many weeds are able to tolerate a rather wide range of climatic life zones to the extent that they can live and reproduce. This does not mean that they are equally adapted to all of these diverse climatic conditions; contrariwise, a given species may possess a number of physiologically different strains which may fairly well adapt it to several climatic or soil provinces. In any case, weeds (and most other plants) occur not only in areas to which best fitted, but extend beyond with a decreasing degree of success in the struggle for existence, until limits of their various tolerances are reached.

These facts are borne out if the behavior of weeds as agricultural pests is considered. Most major weedy species possess economic significance within only a portion of their total range. Beyond this, they may be reasonably common but are less apt to assume a dominant role in the vegetation of disturbed areas; still further, their occurrence becomes sporadic, or their populations will succeed only in favorable

seasons. Quackgrass and Canadian thistle occur throughout Iowa, but their impact on crop production is much greater in the northern part of that state and continues to increase as one proceeds north into Minnesota and Wisconsin. Similarly, horsenettle (*Solanum*) may be found throughout the state of Iowa but is of much greater significance in the southern portion; it is increasingly prevalent and aggressive in Missouri.

Weeds compete not only with crop plants but with each other. A weed growing under conditions to which best adapted, both from the standpoint of vegetative growth and reproduction, will fare better in the competitive struggle with other plants (weeds or crops) than one growing where climatic and other conditions are less than optimum. In the latter circumstance it will probably assume a subordinate role in the vegetational spectrum, will interfere less with the growth of crop plants and other weeds, and will be more easily amenable to control measures.

The above generalizations are largely well known, but specific data are almost completely lacking. It is not possible to estimate the economically significant portion of the range of a weed species without such data; hence, we have no valid estimates.

This type of information, were it available, would be useful in a wide variety of manners. A single example: It could do much to render agricultural seed and weed laws more realistic. Many laws designate as noxious, or prohibit, weeds rarely found in their states, but which are presumed to represent potential threats if introduced. For instance, Russian knapweed (*Centaurea*) and perennial peppergrass (*Cardaria*) are typically weeds of arid regions. They are prevalent and important primarily from the drier portions of the high plains westward. Contrariwise, they are of relatively rare occurrence in the more humid central and eastern parts of the country. However, they are designated as primary noxious in many of the central and eastern states; it is illegal to offer for sale agricultural seed containing their seeds. It has been suggested that the reason Russian knapweed and perennial peppergrass have not become widely distributed in the remainder of the country is the existence of these seed laws.

It is not the purpose of this discussion to criticize agricultural seed or weed laws. For the most part they have been put together from the best information at hand, and any measure which will limit the further spread of potential weed pests is to be commended. Seed laws have done much within states to retard or prevent the infestation of yet more land with locally adapted major weed species. But the thesis that these laws have been the controlling factor in relegating important weeds to specific parts of the country is probably fallacious. Russian knapweed is common in the western part of the country because this is where it is capable of thriving. It has been introduced in many parts of the United States (despite seed laws). Local stands may or may not persist and usually show little tendency to spread. There is, however, little precise data as to the climatic or geographic limits of Russian knapweed or other noxious weeds.

It is not illogical to take a conservative position and consider such plants as at least potentially noxious until such data is forthcoming. This agricultural seed laws have done. Organized information regarding the range of adaptability of major weeds could, however, help render legal statutes realistic and perhaps make it possible for control officials to better channel their efforts.

The above topic was introduced as an example. It is but one of the ways in which progress in the total area of weed control could be facilitated — if we know more about the plants concerned.

THE OCCURRENCE OF WEEDS AS AFFECTED BY HABITAT

Every layman who has been harassed by dandelions in his yard has had the opportunity to note that dandelions rarely occur in cornfields. Likewise, the typical weeds of pastures are rarely found in soybean fields and vice versa. To what extent do habitat and cropping practices control or modify the nature of weed populations?

As emphasized above, weed species are most successful in situations to which they are best adapted to grow and reproduce, and which give them a competitive advantage over other kinds. In crops there is a tendency for weeds which have a life cycle similar to that of the cultivated plant to make out best. If the weed matures seed at the same time as the crop and this seed is subsequently harvested and replanted with agricultural seed, success of the weedy species is further guaranteed. For example, many of the major weeds of fall-planted cereals are winter annuals; of spring grains, summer annuals. Ordinarily, perennial weeds which can tolerate cutting are most persistent in stands of alfalfa. Lawn weeds are low-growing species which are not destroyed by mowing, etc.

In the past, when the same crop was frequently grown on a given piece of ground, season after season, the weed flora of each agricultural crop kind was rather distinctive. Favored weedy species gradually became more and more prevalent each succeeding year. With ascendancy of the practice of crop rotation, much of this individuality of weed populations disappeared. Many pests, formerly of major importance in specific agricultural areas, became relegated to secondary roles; crop rotation through the simple expedient of shifting the habitat is one of the most effective means of weed control.

Differences between the weeds in corn, small grains, and legumes still exist, it is true, but these differences are largely matters of degree. Most of the same weeds occur in all of these crops, but some, depending upon the crop kind, enjoy a greater measure of success than others and become more prominent. But there is little opportunity for a year-to-year build-up.

The recent upsurge in the use of herbicides has further modified the nature of weed populations. 2,4-D, tending to kill a large proportion of the dicotyledonous broad-leaved weeds, has resulted in increased

prevalence and importance of many grassy species. The more recent introduction of weed-killing chemicals effective on annual grasses may reverse this trend.

There is, in general, a greater discrepancy between the weed species of non-tilled areas (permanent pastures and range) and rotation farmland, than between various phases of an ordinary rotation. For example, successful weeds of permanent pastures, vervains (*Verbena*), biennial thistles (*Cirsium*), ironweeds (*Vernonia*), buckbrush (*Symphoricarpos*), *et al.* are infrequently found in land subject to cultivation. On the other hand, the common weeds of corn, (foxtail grass, *Setaria*; butterprint, *Abutilon*; pigweeds, *Amaranthus*) are not usually seen in permanent pastures. Weeds of roadsides, fence rows, and untended areas include a hodge-podge of species, both of cultivated and permanent pasture land, as well as additional kinds usually not characteristic of either. These latter habitats possibly exhibit a greater diversity of weedy forms than any strictly agricultural areas.

There are many factors which influence the habitat characteristics of weeds other than man's cropping practices. These include the nature of the soil, local climate, methods and effectiveness of spread from place to place, ability to reproduce successfully, and competitive ability with associated weeds and other plants. Some weeds, as indicated in the section above, have a much wider tolerance to a variety of environmental conditions than others. The multiplicity of factors which may influence the occurrence and prevalence of weeds results in many inconsistencies if an attempt is made to interpret them on a crop basis, and to some extent defeats such a classification. For example, a given weed may in one area largely be associated with one crop, but in another with an entirely different biotic situation. Some weeds are overwhelmingly abundant in certain limited regions but are almost entirely absent for miles around. Why? We can hazard guesses as to the ecological and distributional peculiarities of weeds, but we know very few direct answers for specific kinds. Much weed control planning could be placed upon a more scientific basis if the environmental tolerances of these plants were better understood.

AGRICULTURAL AREAS AND ASSOCIATED WEEDS

The following enumerates "typical" weeds of various agricultural and related areas of the north-central states. The association of any weed with a specific habitat or crop kind is subject to some of the limitations discussed above. The characteristic weeds of a given situation may be quite different in various parts of the North Central States. For instance, the weedy inhabitants of permanent pastures in Indiana are largely at variance with those of the ranges in western South Dakota. Many weeds are of considerable local importance, but their occurrence is sporadic. Others are limited to specific portions of our range. In some instances the difference between weed populations in different

habitats is not so much a matter of different kinds, but the relative preponderance and the degree of dominance assumed by various species.

Hence, the following is intended to provide only a general picture of the association of weed kinds with particular agricultural areas and to further emphasize the importance of man's manipulations upon the nature of weed populations. It does not constitute a check list applicable in any one agricultural section. Obviously, also, no attempt has been made to list all weed kinds for any area.

Corn

Annuals - Barnyard grass (*Echinochloa crusgalli*); Butterprint (*Abutilon theophrasti*); Cocklebur (*Xanthium* spp.); Crabgrass (*Digitaria* spp.); Foxtail grasses (*Setaria* spp.); Pigweeds (*Amaranthus* spp.); Shoo-fly (*Hibiscus trionum*); Smartweeds (*Polygonum* spp.); Witchgrass (*Panicum capillare*).

Perennials - Canadian thistle (*Cirsium arvense*); Field bindweed (*Convolvulus arvensis*); Horsenettle (*Solanum carolinense*); Quackgrass (*Agropyron repens*).

Soybeans

Annuals - Barnyard grass (*Echinochloa crusgalli*); Butterprint (*Abutilon theophrasti*); Foxtail grasses (*Setaria* spp.); Pigweeds (*Amaranthus* spp.); Shoo-fly (*Hibiscus trionum*); Smartweeds (*Polygonum* spp.); Witchgrass (*Panicum capillare*).

Perennials - Canadian thistle (*Cirsium arvense*); Horsenettle (*Solanum carolinense*); Quackgrass (*Agropyron repens*).

Small Grains

Annuals - Cocklebur (in stubble) (*Xanthium* spp.); Common ragweed (in stubble) (*Ambrosia elatios*); Corn cockle (southern) (*Agrostemma githago*); Field peppergrass (*Lepidium campestre*); Mustards (*Brassica* spp.); Pennycress (*Thlaspi arvense*); Wild buckwheat (*Polygonum convolvulus*); Wild oats (northwestern only) (*Avena fatua*).

Perennials - Canadian thistle (*Cirsium arvense*); Common milkweed (*Asclepias syriaca*); Docks (*Rumex* spp.); Field bindweed (*Convolvulus arvensis*); Horsenettle (*Solanum carolinense*); Johnson grass (southern) (*Sorghum halepense*); Perennial sowthistle (*Sonchus arvensis*); Quackgrass (*Agropyron repens*).

Legumes and Forage Grasses

Annuals - Annual spurges (*Euphorbia* spp.); Barnyard grass (*Echinochloa crusgalli*); Common peppergrass (*Lepidium densiflorum*); Common ragweed (*Ambrosia elatior*); Dodder (legumes only) (*Cuscuta* spp.); Foxtail grasses (*Setaria* spp.); Ground cherry (*Physalis* spp.); Japanese brome (*Bromus japonicus*); Kochia (*Kochia scoparia*); Lambsquarter (*Chenopodium album*); Pennycress (*Thlaspi arvense*); Smartweeds (*Polygonum* spp.); Witchgrass (*Panicum capillare*).

Perennials - Canadian thistle (*Cirsium arvense*); Docks (*Rumex* spp.); Field bindweed (*Convolvulus arvensis*); Ground cherry (*Physalis* spp.); Horsenettle (*Solanum carolinense*); Plantains (*Plantago* spp.); Quackgrass (*Agropyron repens*); Sheep sorrel (*Rumex acetosella*); Yarrow (*Achillea millefolium*); Yellow rocket (*Barbarea vulgaris*).

Permanent Pastures

Annuals - Downy brome grass (*Bromus tectorum*); Hedge mustard (*Sisymbrium officinale*); Horseweed (*Erigeron canadensis*); Ragweed (*Ambrosia* spp.); Stickseed (*Lappula echinata*).

Biennials - Biennial thistles (*Cirsium* spp.); Evening primrose (*Oenothera biennis*); Mullein (*Verbascum thapsus*); Wild carrot (*Daucus carota*).

Perennials - Bonesets (*Eupatorium* spp.); Buckbrush (*Symphoricarpos* spp.); Canadian thistle (*Cirsium arvense*); Dandelion (*Taraxacum officinale*); Ironweed (*Vernonia* spp.); Sheep sorrel (*Rumex acetosella*); Squirrel-tail grass (*Hordeum jubatum*); Vervains (*Verbena* spp.); Whorled milkweed (*Asclepias verticillata*); Yarrow (*Achillea millefolium*).

Lawns

Annuals - Chickweed (*Stellaria media*); Crabgrass (*Digitaria* spp.); Knotweed (*Polygonum aviculare*); Nimblewill (*Muhlenbergia schreberi*); Prostrate vervain (*Verbena bracteata*); Speedwells (*Veronica* spp.).

Perennials - Coarse-leaved fescues (*Festuca* spp.); Dandelion (*Taraxacum officinale*); Plantains (*Plantago* spp.); Quackgrass (*Agropyron repens*); Self-heal (*Prunella vulgaris*).

Home Gardens

Annuals - Annual spurges (*Euphorbia* spp.); Black nightshade (*Solanum nigrum*); Common ragweed (*Ambrosia elatior*); Crabgrass (*Digitaria* spp.); Foxtail grasses (*Setaria* spp.); Lovegrass (*Eragrostis* spp.); Pigweeds (*Amaranthus* spp.); Prickly lettuce (*Lactuca scariola*);

Purslane (*Portulaca oleracea*); Shepherd's purse (*Capsella bursa-pastoris*); Smartweeds (*Polygonum* spp.); Witchgrass (*Panicum capillare*); Yellow sorrel (*Oxalis stricta*).

Perennials - Field bindweed (*Convolvulus arvensis*); Quackgrass (*Agropyron repens*).

Roadsides, Fence Rows, Waste Areas

Annuals - Annual spurges (*Euphorbia* spp.); Downy brome grass (*Bromus tectorum*); Horseweed (*Erigeron canadensis*); Japanese brome (*Bromus japonicus*); Kochia (*Kochia scoparia*); Peppergrass (*Lepidium* spp.); Pennycress (*Thlaspi arvense*); Prickly lettuce (*Lactuca scariola*); Ragweeds (*Ambrosia* spp.); Spanish needles (*Bidens* spp.); Sunflowers (*Helianthus* spp.); Wild hemp (*Cannabis sativa*).

Biennials - Goatsbeard (*Tragopogon pratensis*); Wild carrot (*Daucus carota*).

Perennials - Asters (*Aster* spp.); Catnip (*Nepeta cataria*); Chicory (*Cichorium intybus*); Common milkweed (*Asclepias syriaca*); Docks (*Rumex* spp.); Goldenrod (*Solidago* spp.); Ground cherry (*Physalis* spp.); Hedge bindweed (*Convolvulus sepium*); Horsenettle (*Solanum carolinense*); Johnson grass (southern) (*Sorghum halepense*); Poison ivy (*Rhus toxicodendron*); Quackgrass (*Agropyron repens*); Squirrel-tail grass (*Hordeum jubatum*); Sunflowers (*Helianthus* spp.); White cockle (*Lychnis alba*); Wild rose (*Rosa arkansana*); Yellow rocket (*Barbarea vulgaris*).

Around Farm Buildings, Feed Lots, etc.

Annuals - Barnyard grass (*Echinochloa crusgalli*); Buffalo bur (*Solanum rostratum*); Cocklebur (*Xanthium* spp.); Fall panicum (*Panicum dichotomiflorum*); Jimson weed (southern) (*Datura stramonium*); Kochia (*Kochia scoparia*); Mayweed (*Anthemis cotula*); Prickly lettuce (*Lactuca scariola*); Round-leaved mallow (*Malva neglecta*).

Perennials - Hedge bindweed (*Convolvulus sepium*); Plantains (*Plantago* spp.); Quackgrass (*Agropyron repens*).

Paths, Dry Trampled Ground, Neglected Corners in Urban Areas

Annuals - Crabgrass (*Digitaria* spp.); Common ragweed (*Ambrosia elatior*); Foxtail grasses (*Setaria* spp.); Lovegrass (*Eragrostis* spp.); Knotweed (*Polygonum aviculare*); Prickly lettuce (*Lactuca scariola*); Prostrate spurge (*Euphorbia maculata*); Prostrate vervain (*Verbena bracteata*); Sandbur (*Cenchrus pauciflorus*); Shepherd's purse (*Capsella bursa-pastoris*).

Perennials - Dandelion (*Taraxacum officinale*); Docks (*Rumex* spp.); Pathrush (*Juncus tenuis*).