Proceedings of the Iowa Academy of Science

Volume 80 | Number Article 10

1973

Population Fluctuations of Some Plant Parasitic Nematodes in the Kalsow Prairie, Iowa

D. P. Schmitt
Iowa State University

Population Fluctuations of Some Plant Parasitic Nematodes in the Kalsow Prairie, Iowa[1]

D. P. SCHMITT[2]

SCHMITT, D. P. Population Fluctuations of Some Plant Parasitic Nematodes in the Kalsow Prairie, Iowa. *Proc. Iowa Acad. Sci.* 80(2): 69-71, 1973.

SYNOPSIS: The Kalsow Prairie is a 160 acre native tract located in the Clarion-Nicollet-Webster soil association in Pocahontas County, Iowa. It is composed of clay-loam to silty-clay-loam soil that ranged from pH 5.5 to 6.7, except for a soil drift that was 7.6, among the 15 test sites. The organic matter content was 8.5 to 12.9%. Population density changes of selected plant parasitic nematodes were investigated at four bimonthly intervals beginning in February 1968. The dominant nematodes in potholes were *Helicotylenchus hydrophilus, Xiphinema chambersi, Tetylenchus joctus,* and an undescribed *Tylenchorhynchus* species. The common nematodes in the drier sites were *Tylenchorhynchus maximus, T. nudus, Xiphinema americanum* and *Helicotylenchus pseudorobustus.* The total number of nematodes in a sample was generally highest in winter. Population densities in each subsequent sample decreased until the final sampling in late August and early September. Exceptions to this general trend were *Helicotylenchus hydrophilus, Tetylenchus joctus, Xiphinema americanum,* and an undescribed species of *Tylenchorhynchus* which were not recovered at the winter sampling. Many species of nematodes were not found in great enough population densities to perceive any type of population pattern.

Studies of the original prairie may aid in understanding some of today's environmental problems, especially in agriculture since most of the area now comprises much of our productive agricultural land. Plant parasitic nematodes cause an estimated billion dollars loss annually to field crops in the U.S. (Feldmesser, 1971). Due to the nature of Iowa agriculture, nematodes in cultivated fields most conceivably had their ancestry in native prairies prior to inhabitation by white man. The few nematode studies conducted in native prairies in the U.S. have consisted mainly of faunistic lists (Norton, 1959; Norton and Ponchillia, 1968; Orr and Dickerson, 1966; Thorne and Malek, 1968) with some data on nematode ecology (Schmitt, 1969; Schmitt and Norton, 1972). General habitat relationships of plant parasitic nematodes in the Kalsow and other Iowa prairies are reported by Schmitt and Norton (1972), and only seasonal population changes of those nematodes occurring frequently enough to discern trends are reported here.

MATERIALS AND METHODS

The Kalsow Prairie, in Pocahontas County, consists of 160 acres in the Clarion-Nicollet-Webster soil association. Although never cultivated, a portion of this prairie was grazed by domestic cattle prior to its preservation. Other disturbances include mowing, burning, activities of hunters, biologists, and other visitors. The Clarion-Nicollet-Webster soil association contains gentle slopes and closed drainage systems creating depressions (potholes) that support aquatic flora. Thus, this type of topography results in diversified habitats. The pH of the clay-loam to silty-loam soils in the test areas ranged from 5.5 to 6.7 except for the soil drift area which was 7.6. The organic matter content of the soil was high, ranging from 8.5 to 12.9%.

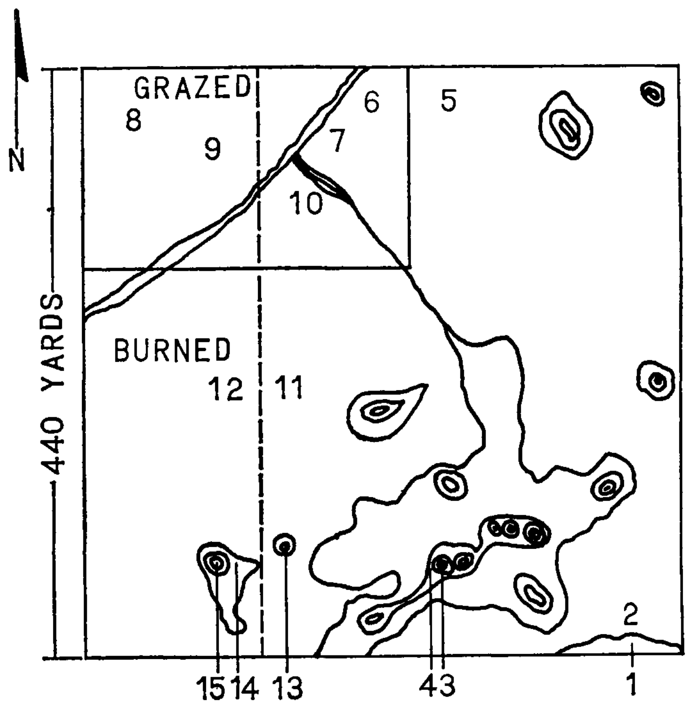

Figure 1. Location of sampling sites in Kalsow Prairie, 1968. See Table 1 for descriptions.

Fifteen sites six feet in diameter, except in the second sampling, consisting of a variety of habitats (Figure 1, Table 1) were sampled in February, late April to early May, late June to early July, and late August to early September, 1968. Soil samples of 600-700 cc were taken with a pickax in February and with a 3-inch diam. soil bucket auger in the remaining sample periods. One sample was taken from each

[1] Journal Paper No. J-7502 of the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa 50010. Project No. 1337.
[2] Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa 50010. Present address: Division of Plant Industries, Tennessee Department of Agriculture, P.O. Box 40627, Melrose Station, Nashville, Tennessee 37204.

TABLE 1. BRIEF DESCRIPTION OF EACH SAMPLE SITE AND THE DOMINANT PLANTS AT EACH IN THE KALSOW PRAIRIE, POCAHONTAS COUNTY, IOWA, 1968

Site	*Site Description*	*Dominant Plant Species*
1	Upland soil drift on a nearly flat area	*Chenopodium album* L. *Setaria viridis* (L.) Beauv. *S. lutescens* (Weigel) F. T. Hubb
2	Immediately north of soil drift	*Andropogon gerardi* Vitnam *Helianthus laetiflorus* Pers. *Poa pratensis* L. *Sporobolus heterolepis* Gray
3	Pothole center	*Carex* Laiche (Que.) *Polygonum coccineum* Muhl. *Scirpus fluviatilis* (Torr.) Gray
4	Pothole boundary	*Calamagrostis canadensis* (Michx.) Nutt. *Carex* sp. *Phalaris arundinacea* L.
5	Near top of west facing slope	*Andropogon gerardi* *Aster ericoides* L. *Poa pratensis*
6	Grazed west facing slope	*Asclepias syriaca* L. *Cirsium arvense* (L.) Scop. *Poa pratensis*
7	Grazed low area	*Asclepias syriaca* L. *Poa pratensis* *Solidago canadensis* L.
8	Burned, grazed hilltop	*Andropogon gerardi* *Poa pratensis* *Solidago canadensis*
9	Grazed, gentle southeast slope	*Andropogon gerardi* *Poa pratensis* *Solidago canadensis*
10	Bottom of the intersection of a north facing slope and a west facing slope	*Poa pratensis* *Solidago canadensis*
11	North facing slope	*Poa pratensis* *Solidago canadensis*
12	Burned north facing slope	*Andropogon gerardi* *Panicum leibergii* (Vasey) Scribn. *Poa pratensis* *Sporobolus heterolepis*
13	Depression on hilltop	*Calamagrostis canadensis* *Carex* sp.
14	Burned pothole boundary on hilltop	*Calamagrostis canadensis* *Spartina pectinata* Link
15	Burned pothole on hilltop	*Carex* sp. *Lysimachia hybrida* Michx. *Polygonum coccineum*

site in February and three from each site at subsequent samplings. Samples were processed within one day after sampling by a modification of the Christie and Perry (1951) method. Briefly, this consisted of washing 250 cc soil through the 35-, 60-, 100-, and 200-mesh sieves. Roots were collected from the 35-mesh sieve and processed for endoparasitic nematodes. The residue on the 60-mesh sieve was examined for cyst nematodes. The residue on the 100- and 200-mesh sieves was placed on a Baermann funnel for 44 hrs. Generic identifications were made from 10% of the nematodes in a sample. Specimens were preserved in 5% formaldehyde for later species identification and counts.

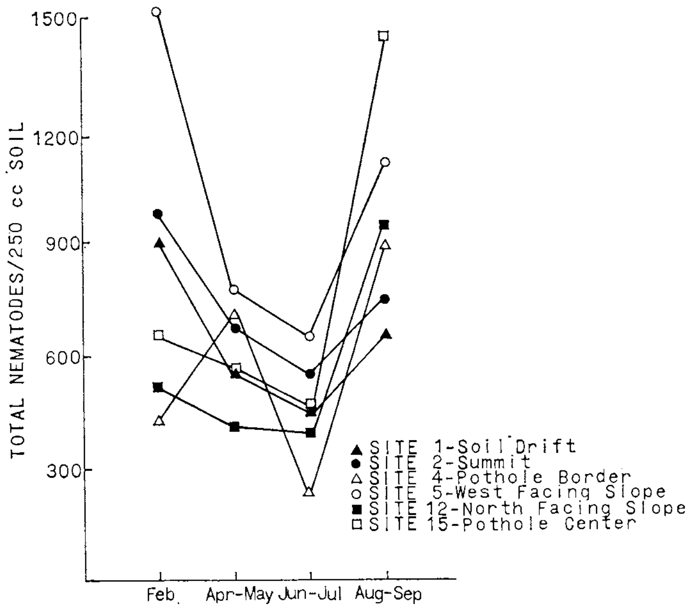

Figure 2. Population changes of total nematodes in different habitats in the Kalsow Prairie.

RESULTS AND DISCUSSION

Populations—Population fluctuations of total nematodes generally exhibited similar patterns for similar habitats. In well-drained areas, such as summits and shoulder to backslopes, populations were large in February, declined until mid-summer, and increased in the fall (Figure 2). Numbers were smaller in September than in February indicating that recovery following the dry summer was slow, a situation that has been observed in cultivated fields in Iowa. Population fluctuations of *Tylenchorhynchus maximus* Allen in well-drained areas coincided with those of total nematodes (Figure 3). Although the general fluctuation trends were similar, the numbers of nematodes and degree of fluctuation changed with site. Other plant parasitic nematodes common in the well-drained areas were *Helicotylenchus pseudorobustus* (Steiner) Golden and *Xiphinema americanum* Cobb, but neither showed the consistent trends among sites as did *T. maximus*. Unfortunately, the host ranges of most nematodes in the prairies are not known enough to judge whether or not these phenomena are largely host or edaphically controlled.

Population changes in pothole areas (i.e. the pothole centers and their borders), were generally consistent and contrasting. *Xiphinema chambersi* Thorne and *Hirschmanniella* sp. were restricted to the pothole areas but did not occur in sufficient numbers to discern population trends. Population

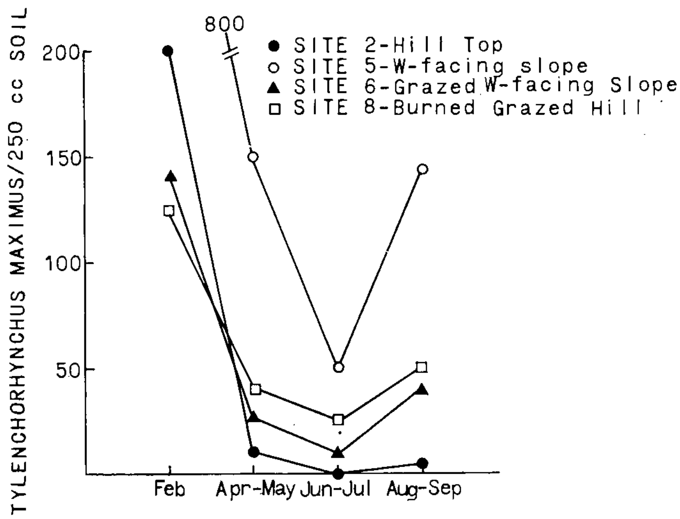

Figure 3. Populations of *Tylenchorhynchus maximus* in well-drained areas of the Kalsow Prairie.

trends of *Tetylenchus joctus* Thorne, *Helicotylenchus hydrophilus* Sher, and an unidentified species of *Tylenchorhynchus* varied among species within a site and between the pothole centers and their borders within a species (Figure 4). These phenomena are probably due to temperature and moisture relationships and to the phenology of the hosts. Little is known about the effect of these factors on nematodes recovered from the pothole areas. *Scirpus fluviatilis* and *Carex* sp. were early seasonal dominants in pothole centers and were followed phenologically by *Polygonum coccineum*. In the pothole borders, *S. fluviatilis* and *Carex* sp. were followed during the growing season by *Polygonum coccineum, Calamagrostis canadensis, Spartina pectinata,* and *Phalaris arundinacea*. Until more is known of the host-parasite relationships and of the edaphic factors governing populations of these nematodes, one can only speculate as to the importance of each factor at present.

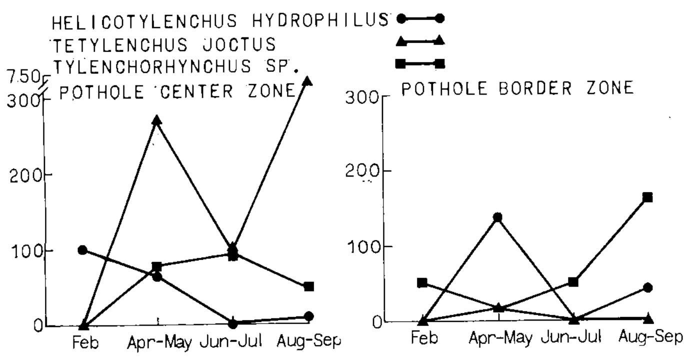

Figure 4. Population fluctuations of *Tylenchorhynchus* sp., *Tetylenchus joctus* and *Helicotylenchus hydrophilus* in pothole areas of the Kalsow Prairie.

Overwintering—Knowledge of the life cycle of plant parasitic nematodes is important in understanding population dynamics. The overwintering stage is important because it relates to the stage or stages of a nematode that may be resistant to adverse environmental conditions. Although eggs of nematodes were not recovered by the extraction technique employed, the absence of vermiform nematodes during the winter samplings would indicate overwintering by eggs. Based on this assumption, it is probable that *H. pseudorobustus, Tetylenchus joctus,* and *Xiphinema americanum* overwinter largely as eggs, while considerable numbers of *Helicotylenchus leiocephalus, Tylenchorhynchus maximus, T. nudus* Allen, and *T. silvaticus* V. *Ferris* overwinter in the vermiform stage where these nematodes occur in the prairie. The observations for *X. americanum* agree with those made in alfalfa fields in Iowa (Norton, 1963) and in an ornamental spruce nursery in Wisconsin (Griffin and Darling, 1964). *Helicotylenchus hydrophilus* apparently overwintered mostly in the egg stage, but some survived in the vermiform stage in the pothole centers. This points up possible major differences in the life cycles of nematodes in sites just a few feet apart and indicates that the habit and activity of nematodes can be manipulated by slight changes in their environment.

LITERATURE CITED

CHRISTIE, J. R., and V. G. PERRY. 1951. Removing nematodes from soil. *Helminthol. Soc. Wash. Proc.* 18:106-108.

FELDMESSER, J. 1971. Estimated crop losses due to plant-parasitic nematodes in the United States. Comm. on Crop Losses. *Soc. Nematol. Spec. Pub.* 1:1-7.

GRIFFIN, G. D., and H. M. DARLING. 1964. An ecological study of *Xiphinema americanum* Cobb in an ornamental spruce nursery. *Nematologica* 10:471-479.

NORTON, D. C. 1959. Relationship of nematodes to small grains and native grasses in north and central Texas. *Plant. Dis. Rep.* 43:227-235.

NORTON, D. C. 1963. Population fluctuations of *Xiphinema americanum* in Iowa. *Phytopathology* 53:66-68.

NORTON, D. C., and P. E. PONCHILLIA. 1968. Stylet-bearing nematodes associated with plants in Iowa prairies. *Proc. Iowa Acad. Sci.* 75:32-35.

ORR, C. C., and O. J. DICKERSON. 1966. Nematodes in true prairie soils of Kansas. *Trans. Kan. Acad. Sci.* 69:317-334.

SCHMITT, D. P. 1969. Population patterns of some stylet-bearing nematodes in a native Iowa prairie. *J. Nematol.* 1:304 (Abstr.).

SCHMITT, D. P., and D. C. NORTON. 1972. Relationships of plant parasitic nematodes to sites in native Iowa prairies. *J. Nematol.* 4:200-206.

THORNE, G., and R. B. MALEK. 1968. Nematodes of the Northern Great Plains. Part I. Tylenchida (Nemata: Secernentea). *S. Dak. Agr. Exp. Sta. Tech. Bull.* 31. 111 pp.