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Report for the summer of 1947

The Biology of the Myriapoda of the Douglas Lake Region.

Bert M. Johnson

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General

FIELD TRIPS: A total of 19 field trips (recorded) were made (see F.R. 1 to 19, H.C. 1 to 19) with a half a dozen unrecorded exploratory trips of a spontaneous nature.

The purpose of the field trips was primarily to determine the associations and strata ecologic relationships within the larger habitatic groups (Pearse: Heterohabitum) of terrestrial animals on moist ground associations, animals of rock crevices, animals of the forest (floor) with special reference to all those associated with the myriapoda.

Localities visited:

Grape Vine Point	(1)	Aspen* (2) Hardwoods**
Nigger Creek Area	(1)	Conifers
Vincent Lake Area	(1)	Aspens*
Fairy Island	(1)	Conifer**
Riggsville Corner	(1)	Hardwoods***
Ocqueoc River Area	(1)	Shrubs along roadside**
Ocqueoc Falls	(1)	Conifer-Vaccinia
Ocqueoc Lake	(1)	Aspen*
	(2)	Lake Shore
	(3)	Conifer- Vaccinia
Primo Farm	(1)	Deserted farm buildings****
Colonial Point	(1)	Hardwoods (old)***
Carp Lake Area	(1)	Aspen-Birch
Cecil Bay Area	(1)	Conifer-Vaccinia
Mill Creek Area	(1)	Margin of creek bed*
	(2)	Limestone out-crop talus*
	(3)	Conifer (Balsam)**

Unrecorded "exploratory"trips:

The Gorge*
Sedge Point (Douglas Lake) Area
Roadside fields (Pellston road)
Douglas Lake Beach (Grape Vine Point)
Straits (Mackinac) Beach

*------ few specimens collected
** many " "
*** specimens common
**** specimens abundant, excellent collecting

Techniques and Methods

All the myriapoda collected were kept alive for rearing purposes. The object of these collections was to determine one or two dominant forms of the area that were not only accessible but adaptable to laboratory conditions. In other words, that species that was collected most frequently received the greatest attention.

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No serious attempt was made to obtain as many kinds of myriapoda as possible until it has been ascertained what particular environment affords the greatest possibilities for the growth and reproduction of this group.

The mryiapods were captured by hand and it took considerable training of eye and hand to catch the swift moving centipede when removing its cover. All specimens, when captured, were placed in individual shell vials which were numbered and stoppered with #4 rubber corks (bored) and narrow mesh cheese cloth to prevent the captured animal from escaping through the bore hole in the cork. The purpose of the hole was to provide sufficient aeriation and to prevent overheating of the vial. Centipedes collected in bakelite capped vials quickly die and frequently do not survive a half-day collecting trip.

Centipedes, due to their carnivorous eating habits, were always isolated, but millipedes, frequently found in small groups, or copulating, were place in the same vial with no ill effects.

Upon returning to the laboratory, the specimen or specimens were placed in previously moistened plaster cups with the field record number marked on the glass lid, and the animals were permitted to adjust themselves to the environment of the plaster cup. Later the animals were anesthetized with an ether swab dropped into the plaster cup, and when completely relaxed, the sex of each animal was recorded, its body length and width, number of prosternal teeth, coxal pores, and ventral spines of the first, penultimate and ultimate appendages. All missing parts (antennae, appendages, etc) were carefully noted for purposes of observations on regeneration. Most of the animals were classified to genera and a few to species. However, many of the identifications were hurried and not absolute since the effects of the ether wears off quickly. Re-etherizing frequently kills a specimen. Since the purpose of the collections was to keep the animal alive for observation, final identification of all collected specimens have been deferred until a later date. As a consequence no identification list or census report will accompany this summary.

All males and female of the approximate same size and of the same species were placed together in the same plaster cup primarily to encourage mating and copulatory behavior patterns. This applied to both centipedes and millipedes. Copulating activites of the Polydesmus were observed and will be found under a special section of this report; none of the many pairs of centipedes, placed together for mating, were observed in any copulatory activity or displayed any type of behavior that may be attributed to a sexual behavior pattern.

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Hardwood Habitat:
Dominant type of trees: Acer, Quercus, Ulmus and Tilia.
Forest floor: Little or no vegetation; a varying thick mat of fallen, decaying leaves; usually an abundance of fallen timber. Drainage good, but many gullies, hollows and swells present. Heavily shaded, protected, generally moist. Soil: loam with organic matter.
Type forest: Riggsville Corner; Colonial Point

( ) The fallen timber, which may be in any state of decay offers the best collecting site for myriapoda. Timber that is still sound (freshly cut) with the phloem still intact with the xylem, generally does not offer a collecting site within the log, but by carefully rolling the log to reveal (1) the most underside of the log and (2) the moist area where the log was in contact with the soil or leaf mold, one may find a number of different species of centipede and an occasional millipede.

( ) Fallen timber, in that state of decay in which the bark is free from the heartwood and much of the timber has been invaded by wood inhabiting insects, seems to be the most favorable site for collecting not only the greatest variety of myriapoda but also the greatest number. By carefully stripping small sections of the bark away from the wood, centipedes and millipedes will be exposed on all sides of the log preferably the top and the bottom. At Colonial Point the top of the log was the most favorable spot for capturing Lithobius multidentatus. Similarily the same site is utilized by Spirobolus marginatus for feeding, depositing their fecal-egg pellets and for ecdysing sites. On July 31st, twenty-six mature Spirobolus marginatus were found coild in the debris between the bark and heartwood of fallen maples in little circular excavations where they were undergoing ecdysis simultaneously. A photograph was taken of this aspect of mass ecdysis.

( ) Fallen timber, which has reached a state of advanced decay, that is, the bark has flaked off, the xylem is soggy, loose, cracked and easily broken apart by the hands, offers a habitat for many of the smaller species of Lithobius, especially numbers of immature individuals of this genera, and certain kinds of millipedes, such as Parajulus. Fallen timber which is so decayed that it is penetrated by small plants and has become almost a paart of the soil, offers an occasional small form of centipede and a few millipedes: Brachydesmus.

( ) During the day, few centipedes were collected in the leaf mold away from the vicinity of fallen timber, but infrequently immature centipedes were observed. This site is ideal, however, for many Parajulus, and Polydesmus and immature Spirobulus. The leaf mold of the gullies and hollows offered no more in myriapod fauna than did the slopes and areas of good drainage this year.

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The Aspen-Birch habitat:

Dominant type of trees: Populus, Betula, Robinia.

Forest floor: Varies from areas of little vegetation and much leaf mold, to areas covered with Pteris aquilina and little leaf mold; abundant fallen timber; some shade but area is generally brighter than a hardwood forest; soil is generally sandy, not too moist; the forest floor is generally dry and warm on the surface and only in areas where there is a considerable amount of shade and a thick deposition of leaf mold is moisture retained.

Type of forest: Vincent Lake Area; Ocqueoc Lake Area

(1) The fallen timber that is firm with the ploem in contact with the firm heartwood offers little for the collector except that immediate area where the log is in contact with the soil or leaf mold when the log is overturned. Spirobulus may be found burrowed here, and, infrequently, Polydesmus .

(2) Timber in which the wood has softened and decayed, leaving the bark as a protective rind around this moist ecological miche presents the best site for collecting Spirobulus, Spirobulus eggs, Brachydesmus, Polydesmus and Parajulus only, however, when the log is moist and cool. Geophilus were found in such timber that was much less moist

(3) Completely decomposed timber are a favored site for Polydesmus and Parajulus, especially old stumps that penetrate below the surface of the soil and thereby retain a considerable amount of moisture.

(4) The leaf mold of such a forest does not offer many myriapod forms. Rarely are myriapods found in areas covered by Pteris Aquilina and leaf mold unless there are small pieces of fallen timber near by from which the myriapods had undoubtedly wandered.

(5) The numbers and kinds of myriapoda found in environments described above are greatly reduced when compared with the number found in a hardwood area of equal size.

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The Coniferous forest habitat:

Dominant trees: Pinus, Thuja, Tsuga, Abies.

Forest floor: Covered with the brown, not-too-readily decomposed conifer needles; much fallen timber; good drainage; soil "sterile" and sandy. Heavily shaded when trees are thick. In the flat open areas the ground cover between the trees may consists of Vaccinia, Myrica and Pyrola in varying abundance.

Type of forest: Ocqueoc Lake; Mill Creek Area

(1) Such a forest floor as described above usually does not offer any favorable collecting sites, generally speaking, especially in those areas where the trees are far apart, the soil is sandy and dry, and Vaccinia and Pyrola are the dominant vegetation, not a single myriapod was collected.

(2) But, in a small conifer clump on Fairy Island where a few scattered piece of birch were lying on the needles, several excellent collecting sites were found for Geophilus rubens and a few Lithobius.

(3) The thick confier patch near Mill Creek, between Highway 23 and the Straits, presented afavorable site for a number of large Lithobius forficatus which were congregated under a small piece of conffer timber. The soil was dry to excellent drainage and the forest floor needles were dry except for the immediate vicinity under the timber.

(4) One should not be too nasty to exclude the conifer area as a collecting spot for centipedes.

(5) No millipedes were found in such areas.

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Natural history notes on Lithobius forficatus Linnaeus

One of the largest and most dominant form of centipede in the Douglas Lake Area is undoubtedly Lithobius forficatus. It exceeds Lithobius multidentatus in abundance. From specimens (living) identified as this species, body length ranges from 14mm to 29mm with an average of 22.5 mm. A type specimen of the area will not be described at this time until a greater number have been collected.

Habitat preference: The species definitely prefers the hardwoods; specifically, the fallen timber which not only supplies the moist habitat demanded by the animal but the host of wood inhabiting insect fauna as well, upon which, the species undoubtedly feeds. Most of the specimens collected were found under fallen timber, or, if the timber were well decayed and split, in the various strata and crevices and generally the sites preferred by isopods such as Cylisticus and Porcellio. The species also invade deserted farm buildings where they can be found under planking, shingles, and farm yard debris.

Reproduction: No sexual activity or behavior patterns have been observed on couples placed in plaster cups.

Behavior: Although it is of the general opinion that centipedes are not gregarious due to the fact that they are carnivorous and will attack each other, a favorable locality will uncover five or six specimens all within the same small area (five-six inches square). In the laboratory, specimens attack one another when first placed into the plaster rearing cups. The animals are extremely excited when first placed into the cups and run madly around and around the cup, antennae waving frantically and malapedes working madly. However, the animals quickly adjust themselves to the environment of the plaster cup and the attacks diminish unless one of the specimens is wounded or weakened. Once adjusted, the animals seem to tolerate one another, resting side by side in the darkest area of the cup or across one another peacefully.

It was observed that when two males, or a male and a female, or two females were placed together in the same thunder mug, and one of the pair ecdysised, that specimen would be attacked continually, and generally would be found consumed except for the exoskeleton by his cell mate. Evidently the animal can defend himself against his kind until ecdysis, at which time the animal is extremely vulnerable. It would seem wise, then, to only mate couples until one or the other undergoes an ecdysic period, and then remove the vulnerable party if one desires to keep it alive and healthy.

When attacking a fellow centipede, or capturing a large fly, spider or Drosophila, the attack is made with such rapidity that it almost escapes the eye. Generally the aim of the centipede is for that area immediately behind the head, which is first seized firmly by the pincer movements of the malapedes. Once captured, the victim is carried a short distance (in the plaster cup) with rather savage movement of the head and antennae. The victim does not die immediately but may struggle for five to eight minutes while the centipede feeds.

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Feeding habits: The centipede feeds immediately upon capture. The larger of the two maxillae explores the area of the surface fed upon. Chewing movements are augmented by ovbious movements of the head forward and back without any movement of body segments. The antennae are thrust straight forward in a slight arch with no exploratory gesticulations.

Ecdysis: There has been no clue to anticipate the ecdysic period of a centipede to date.

A specimen that has recently undergone ecdysis can easily be differentiated from one that has not, for the new exoskeleton has a decided purple cast to it dorsally, a greyish tone, ventrally, while the appendages appear a delicate creamy white. Gradually the dark brown and amber color of the body and appendages are regained.

A description of an old exoskeleton recently shed (from speciment 73rg47) is as follows: The exoskeleton was found in two parts, the head separated from the body. The right antennae of the head was missing; the ventral aspect of the exoskeleton was in perfect condition with malapedes, maxillae positions unchanged. Dorsally, there is an oval opening, formed by the pushing upward and outward of the dorsal cephalic plate (tergite) which is hinged anteriorily. The body exoskeleton is completely intact but the anterior segments are pushed together like the pleatsof an accordian, all but the last four segments. Each segment can be determined.

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Natural history notes on Polydesmus sp.

Probably the millipede that rivals Spirobulus marginatus in coloration is the prevalent, not-too-conspicuous, easily captured Polydesmus of the Douglas Lake region. One particular species, quite prevalent, is not described by Williams & Hefner. It has not been completely classified.

Feeding habits: The animal is herbivorous and feeds on the decaying, moist heartwood of Populus, Betula and leaf mold. It demands a great deal of food and when supplied with suitable food, it eats voraciously depositing quantities of small fecal pellets the color of the food consumed. The fecal pellets do not contain eggs.

Unfortunately the animal does not respond readily to laboratory conditions in the same manner as Lithobius forficatus; the mortality rate is extremely high. Fingerbowls were discovered to be much more suitable for the demands of the animal, but speimens still die off periodicaly although there is sufficient food and moisture present.

There are no head movements while feeding, the head is simply pressed against the food material and the jaws wear away the cellulose.

Reproduction: The copulatory activity of Polydesmus sp. was observed in several instances in the field and in the plaster cups and finger bowls within the laboratory.

The ventral parts of the male and female are in juxtaposition the entire length of the two animals. The male is the superior member during the period of copulation, and carries the female, who is subordinate and passive, ventrally by means of its paired 8, 9th and 10th appendages, frequently bringing into play the 7th pair also. These appendages almost meet one another on the dorsum of the female; they do not move or change position during the copulatory period but remained fixed as if following the dictates of an instinct pattern.

The female's head is about six appendages behind the male's, and it is bent back slightly in a delicate arch. When undisturbed, there is no body or appendicular movement of either sex, but when disturbed, the male becomes extremely excited, moving his antennae and appendages which causes a corresponding response in his mate. Frequently the male carries the female toan ther site. They rarely separate unless extremely disturbed by intense light, handling, or by the gently prying of a teasing needle.

Due to the fact that the two bodies are so close together, that the male's grasping appendages interfere with a good view, that the two copulating individuals will not remain in a laterally exposed position for any length of time, and that pressure interferes with their copulatory activities and the separate, it has been impossible to exactly determine in what manner the heavily spined male gonopods grasp the genital area of the female.

Upon separating the female from the male, the gonopods of the male appear quite normal with the exception that they may extrude beyond their normal position for a short time, but it is in the genital area of the female that bear striking changes of unusual

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interest. Examining the female (8DL47) under the binocular microscope, in the region of the gonopore, two very conspicuous (they can be seen with the naked eye), yellow, waxy swellings with whitish caps were observed. They were "slipper" shaped and seem to originate from within the gonopore and were about as long as the width of the third segment. The lobes could be moved slightly by means of a teasing needle but they could not be dislocated from the orifice of the gonopore. A scume of waxy material appeared on the surface of these two swellings.

These swellings were thought, at first, to be a form of jell related to the transfer of spermatozoa from the male to the female (?) and perhaps produced by the female, however on observing another copulating pair (83Rg47 and 84Rg47) after separation, the female revealed that what was formerly mistaken for hard jelly swellings around the gonopore were actually extruding gonadal "appendages" from within the gonopore. These gonadal appendages were hirsute and the proximal ends in juxtaposition and somewhat translucent within the gonopore. These gonadal appendages are evidently retracted within the gonopore of the female sometime after copulation. The same characteristic jell was also observed smeared at the base of the male gonopods and also around the vicinity of the gonopore of the female. Perhaps the hirsute condition of the female gonadal appendages might be instrumental in retaining the copulatory jell. Sketches have been made of the female gonadal appendages.

Egg-nests: A fingerbowl supplied with decaying populus heartwood, leaf mold and organic humus, induced on two ocassions, two different females to prepare egg nests in the leaf mold. The nest, which was roughly speroidal and almost a centimeter in diameter, was composed of a brownish, organic material which was either deficated or masticated by the female (?) and formed into a tough, protective pavement. The nest was hollow and completely lined with small (three eggs side by side measured 1 mm.), milky-white eggs, approximately 175 in number. The eggs were not perfect spheres but slightly flattened and the membranes of many were wrinkled into peculiar patterns. All were covered with minute droplets of water. A few of the eggs were almost transparent (unfertilized?) but there numbers were very small when comparted with the entire clutch (about 10 out of the 175). However, scattered throughout the eggs were many spindle shaped bodies which proved to be shriveled membranes of eggs that had somehow lost their yolk contents. This was proven by gently pricking a few eggs and watching the contents drain out and the tough membrane assuming the spindle shape. The eggs were deposited near one another, occupying all the available area of the egg-nest pavement. There was no evidence of a retaining jelly-like matrix, but undoubtedly the eggs were cemented to the pavement by some product.

Unfortunately the proper technique for maintaining the nests to produce offspring from these nests have not been developed; the eggs whithered and dried (although every attempt was made to maintain the humidity of the fingerbowl at a constant level) and the females also died.

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Spirobulus marginatus:

Still in progress is a study of the egg development of Spirobulus marginatus within the fecal ball. A series of sketches of the development are planned in anticipation of a morphological comparison with that of Polydesmus in the future.

Fauna of Hardwood forest
Hyla crucifer
Hyla versicolor
Plethodont cinereis
Tenebrionidae
Formicidae
Collembola
Mycetophilidae (larve)
Elateridae (larvae)
Lycosidae
Attidae
Cylisticus
Porcellio
Polygyra alba.
Polygyra thyroidus
Polygyra fraterna
Polygyra monodont
Anquispira alternata
Retinella
Succinea
Strobilops
Philomycus carolineianus
Deroceras
Pallifera
Hemidrilus
Phalangidae

Aspen-Birch
Plethodont cin.
Formicidae
Elateridae
Scarabeidae
Acarina
Hymenoptera
Tabanidae
Collembola
Polygyra alba.
Polygyra thyroidus
Succinia
Anquispira alt.
Retinella
Philomycus carol.
Isopoda
Earthworms

Conifers
Formicidae
Elateridae
Succinea
Anquispira
Isopoda
Earthworms
Phalangidae