The Great Lakes Entomologist

Volume 16
Number 4 - Winter 1983 *Number 4 - Winter 1983*

Article 13

December 1983

Observations on North Dakota Sponges (Haplosclerina: Spongillidae) and Sisyrids (Neuroptera: Sisyridae)

Ralph D. Stoaks

Joe K. Neel
University of North Dakota

Richard L. Post
North Dakota State University

OBSERVATIONS ON NORTH DAKOTA SPONGES (HAPLOSCLERINA: SPONGILLIDAE) AND SISYRIDS (NEUROPTERA: SISYRIDAE)[1]

Ralph D. Stoaks[2], Joe K. Neel[3], and Richard L. Post[4]

ABSTRACT

Factors influencing occurrence, distribution, and ecology of sponges and sisyrids are discussed, with emphasis on northeastern North Dakota. New state records for North Dakota sponges, *Eunapius fragilis* Leidy and *Ephydatia fluviatilis* L. and the sisyrids, *Sisyra vicaria* (Hagen) and *Climacia areolaris* (Hagen), and new county records for *C. areolaris* in northwestern Minnesota and *Eunapius fragilis* in northeastern North Dakota are reported. A rare association of the parasite, *S. vicaria* with the host, *Ephydatia fluviatilis* is also reported. Some physicochemical relations of *Eunapius fragilis* found in the Forest River, North Dakota, are discussed.

Little is known about freshwater sponge ecology and pollution tolerance. This is the first study of sponges and sisyrids in North Dakota. Literature on environmental tolerance of freshwater sponges has been summarized by Harrison (1974).

Much of the data in this paper were obtained from occasional samples of Forest River headwaters when limnological features of riffle dwelling aquatic insects were investigated in 1969–1971 and during a survey of Trichoptera in the North Dakota Garrison Diversion Area in 1968. At present limnological data are available from North Dakota sponge habitats only from the Forest and Turtle rivers. A long term investigation of the limnology of the Turtle River is being monographed by J. K. Neel.

Most of our collections were made east of the Missouri Couteau (Fenneman 1938, Fig. 1). The Drift Prairie and the Red River Valley were covered by continuous ice sheets of the Wisconsin period. The glaciated topography of the Drift Prarie is a source of numerous shallow water habitats, many of which are moderately to highly alkaline. The alkalinity, hydrogen ion, and hardness of the water of these habitats is primarily derived from carbonate rocks of glacial origin and pre-glacial sedimentary formations.

METHODS

Submerged substrates with sponges attached were taken to the laboratory in water samples from the collecting sites. Specimens were detached, fixed, preserved, and identified from gemmules as suggested by Jewell (1959).

Larval sisyrids were collected from sponges on the surface of decomposing logs. Sisyrids were preserved using the methods of Brown (1952).

Our collections were from clear streams, but sloughs and small lakes were often turbid because of winds. Collections were in depths of 0.6 m or less. We examined submerged and semi-submerged roots, rock, stones, rubble, sticks, logs, and stumps in shallow water. In this paper nomenclature follows Penney and Racek (1968) and Poirrier (1974).

[1]Approved by the Director, North Dakota Agricultural Experiment Station as Journal Article 1230, and partly based on a dissertation by the senior author, approved by the Entomology Department, North Dakota State University.

[2]8047 El Capitan Dr., La Mesa, CA 92041.

[3]Biology Department, University of North Dakota, Grand Forks, ND 58202

[4]Entomology Department, North Dakota State University, Fargo, ND 58205

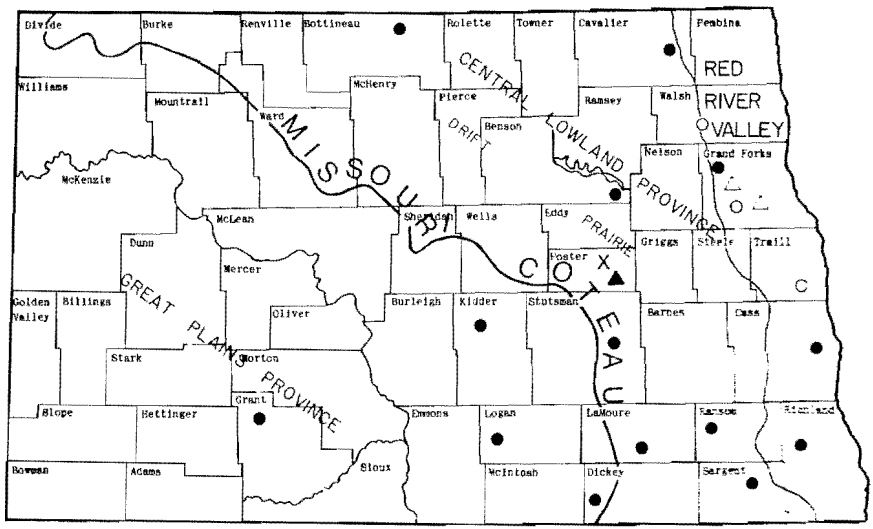

Fig. 1. Distribution of Sponges and Spongilla-flies in North Dakota

Sponges

X = Ephydatia fluviatilis

○ = Eunapius fragilis

● = Sponges unidentified - No gemmules

Spongilla-flies

△ = Climacia areolaris

▲ = Sisyra vicaria

Specimens of *Climacia areolaris* collected by George and Jeannette Wheeler, R. E. Jacobsen, and J. K. Neel were examined from the Invertebrate Collection of the University of North Dakota Biology Department. Field specimens of sponges and sisyrids of J. K. Neel were deposited in the above collection. Sisyrids collected by the senior author were deposited in the North Dakota State Insect Reference Collection at North Dakota State University.

RESULTS AND DISCUSSION

Gemmules were not found until after late July or early August of 1968, 1970, and 1971, presumably because of delayed maturation caused by low water temperatures, decreasing amounts of precipitation, or reduced water volume (droughts occurred in summers of 1969–1971). Not all sponges with gemmules were attacked by sisyrids: *Eunapius fragilis* was unparasitized in the Forest and Elm rivers. We do not know if the sisyrids we collected were attacked by hyperparasitic wasps since we observed none of the susceptible, non-aquatic, sisyrid stadia. In many instances sponges had no gemmules and were unparasitized by sisyrids. The appearance of gemmules and mature sponges does not always imply sisyrid presence. White (1976) found many mature sponges with gemmules, but few sisyrids were present.

Information on sisyrid environmental tolerances is limited to short comments by a few workers: Roback (1974), Matteson and Jacobi (1980), and Davis (1980). We noted that water quality of Red River Valley streams (Cvancara 1966, Cvancara and Harrison 1965, and Cvancara et al. 1972, U.S. Geol. Survey 1971b) is similar to sisyrid tolerances described in the above papers. We conclude from our data that sisyrids tolerate the alkaline and mineralized waters of Red River Valley. Our data exceed the high range of

https://scholar.valpo.edu/tgle/vol16/iss4/13
DOI: 10.22543/0090-0222.1482

tolerance of *Eunapius fragilis* (Table 1) for alkalinity, hardness, phosphate, and ammonia nitrogen; other values in Table 1 are similar to ours, except Forest River sponges tolerated slightly colder water. We also found sponges (species unknown) surviving higher levels of phosphate (Table 1) than any sponge in a summary by Harrison (1974).

Counties with sponges having no gemmules or immature gemmules in early summer of 1968, 1970, and 1971 are shown in Figure 1. *Eunapius fragilis* will probably be discovered in most of these counties considering its cosmopolitan dispersal in North America (Old 1931, Penney and Racek 1968). *Eunapius fragilis* occurs in South Dakota (Vaughn and Brummel 1963), and in many suitable habitats in eastern South Dakota and western Minnesota. These states share a similar climate, topography, and glacial history with North Dakota.

Papers by Parfin and Gurney (1956) and Poirrier and Arceneaux (1972) suggested that *S. vicaria* is not restricted to *Eunapis fragilis*. Poirrier (1974) associated *S. vicaria* with *Ephydatia fluviatilis*. Why in our study these parasites attacked sponges in only a slough near Juanita Lake, North Dakota, and why only *Ephydatia fluviatilis*, is unknown.

Sponges collected in the Forest and Elm rivers were from riffle areas that normally had fast or moderately fast discharge, but sisyrids were never collected from sponges in fast water unless the river was at low stage. Each branch of the Forest River had at least one record of sponges. Flooding during ice melt probably well distributed gemmules which accounts for the sudden appearance of sponges in the Forest River and English Coulee in spring. *Eunapius fragilis* was found on one headwater branch of the Forest River and probably is widely distributed in its watershed but it may not be the only species present for three reasons: (1) most samples of our stream sponges were not identified; (2) *Eunapius fragilis* is commonly in the same stream with other species of sponges (Pennak 1978); and (3) *Spongilla lacustris* L. has been found in a midwestern riffle stream (Matteson and Jacobi 1980) and is known to occur in nearby waters of the Red River Valley in Minnesota (Rollins 1973) and South Dakota (Vaughn and Brummel 1963). Sponges were collected from the headwaters of the Middle Branch of the Forest River in May although peak discharge was in April 1971 when the U.S. Geological Survey (1971a) gage near Fordville recorded 64.8 m^3/s and ice masses scoured the stream bottom. During sponge collections the Forest River had moderate alkalinity, calcium and magnesium hardness, and hyrdogen ion values, but variable to high nutrient concentrations. In late fall

Table 1. A comparison of water quality of *Eunapius fragilis* habitat in the Forest River, North Dakota, with field studies summarized by Harrison (1974). Data are presented in mg/liter unless otherwise indicated.

Physicochemical conditions	South Branch Forest River	Other Rivers Harrison (1974)
Hydrogen Ion	7.0–8.4	4.2–9.2
Alkalinity		
methyl orange	166–346	14.7–230
phenylpthalein	0–6	0
Total hardness	170–310	8–200
Calcium hardness	150–220	0–30
Magnesium hardness	60–120	4.3–10.5
Oxygen	5.2–9.0	2.5–10.7
Oxygen percent concentration	50–94	data not given
Phosphate	0.00–2.92[a]	0.01–0.1
Ammonia nitrogen	0.0–0.5	0.001–0.169
Temperature in °C	3.0–29.9	11–34

[a]Orthophosphate. Highest level of phosphate (orthophosphate) was on Middle Branch of Forest River at site with unidentified sponges 6.49 mg/liter on 17 October 1970 (Stoaks 1975).

1970 orthophosphate values had greatest peaks with an upper range of 6.49 mg/liter on the Middle Branch (Stoaks 1975). The South Branch had an upper orthophosphate value of 2.92 mg/liter at the same location where *Eunapius fragilis* was collected, but not on the same date when the sponge was collected. Cvancara et al. (1972) reported orthophosphate values ranging from 0.11 to 0.95 mg/liter in the Forest River, but had few water analyses and no sponge collections.

Considering biological, developmental, and ecological factors essential for sisyrid colonization, their absence in Forest River sponges is not unusual. The mechanical action of the rushing water in riffles of Red River Valley streams and rivers hindered sisyrid development except in backwaters or during low stage in late summer and fall.

An analysis of our data indicates that *C. areolaris* larvae can be collected as early as mid-May (Table 2) and as late as mid-October, which suggests several broods per year in spite of long and severe winters and extensive droughts which characterize the study area.

Matteson and Jacobi (1980) reported sisyrids in a shallow Wisconsin stream, while our data and intensive field studies of sisyrids by others have involved lakes, reservoirs, sloughs, and streams at low discharge (Brown 1952, Isom 1968, Poirrier 1969, Poirrier and Arceneaux 1972, White 1976), all standing or slow water environments. Headwater riffle streams feeding the Red River of the North provide an unstable environment for sisyrid colonization and survival except at low discharge and during non-winter months. During ice and snow melting, Red River Valley streams scour the substrate and enormously increase in discharge and turbidity. Stream pools and backwaters are compatible with the sisyrid life cycle, but lakes, reservoirs, and sloughs in eastern North Dakota are more inviting habitats for sisyrids than streams because they are not subject to extreme and sudden changes in discharge, scouring, and turbidity.

Table 2. Records of North Dakota and Minnesota sponges and sisyrids.

Location Date & Collector	Type of Record	Species	
		Sponge	Sisyrid
English Coulee at Fox Bridge, Grand Forks, Grand Forks Co., ND, 15 May 1957, G. & J. Wheeler	State		*Climacia areolaris*
Middle River, Old Mill State Park, Marshall Co., MN, 4 Aug 1967, J.K. Neel	County		*Climacia areolaris*
Slough 1.9 km E. Grace City, Foster Co., ND, 31 July 1968, R. D. Stoaks	State		*Sisyra vicaria*
	State	*Ephydatia fluviatilis*	
Forest River, S. Branch, 5.8 km S of Fordville Walsh Co., ND, 11 July 1971, R. D. Stoaks	County	*Eunapius fragilis*	
Elm River 1.9 km NW Grandin, Traill Co., ND 16 Aug. 1968, R. D. Stoaks	State	*Eunapius fragilis*	

https://scholar.valpo.edu/tgle/vol16/iss4/13
DOI: 10.22543/0090-0222.1482

ACKNOWLEDGMENTS

We thank Dr. Michael Poirrier, Department of Biological Sciences, University of New Orleans, and Dr. Edward Balsbaugh, Jr., Entomology Department, North Dakota State University, for reviewing the manuscript. We thank Dr. Harley Brown, Zoology Department and Stovall Museum, University of Oklahoma, for his manuscript comments and sisyrid identifications; and Dr. Williard Hartman, Peabody Museum, Yale University for sponge identifications.

LITERATURE CITED

Brown, H. P. 1952. The life history of *Climacia areolaris* (Hagen), a neuropterous parasite of fresh-water sponges. Amer. Midl. Natur. 47:130–160.

Cvancara, A. M. 1966. Mussels of the Red River Valley in North Dakota and Minnesota and their use in deciphering drainage history. p. 186–196. *in* W. J. Mayer-Oakes (ed.). Life, land and water. Proc. 1966 Confer. on Environ. Studies of the Glacial Lake Agassiz Region. Univ. Manitoba Press. Winnipeg.

Cvancara, A. M. and S. S. Harrison, 1965. Distribution and ecology of mussels in the Turtle River, North Dakota. Proc. North Dakota Acad. Sci. 19:128–146.

Cvancara, A. M., J. M. Erickson, and J. J. Delimata, 1972. Present and past mollusks of the Forest River, North Dakota. Proc. North Dakota Acad. Sci 25:55–65.

Davis, J. 1980. Species composition and diversity of benthic invertebrate populations in the Pecos River, Texas. Southwestern Assoc. Natur. 25:241–256.

Fenneman, N. M. 1938. Physiography of eastern United States. McGraw Hill, N.Y.

Harrison, R. W. 1974. Sponges p. 29–66. *in* C. W. Hart, Jr. and S. L. Fuller. Pollution ecology of freshwater invertebrates. Academic Press. N.Y.

Isom, B. 1968. New distribution records for aquatic neuropterans. Sisyridae (Spongilla-flies) in the Tennessee River drainage. J. Tennessee Acad. Sci. 43–100.

Jewell, M. 1959. Porifera. *in* W. T. Edmundson (ed.). Fresh water biology. John Wiley and Sons, N.Y.

Matteson, J. D. and G. Z. Jacobi. 1980. Benthic macroinvertebrates found on the freshwater sponge *Spongilla lacustris*. Great Lakes Entomol. 13:169–172.

Old, M. 1931. Taxonomy and the distribution of the fresh-water sponges (Spongillidae) of Michigan. Papers Michigan Acad. Sci. Arts & Letters. 15:439–477.

Parfin. S. I. and A. A. Gurney. 1956. The spongilla-flies with special reference to those of the western hemisphere (Sisyridae: Neuroptera) Proc. of U.S. Nat. Mus. 3360:421–529.

Pennak, R. W. 1978. Fresh-water invertebrates of the United States. 2nd ed. John Wiley and Sons, N.Y.

Penney, J. T. and A. A. Racek. 1968. Comprehensive revision of a worldwide collection of freshwater sponges (Porifera: Spongillidae). U.S. Nat. Mus. Bull. 272. Smithsonian Inst. Press. Washington D.C.

Poirrier, M. A. 1969. Some fresh-water sponge hosts of Louisiana and Texas spongilla-flies, with new locality records. Amer. Midl. Natur. 81:573–575.

_____. 1974. Ecomorphic variation in gemmoscleres of *Ephydatia fluviatilis* Linnaeus (Porifera: Spongillidae) with comments on its systematics and ecology. Hydrobiology 44:337–347.

Poirrier, M. A. and Y. M. Arceneaux. 1972. Studies on southern Sisyridae (Spongilla-flies) with a key to the third instar larvae and additional sponge-host records. Amer. Midl. Natur. 88:455–458.

Roback, S. 1974. Insects, Neuroptera. p. 336–337. *in* C. W. Hart, Jr. and S. L. Fuller. Pollution ecology of freshwater invertebrates. Academic Press. N.Y.

Rollins, L. A. 1973. Poriferan fauna of a Minnesota pond. J. Minnesota Acad. Sci. 38:83–85.

Stoaks, R. D. 1975. Seasonal and spatial distribution of riffle dwelling aquatic insects in the Forest River, North Dakota. Ph.D. dissert. North Dakota State Univ., Fargo.
U.S. Geological Survey. 1971a. Water resources data for North Dakota. Part 1. Surface Water Records. U.S. Govt. Print. Office. Washington, D.C.
_____. 1971b. Water resources data for North Dakota. Part 2. Water quality records. U.S. Govt. Print. Office Washington, D.C.
Vaughn, C. M. and C. N. Brummel. 1963. The Spongillidae and Bryozoa of eastern South Dakota. South Dakota Acad. Sci. 42:103–107.
White, D. S. 1976. *Climacia areolaris* (Neuroptera: Sisyridae) in Lake Texoma, Texas, Oklahoma, Entomol. News. 87:287–291.

https://scholar.valpo.edu/tgle/vol16/iss4/13
DOI: 10.22543/0090-0222.1482