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MICRO-ARTHROPODS FROM TWO QUEBEC HUMUS FORMS

Marshall

STUDIES ON THE MICRO-ARTHROPOD FAUNA OF TWO QUEBEC WOODLAND HUMUS FORMS

by

Valin George Marshall, M.Sc.

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Department of Entomology,
Macdonald College of McGill University,
Montreal.

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"How many people, in passing through the forest, have any idea of the life teeming under their very feet, every plot of ground that they tread upon being alive with an immense number of small animals. It constitutes a world of its own, unobserved by our eyes. We see the roedeer and the hare; sometimes, especially towards dusk, we encounter the fox and the badger; we enjoy the singing of birds and watch with pleasure their activities; admire the birds of prey soaring majestically above our heads; observe the little squirrel as it nimbly skips from tree to tree. On closer observation we shall also catch sight of a timid little mouse, a frog hopping off and vanishing like a brown shadow, a little snail or a beetle crossing the forest path or crawling up a stem; and the butterflies, fluttering among the trees, are well known to us. But the abundance of life beneath our feet, we shall discover only by lying down and looking closely among the leaves, herbs, and grass. Then, descending to animals of a class far smaller in size, we shall be fairly taken aback by the profusion of animals disclosing themselves to our view. If we pick up a little bunch of leaves or a tuft of moss, we shall see a great number of animals, crawling and leaping out, so small that it is impossible for us to follow them with our eyes."

Bornebusch (1930:2).

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I. INTRODUCTION

Soil is defined in a number of ways (Muller, 1960). It is regarded as the biochemically weathered portion of the regolith (Lyon *et al.*, 1952:3) and as possessing, among other properties, certain "biological characteristics" (Joffe, 1936:37; Handley, 1954:1). From a zoological point of view Drift's (1951:6) definition of soil is adequate. Soil is the "mineral substrate in which the vegetation takes root, including the dead organic material, which is found in and upon the mineral substrate."

Although it is recognized that soil is teeming with life, it is only relatively recently that much attention has been paid to the biological aspect of the soil. Hallsworth (1955) observed that although the chemical and physical properties of the soil have been studied for over one hundred years, soil survey reports and other accounts of pedological investigations have, for the most part, neglected populations of animals in the soil.

The problems relative to the study of the soil fauna are complex, requiring at the very outset, not only familiarity with the soil itself but also some knowledge of the many diverse groups of animals encountered. The aid of specialists for the difficult task of identifying the animals normally found in the soil, also, is almost indispensable (Alvarado and Selga, 1962).

As a result, it is often difficult to undertake an ecological study without becoming involved in taxonomy (Evans, 1955; Macfadyen, 1963:3). This is particularly true in the study of the soil organisms. Evans (1951) had to spend a great deal of time on systematics while investigating the fauna of some British soils even though the British fauna, in general, is one of the most completely known. Wallwork (1959:557) considers that the lack of taxonomic descriptions of even the common soil mites is greatly hampering the work of the soil zoologist. Kühnelt (1963:117) observes that "even a Berlese sample of temperate forest soil may contain such an embarrassing number of arthropod species that adequate identification seems almost hopeless." This is particularly true in North America where the taxonomy of many groups has been unworked for over 40 years (Engelmann, 1961:222) and has been abundantly demonstrated by the present investigation.

The lack of adequate information on the taxonomy of the soil fauna is of more than zoological importance as soil animals play an important part in the development of soils (Romell, 1935; Kubiëna, 1955; Rhee, 1963; Langmaid, 1964).

With respect to the arthropods occurring in the soil mites followed by collembola are the most numerous and widespread. Murphy (1953:171) points out that they occur in "practically all situations where vegetation is growing, where they will be found living amongst the decaying material provided by plants."

It is generally recognized that the decay of organic matter, humification and mineralization, is due, for the most part, to fungi and bacteria (Meyer and Maldague, 1957; Nef, 1957). However, it would seem that the arthropods, by their fragmentation and mixing, perform a vital function in the preparation of organic material before the micro-organisms can operate to their fullest advantage (cf. Witkamp and Drift, 1961; Edwards and Heath, 1963; Sharma, 1964; Gasdorf and Goodnight, 1963). Murphy (op. cit.:181) puts it thus: "Frequently low bacterial populations of forest sites points to the need of investigations of the role of these organisms [the soil fauna] as a link in the biochemical chain whereby organic material is broken down and its constituents released for reutilization."

P. E. Müller, in a number of papers at the latter part of the last century, pointed out to foresters the very different humus formations, mull and mor, which he believed were biological and not merely physico-chemical systems and that the fauna present therein was an important tool in their formation. According to Kubiëna (1953: 42), in cultivated soils, the clay-organic complex characteristic of mull soils provides a lasting quantity of humus, while in other forms it is more readily used up. As a long term consideration mull is a more satisfactory soil type biologically, since it allows optimum rates of turnover of nutrients (Handley, 1954:94). Therefore, an attempt should be made to intensify the formation of mull by all possible methods. Such a goal can without doubt be accelerated by the study of soil animals.

Handley (op. cit.:2) suggested that, "since the soil types described by P. E. Müller can be differentiated biologically, the processes going on in them are likely to be fundamentally different, and as these soils can also be differentiated morphologically and thereby recognized in the field, these contrasting soil types form a logical starting point for investigations."

It was against this background that the present investigation in soil zoology was initiated in 1960 at Macdonald College, McGill University. The work was carried out with three main objectives: firstly, to obtain information concerning the composition of the fauna in mull and mor of local woodland soils; secondly, to compare the fauna in these habitats in order to determine their similarities and differences and thus to discover what relationships, if any exist between fauna and habitat; and, thirdly, to establish a nucleus collection of soil arthropods that might serve as a reference for future research.

Part of the results have already been reported (Marshall, 1963; Marshall, 1964; Marshall and Kevan, _in press_). The project herein discussed is concerned with the arthropod fauna, in a general way, and with particular reference to the Oribatei and Collembola. Collectively these groups may be regarded as micro-arthropods (Haarløv, 1960:39; Kevan, _in press_).

II. REVIEW OF LITERATURE

A. GENERAL

In recent years there has been a gradually increasing awareness of the importance of animals in the soil and of the fruitful field which they present for zoological research in its own right (Kevan, 1962:xi). Yet it was only in 1955 that the first international gathering concerned itself with the zoological aspect of the soil. Russell (1962:ix) attributes this mainly to the fact that, in the past, writers on soil knew little about the animals, and conversely zoologists knew little about the soil.

However, as far back as 1789 Gilbert White seemed to have realized the importance of certain animals in the maintenance of soil fertility (Bornebusch, 1930:6,87; Kevan, 1962:1). Thereafter, work in soil zoology continued in a disjointed manner until quite recently.

Darwin (1840) published his famous introductory work, which discussed the way in which he believed vegetable mould was formed through the action of earthworms. This was followed by a comprehensive account (Darwin, 1881) on "The formation of vegetable mould through the actions of earthworms with observations on their habitat." About that time, also, Müller (1879-1889) drew attention to the differences of the fauna in mull and mor soils.

In 1905, Berlese, the "father of modern Acarology," published the description of an apparatus now called the Berlese funnel, which was able to separate arthropods from soil and other such materials. This was probably the first method of obtaining large numbers of live arthropods from the soil with relative ease. The original Berlese funnel has since been modified (Tullgren, 1918; Haarløv, 1947, 1955), or in some cases completely revolutionized (see Macfadyen, 1955; Kevan, 1962; Murphy, 1962). Despite the limitations of this apparatus, Berlese had, nevertheless, evolved a suitable extracting method which is a basic requirement in the study of soil arthropods.

Early workers such as Diem (1903) stimulated interest in the subject of the soil fauna, so that further investigations eventually led to an extensive literature of comprehensive papers, books and symposia, too numerous to be dealt with here in any detail. Most of this work has been done in Europe and this is reflected in a number of books on the subject (see Kevan, 1962, <u>in press</u>; Kühnelt, 1963, for titles). Special attention should be drawn to the works of Bornebusch (1930), Jacot (1940), Forsslund (1945), Fenton (1947), Ghilarov (1949, 1963), Franz (1950), Kühnelt (1950, 1957, 1961, 1963), Drift (1951), Delamare Deboutteville (1951), Murphy (1953, 1962), Eglitis (1954), Kevan (1955, 1961, 1962), Nosek (1957, 1957a), Farb (1959), Schaller (1962), Doeksen and Drift (1963), Christiansen (1964) and Dunger (1964). It is also encouraging to see that more attention is being paid to the soil fauna in general ecological and biological texts such as those of Hartmann (1952), Lawrence (1953), Tischler (1955), Macfadyen (1957, 1962, 1963), and Balogh (1958) as well as books on soil itself, for example, Russell (1957).

A survey of the literature on the zoology of forest soils has already been given by Marshall (1963). The present review will, therefore, be restricted to the major papers which simultaneously deal with mull and mor formation in forest soils with reference to the arthropods; and (2) a brief discussion of the major environmental factors which affect the soil fauna.

The majority of studies on the fauna of forest soils deals directly or indirectly with mull or mor humus forms, and, since such publications are numerous (see papers listed above for titles), a great deal of selection has had to be exercised. The present review of literature thus makes no pretence at completeness.

B. MULL AND MOR WITH REFERENCE TO THE SOIL FAUNA

P. E. Müller was probably the first writer to realize fully the importance of animal life in soil formation. As a result of his studies on beech and oak forests and heaths in Denmark, Müller (1889) concluded that their soils could be separated into two biologically distinct groups which he referred to as mull (in Danish, muld) and torf (now called mor or raw humus). The surface of mull was indicated as being covered by a relatively thin layer of litter, sharply differentiated from the well-decomposed organic matter which was described as being intimately mixed with the mineral substrate below. This friable and loose substrate is rich in animal life especially earthworms. In contrast, the mor is firm and does not give way under foot. When the horizons are exposed the topmost layer is composed of a thick blackish-brown layer of humus - the mor. Below the mor and more or less distinctly demarked from it is a layer of loose sand. Müller observed that the mole as well as its prey, the earthworm, was absent from mor and that it has been considered sterile by entomologists, although there were present some "Crustacea" such as "Oniscen" and "Juliden."

The work of Bornebusch (1930), although much criticized, is nevertheless of great importance. I am in full agreement with Haarløv (1960:12) who states that "his main results are still valid and his work is one of the classics in zoo-ecological literature." Bornebusch clearly demonstrated that mull and mor contained their own characteristic faunas, and that earthworms are especially important in mull formation. He also noted that a mull type soil had fewer but larger animals, while a mor was characterized by smaller animals, which were, however, in greater numbers than in mull. He concluded that arthropods were of the greatest importance in raw humus. He also realized that as a standard for the activity of the fauna, mass was more reliable than numbers and both these were less satisfactory as compared with respiration. He showed that in better developed mull soils earthworms represented 80 per cent of the biomass but only 60 per cent of the respiration; in better developed raw humus they represented 22 per cent of the mass and only 12 per cent of the respiration. These figures, however, may not be very reliable (cf. Macfadyen, 1963a; Engelmann, 1961).

From their study of forest humus layers in New York, Eaton and Chandler (1942) concluded that earthworms and arthropods were the principal agents involved in converting forest litter into humus. They reported that in the mor humus form the fauna was similar, with arthropods predominating, but there was a striking absence of earthworms. These authors showed that arthropods were most active near the surface and declined in numbers in the deeper parts of the soil.

Fenton (1947) wrote an important essay on the soil fauna of two forest soils, mull and mor. He theorized as to the major factors affecting the distribution of the "mesofauna" and ultimately the development of mull and mor soils. He suggested that the palatability of the leaves, which was closely related to calcium content, seems to attract the larger forms, such as worms, insects, millipedes, etc., resulting in a rapid incorporation of the leaf-fall into the soil.

Handley (1954) published a large work on mull and mor formation in relation to forest soils, but only a few brief remarks concerning it can be made here. Of the large number of factors considered to have an influence on soil formation, no single factor was shown to have an overriding influence in determining the differential formation of mull and mor. However, under certain conditions, the species composition of the vegetation, acting through the properties of the vegetation debris, controlled the micro-organisms and the fauna, and determined whether mull or mor was formed. Mull and mor seemed to be differentiated by the following properties:

1. There are apparently greater quantities of cellulose in the organic matter of mor as compared with that of mull.
2. The nitrogen of mor appears to exhibit a greater degree of resistance to mobilization by biological

agencies than the nitrogen of mull.

3. There is a tendency for the production of extremely acid conditions when mor is formed.
4. The soil fauna populations of mull and mor seem to exhibit characteristic differences.
5. The differences between mull and mor appear to concern differences in type or course of decomposition and resynthesis rather than different rates of decomposition of litter.
6. Whatever the mechanisms responsible for the differential formation of mull and mor may be, a particular condition represents a phase in a dynamic system which is reversible under the influence of the changing intensity of various factors.

Murphy (1955) discussed the ecology of forest soils in relation to mull and mor formation, with particular reference to the "meso-fauna" (or "meio-fauna") in those habitats. He showed that mors usually contain a large number of small species while mulls are faunistically richer with smaller numbers of large biomass. Murphy emphasized that population densities without ancillary data can give a false impression, and he considered that, although biomass estimations provide useful additional data, the ultimate object of quantitative studies should be a measure of the activity of the fauna. Briefly reviewing the biotic and pedological factors responsible for mull and mor formation, he suggested that tree species may be the most determinant factor, but ground vegetation and a high water table may be important under certain conditions. Murphy concluded that the exact role of the fauna could not yet be assessed in full, but that a change from one humus form to another suggested a mutualism between flora and fauna, provided that the vegetation was the first to alter.

Drift (1961) discussed the causes and consequences of difference in soil fauna in several types of oakwood. He found that the densities of the macrofauna in calcareous mull, acid mull and mor were in the proportion of 4:3:2 and the saprophagous part of the fauna in the proportion of 3:2:1. In feeding experiments, litter of alder was preferred by all species tested, and oak was attacked only by Tipula. Litter of poplar and birch was intermediate. Drift observed that oak leaves in mull and mor differed with respect to the percentage of "sunleaves" and "shadowleaves." In mull the shadowleaves, found in the shade of higher poplar and alder trees, which bud earlier than oak trees, predominated. In mor the sunleaves predominated. These types of leaves differed in thickness, proportion of different tissue layers in the leaf, water content and lignin content. Sunleaves, because of their more corrugated border, became desiccated quicker than shadowleaves, causing evaporation to be twice as great in mor as in mull. The macro-organisms attacked shadowleaves much more rapidly, thereby bringing about a difference in litter accumulation.

In their study of the breakdown of forest litter in relation to environmental factors, Witkamp and Drift (1961), compared the production and breakdown of litter in a single stand in mull and mor. They found that the production of litter was almost equal in both types, but the litter in mull was composed mainly of shadowleaves which fell earlier and had a more favourable C/N ratio for biological decomposition. The fluctuation of the density and activity of the floral and faunal elements were generally synchronous in both humus forms; however, carbon dioxide concentrations were higher in mull. In calcareous mull, larger litter feeding animals, bacteria and actinomycetes dominated as a result of higher air humidity, the presence of calcium carbonates, more protein and easily decomposable carbohydrates. In mor where the litter contained more lignin and less protein, fungi and micro-arthropods were more numerous. These authors concluded that differences in forest floor type were presumably controlled by edaphic factors which influence vegetation, litter composition, air humidity, soil microflora and fauna and ultimately humus type.

Drift (1962) gave a brief preliminary account of a comparative study of the numbers of certain saprophagous and predacious animals, Acarina and Collembola occurring in calcareous and acid mull (moder) and mor humus forms in oak woods. He found that there was little difference in the macro-fauna on the mull sites, presumably due to better humidity conditions and mixed litter. He ascribed the smaller numbers of species and individuals on the mor site to unfavourable water conditions, due to elevation, and to the composition of the litter, mainly oak, which was less readily eaten as compared with alder, aspen and even birch present on the mull sites. He also observed that there was a greater number of saprophagous species in mull and by the action of these animals and of micro-organisms, the species composition of which was quite different in the two humus forms, there was a more rapid disintegration of excrement in mull. The moder took an intermediate place with regard to the rate of organic matter decomposition.

Drift (1963) studied the disappearance of litter in mull and mor in connection with weather and the activity of the macro-fauna. He found that meteorological conditions apparently influenced litter breakdown and that moisture conditions seem to be more important than temperature, although mild winters and warm springs, when moisture is adequate, may accelerate decomposition. Actual litter disappearance in mor can exceed that in mull if in the latter the litter is decomposed before the next fall. However, under unfavourable conditions, mull litter can be decomposed before the next fall whereas in mor accumulation occurs. The actual agencies in this relationship were the micro-organisms of which the macro-fauna is mainly responsible for the removal of litter. He found that apart from the qualitatively and quantitatively richer saprophagous macro-fauna in mull, seasonal activity patterns may be distinct from those in mor.

C. ENVIRONMENTAL FACTORS

1. GENERAL REMARKS

Before a meaningful analysis of the results can be made it is necessary to outline certain basic ecological factors which affect the soil fauna. The most important of these have been summarized by Bellinger (1954) and Kühnelt (1950, 1955, 1957, 1961). Kevan (1962) divided them into physical factors on the one hand, and biotic factors on the other. The former include mainly soil structures, soil aeration, soil temperature, pH, the electrolyte content of the soil and the influence of light. The more important biotic factors are the indirect effect of the vegetation, food supply and natural enemies.

At present, any discussion of factors causing population differences must be highly speculative, since a proper understanding of the relationship of an animal to its environment requires detailed information which is now scant (Bellinger, op. cit.:37). However, it is possible to make certain generalizations from the limited information available.

2. PHYSICAL FACTORS

a. Soil Structure:

Kuhnelt (1955) differentiated between burrowing and non-burrowing animals. Those with developed capacity for digging include moles, wireworms, termites, millipedes, earthwroms, and so on. A great number of the soil fauna are non-burrowers which Kühnelt (1963) divided into litter inhabitants, inhabitants of microcaverns, and water animals of the soil. Inhabitants of microcaverns are represented by many small arthropods such as Pauropoda, Symphyla, Collembola and Acarina. As a result, the micro-arthropods, perhaps with the exception of endophagous[1] species, are limited in their distribution by the size of the soil pore spaces. Kühnelt (1961:207) observed that clayey pasture soils harboured many light-coloured Oribatei and smaller species, such as Laelaps and Parasitus, while loose alluvial soils contained the larger, usually more strongly pigmented Macropylina as well as Pergamasus

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[1]A term coined by Jacot (1939) for animals which literally eat their way into pine needles, as opposed to those which consume the leaves from outside, which he referred to as "ectophagous."

crassipes (L.) and Uropoda [= Leiodinychus] krameri (G. and R. Canestrini, 1882). As far as the density of the animals is concerned, total pore volume of some soils does not seem to be a limiting factor (Haarløv, 1960).

b. Soil Moisture:

Soil moisture seems to be a very important factor in limiting the fauna, and its effect has been appreciated by a number of authors (Lunn, 1939; Pearse, 1946; Lawrence, 1953; Maldague, 1961; Tarras-Wahlberg, 1961; Winston, 1963; and others). Bellinger (1954) differentiated between the soil water content and the humidity of the soil atmosphere, pointing out that if the soil is supporting a population of Collembola, there is reason to believe that it is perhaps saturated. Thampdrup (1939), cited by Bellinger (1954), indicated that if the water content exceeded 20 per cent by weight the atmosphere was essentially saturated. Kühnelt (1961:217) believes that the pF concept of measuring water availability adopted by Overgaard Nielsen (1959) would be a sounder approach. This indeed, has been demonstrated by Dalenius (1962).

Micro-arthropods vary considerably in their dependence on moisture (Madge, 1964, 1964a), and it is probably true to say that resistance to dryness seems to increase with size and degree of sclerotization. Kevan (1962:131) notes that delicate unpigmented Rhagidia die rapidly when removed from a saturated atmosphere, while more heavily sclerotized Oribatei are more resistant to desiccation. However, even among these Riha (1944), as cited by Kevan (*loc. cit.*), found that genera such as *Galumna* and *Carobodes* were more drought resistant than *Oppia* and *Suctobelba* and that even between species, *Phthiracarus ligneus* Willmann, 1931 was less resistant than *Ph. globosus* (Koch, 1841).

Similarly, Kühnelt (1961:155ff.) records that, among the Collembola, surface-forms such as *Entomobrya muscorum* Nicolet, 1841 and *E. superba* (Reuter, 1876) were negatively hygrotactic, and *Lepidocyrtus lanuginosus* (Gmellin, 1788) and *Tomocerus vulgaris* (Tullberg, 1871) were less sensitive to low humidity than *Onychiurus armatus* (Tullberg, 1869), which lives deep in soil. Even within a species complex, colour forms can be separated according to certain humidity preferences (Agrell, 1941).

According to Kühnelt (*op. cit.*), very wet soils are usually avoided, although some mites, for example *Pergamasus runcatellus* Berlese and *Hydrozetes terrestris* Berlese, 1910 are characteristic of the upper layers of such wet places, while in the deeper B horizon *Rhodacarus*, *Scutacarus* and *Oppia* species as well as Collembola of the genera *Tullbergia* and *Onychiurus* are common. Normal flooding does not seem to affect many of these forms, since they can remain rolled up in the water.

In contrast to the requisite relative humidity, the effect on the soil fauna of ambient moisture content is still confusing, and Christiansen (1964) has suggested that a classification using a combination of temperature and humidity preference, as proposed by Cassagnau (1961), merits serious consideration.

c. Soil Aeration:

The soil usually contains a higher carbon dioxide content than the surrounding air because of the respiration of the living organisms present, and the decomposition of organic matter. Kühnelt (1961:207ff.) stated that the carbon dioxide content increases with increasing depth, but then falls off. At a depth of 12 to 30 cm. it is only about 20 to 30 parts per million. The air pressure is more or less the same down to a depth of about 3 metres.

The sensitivity of micro-arthropods to carbon dioxide is quite variable. Gamasoid mites, such as *Macrocheles* species, living in dung can tolerate 100 per cent carbon dioxide for as long as 50 hours. Some Oribatids, for example, *Belba*, *Carabodes* and *Achipteria* species, survived 20 hours in 50 per cent carbon dioxide, while *Parasitus coleoptratorum* (L.) and Collembola of the genus *Onychiurus* were killed by the same treatment. The latter species are very sensitive to lack of oxygen and perished in 100 per cent nitrogen after 7 days, while all *Macrocheles* species survived (Kühnelt, 1961:208).

According to Murphy (1953:180) Schwiebia is also capable of living at low oxygen tensions. Ghilarov (1947) noted that certain mites and Collembola penetrate the soil to a greater depth than earthworms where the oxygen tension is low. In this respect Kühnelt (1961:157) states that Collembola are more resistant to lack of oxygen than soil mites. For example Folsomia fimetaria (L.) can live in places with considerable lack of oxygen, resulting from putrefaction processes.

Mites and Collembola differ in their ability to withstand various noxious gases (Moursi, 1962). Kühnelt (1961:209) mentions that a concentration of 0.5 per cent hydrogen sulphide was tolerated by most animals tested, except for Parasitus coleoptratorum (L.), Onychiurus sp. and a few others. Even 5 per cent ammonia seems to have a very deleterious effect on soil arthropods. However, smaller quantities may be important for the survival of some species (Wallwork and Rodriguez, 1963).

Because of the similar response of certain Acarina, Collembola and Diptera (larvae) to carbon dioxide and nitrogen, Moursi (1962a) maintained that the response of soil animals to these gases is not due to their specific characteristics but rather to the change in the oxygen content. He concluded that soil animals probably oriented themselves because of their reaction to differences in the oxygen content of the soil atmosphere.

d. Soil Temperature:

Temperature is probably of less importance to soil animals than to surface dwelling species, not because they are insensitive to temperature, but because soil is such an excellent insulator (Kevan, in press). Temperatures in the soil are seldom too high and during relatively slow and moderate fluctuations, many species are able to migrate in order to avoid ill effects (Dowdy, 1944; Kühnelt, 1961:137, 218).

It is known that many soil arthropods can survive at relatively low temperatures. Hammer (1944, 1946, 1952, 1953, 1953a, 1954, 1955), Lindquist (1961), Oliver (1963) and McAlpine (1964) have published on the Arctic and sub-Arctic fauna. In many cases, mites and Collembola were taken from Peary land, north Greenland, where there are only about two months of frost-free days and the temperature during the warmest part of the summer is only about 6° C. Dalenius and Wilson (1958), Domrow (1962), Fain (1962), Gressitt (1962), Gressitt et al. (1963), Pryor (1962), Salmon (1962), Wallwork (1962, 1962a, 1962b, 1963), Atyeo (1963), and Womersley and Strandtmann (1963), among others, have contributed to our knowledge of the Antarctic fauna, thriving under comparable conditions to those of the Arctic described above.

The ability of certain species of Collembola to tolerate low as well as high temperatures has been observed by Agrell (1941). Although many forms can survive at sub-zero (° C.) temperatures, most of them require somewhat higher temperatures for full development (Marshall and Kevan, 1962; Milne, 1962; Sharma and Kevan, 1963, 1963a, 1963b). Many mites may require a relatively high temperature for development (Kevan and Sharma, 1963).

Exact information as to the temperature tolerance of soil mites is limited. Sinha (1964) found that the ability of certain stored product mites to withstand sub-zero (° C.) temperatures is variable. Wallwork (1960) studied the temperature tolerance of some North American and African Oribatei. He found that the preference zone for the majority of species ranged from 21° C. to 26° C. Tarras-Wahlberg (1961) found that while some mites such as <u>Tectocepheus</u> <u>velatus</u> (Michael, 1880) seem to prefer relatively high temperatures (25-30° C.), others, for example, <u>Nothrus</u> <u>pratensis</u> Sellnick, 1928, and especially its nymphs, favoured a cooler situation (2-12° C.). Dalenius (1962a:124) recorded that some immature Oribatei seem to be more sensitive to low temperatures than the adults. He was, however, sceptical of the results, and quite the opposite effect has been observed by Tarras-Wahlberg (1961:36), Wallwork (1959:560), and Gressitt <u>et</u> <u>al</u>. (1963:300). Adults appear to be less cold resistant and a relatively higher mortality appears among them during hibernation.

At the upper end of the temperature scale many mites and Collembola perish between 34° C. and 40° C. (Wallwork, 1960; Christiansen, 1964). However, some arthropods can stand temperatures well above these limits (cf. Tuxen, 1944; Willson, 1960).

It is interesting to note that under high temperatures certain Collembola develop phenotypic differences (Cassagnau, 1955, 1956, 1956a, 1956b; Willson, 1960). However, "unfavourable" temperature conditions is probably not the only factor involved (Sharma, 1964). Christiansen (1964) refers to this condition as "ecomorphosis" and suggests that it offers an explanation of occasional but persistent abnormal populations. Such abnormalities help to confuse an already obscure taxonomic picture of the Collembola fauna (Kevan et al., 1964).

e. Influence of pH:

According to Gisin (1943), pH is often indicative of certain soil types and therefore associated with different Collembolan populations. Williams (1942) observed a relationship between neutral pH and high soil population densities and Davis and Murphy (1962), considering a number of soil factors, stated that pH, organic matter, pore space and soil moisture, were highly important while mechanical composition and root-content were less effective in recolonization of soils reclaimed from open-cast iron-stone mining. Even earthworms, which are generally regarded as being acid intolerant, may invade soil of low pH (Bornebusch, 1930; Hallsworth, 1955; Satchell, 1955; Langmaid, 1964). Many authors are of the opinion that pH is not a determining factor in the life of soil animals (Agrell, 1941; Bellinger, 1954; Nosek, 1957; Dhillon and Gibson, 1962; Maldague, 1961; and Davis, 1963).

f. Electrolyte Content of the Soil:

Most soil animals live in soils with a relatively low electrolyte content. There seems to be no true halophilic species of Collembola, although there are a few oribatid mites which normally occur on the shore of the North Sea (Kühnelt, 1961). Saline soils are usually very poorly populated by the macro-fauna, but Schuster (1958), cited by Kevan (*in press*), found surprisingly little effect on micro-arthropods, especially mites and Collembola. Contrary to current belief, soil arthropods with heavily calcified cuticle are not affected in any way by a low calcium content of the substratum (Kühnelt, 1963).

g. Influence of Light:

True soil animals are very sensitive to ultraviolet light and the majority of forms usually try to escape light. Certain surface dwelling species are positively phototropic (Dietrich, *et al*., 1959; Christiansen, 1964), but in general the response is photonegative. The influence of light has been interpreted mainly from indirect evidence. For example, Kühnelt (1961:221) noted that poor pigmentation may be connected with lack of light. In many surface-dwelling Collembola, especially in the Isotomidae, a characteristic grey colour occurs, while green predominates in the Smynthuridae. Strenzke (1949, 1949a) reported that the Collembola, Friesea mirabilis (Tullberg, 1871) found in surface moss are coloured grey-blue or dark-blue, while individuals found in deeper strata are nearly completely colourless. Surface-dwelling mites may also be brightly coloured, for example red Trombidium or yellow Labidostommidae. Deep-dwelling species are usually eyeless and colourless. The mesostigmatid mite, Rhodacarus roseus Oudemans, 1902, which remains in deep soil is pink owing to the presence of porphyrin. Corresponding to reduction of eyes, a compensatory formation of tactile organs may be found, for example in the Oribatei. Tarras-Wahlberg (1961), from experimental work, obtained no conclusive results where the oribatid Diapterobates humeralis (Hermann) had to choose between light and dark.

3. BIOTIC FACTORS

Perhaps the most important biotic factor affecting the soil population is the vegetation (Murphy, 1953; Nosek, 1957; Karg, 1963; Naglitsch and Steinbrenner, 1963).

According to Kevan (1962:138), different quantities of organic matter affect physical structure and texture; or living and dead roots may provide channels by which non-burrowing animals may penetrate as well as providing them with food. Chemical secretions from the micro-organisms or even the nature of certain hyphae may render certain soils intolerant for some species while promoting favourable conditions for others. Führer (1961) observed that the oribatid mite Pseudotritia ardua (Koch, 1841) was attracted to decaying roots affected by certain bacteria, upon which they presumably fed. However, Bornemissza (1957) found that the product of decaying carrion may seriously depress the natural soil fauna.

Food supply is one of the most significant biotic factors affecting life in the soil, yet our knowledge of what particular species of soil animals eat is fragmentary (Kevan, *in press*). Attempts have been made to classify soil organisms on their feeding habits (*cf*. Jactot, 1936, 1940; Haarløv, 1960; Kevan, 1962). Many species appear to be omnivorous (Drift, 1951; Wallwork, 1958; Karg, 1961, 1961a; Bhattacharyya, 1962) and feed on a host of materials, including organic matter in all stages of decomposition, fungi and bacteria (*cf*. Winston, 1956; Woolley, 1960; Hartenstein, 1962; Kevan, 1962; Kühnelt, 1963; Woodring, 1963; Christiansen, 1964). Other species appear to be oligophagous (Sharma, 1964).

The abundance of the animals in the soil is affected by the presence of their predators and parasites. Predators of mites include a large number of arthropods including other mites. According to Kevan (1962:42), certain beetles prey on mites, but Cloudsley-Thompson (1958:194) points out that because some mites are distasteful and others are protected by a hard exoskeleton they do not make desirable prey. The Collembola which are soft-bodied fall victim to mites, pseudoscorpions, beetles, centipedes and even other Collembola, although certain species in the genera *Onychiurus* and *Hypogastrura* are toxic to ants (Christiansen, 1964). The majority of parasites which affect the micro-arthropods are Haplosporidia, gregarines, nematodes, gordiid larvae and Laboulbeniaceae, but epidemics of virous, fungal and bacterial diseases have been recorded in cultures (*cf.* Paclt, 1956; Lindquist, 1961; Christiansen, 1964; Kevan, *in press*).

It is probably not out of place to mention here that the activities of man may greatly influence animal populations in the soil. Fertilization of soils seems to increase the numbers of organisms, insecticides and herbicides appear to show no significant influence (Hoffmann *et al*., 1949; Hartenstein, 1960), while certain waste oils, some plastics and radiation definitely tend to reduce the soil fauna (Kevan, 1962; Kühnelt, 1963; Rhee, 1963; Rapoport and Cangioli, 1963; Christiansen, 1964).

III. MATERIALS AND METHODS

A. SITE DESCRIPTION

1. GENERAL

a. Location:

The habitat chosen for study comprises about 300 acres of woodland, the Morgan Arboretum, located on the western end of the Island of Montreal (Figure 1). The elevation of this part of the island ranges from 50 to 100 feet above the level of the Lake of Two Mountains, which itself is about 75 feet above mean sea level.

b. Climate:

The climate is cool and moist with precipitation throughout the year (Appendix A, Table I). Sanderson (1948), adopting the new Thronthwaite classification (Thornthwaite, 1948), concluded that the climate of Montreal is of a mesothermal humid type. The soil and air temperatures of the experimental sites are given for purposes of comparison (Appendix A, Tables II and III).

c. Geology:

Stanfield (1915) described the geology of the Island of Montreal. The Morgan Arboretum is underlain by Palaeozoic Beekmantown Calciferous Dolomite, covered by

Figure 1. Location of sample areas in Morgan Arboretum.

1. Maple mull (Site 1)
2. Beech mor (Site 2)
3. Hemlock mor (Site 3)

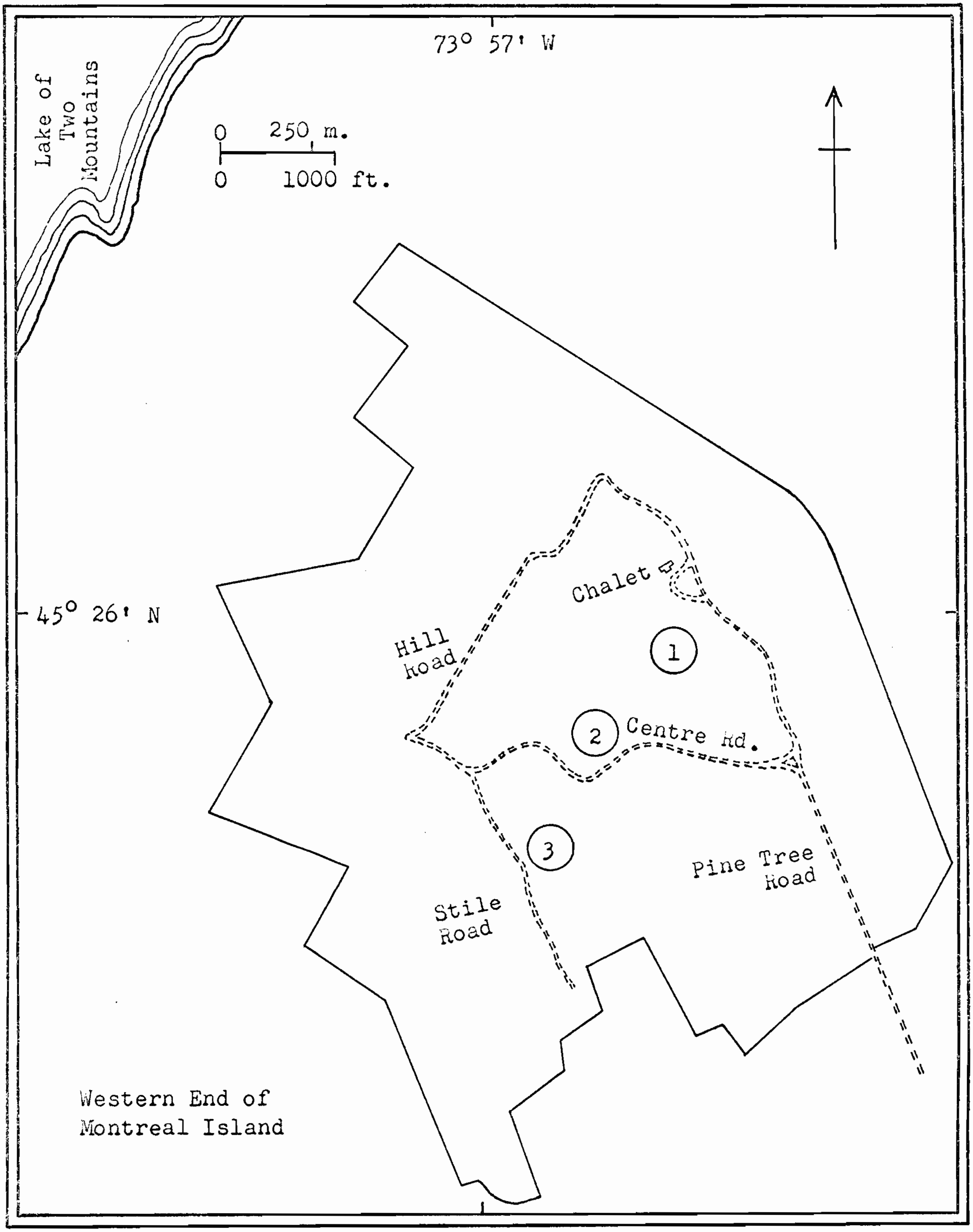
73° 57' W
Lake of
Two
Mountains
0 250 m.
0 1000 ft.
45° 26' N
Chalet
Hill
Road
1
2
Centre Rd.
3
Pine Tree
Road
Stile
Road
Western End of
Montreal Island

Figure 1

boulder clay and overlain in some parts by Leda clay. Most of the area is further capped by fine Saxicava sand of varying depths which play an important role in the drainage pattern.

2. SAMPLE AREA

a. Stand Condition:

According to Long (1955) the vegetation of the Morgan Arboretum may be considered to belong to two groups corresponding to soil catenas. The first is the beech-hemlock catena found on sandy soils, the beech occupying the higher, better-drained portions while the hemlock is restricted to the low areas within reach of ground water. The second is the maple-basswood catena located on clayey and loamy substrates. This natural association of soil and plant facilitated the selection of sampling sites for study.

The sample sites were chosen on soils representing two humus forms, mull and mor (or raw humus of Kubiëna, 1953), and three dominant tree species. These were as follows: Site 1, a mull-type soil, with a mixed hardwood stand of which sugar maple (Acer saccharum Marsh) predominated; Site 2, a mor humus form, with a pure stand of beech (Fagus grandifolia Ehrh.); and Site 3, a mor humus form, with a pure stand of hemlock (Tsuga canadensis L.).

Site 1, which will hereafter be referred to as "maple mull," is situated in the eastern part of the Arboretum (Figure 1) on a gentle slope facing north. The greater part of the grove consists of maple (*Acer saccharum* Marsh, *A. rubrum* L. and *A. saccharinum* L.), but also present are white ash (*Fraxinus americana* L.), red oak (*Quercus rubra* L.), basswood (*Tilia americana* L.) and hickory (*Carya cordiformis* (Wang) Koch and *C. ovata* (Mill.) Koch). The stand is young, about 30 to 40 years old and growing at the rate of one-half to three-quarters cords[2] per acre per year. The height of the dominant trees ranges from 40 to 60 feet.

The maple mull ground vegetation is abundant in early spring (Appendix B, Figure 1). The lesser vegetation, like the trees, seems to show preference for one site over another. On the site selected, the ferns, shrubs and herbaceous plants include the following: blue cohosh (*Caulophyllum thalictroides* (L.) Michx.), white trillium (*Trillium grandiflorum* Michx.), Jack-in-the-pulpit (*Arisaema atrorubens* (Ait.) Blume = *triphyllum* (L.) Schott.), false Solomon's seal (*Smilacina racemosa* (L.) Desf.) and maiden hair fern (*Adiantum pedatum* L.).

Site 2, which hereafter will be called "beech mor," is situated on an escarpment about 20 feet above and west of Site 1 (Figure 1). This is a "reserve" block

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[2] One cord (Quebec) = 128 cu. ft., stalked.

of the Arboretum and no cutting has taken place for the last 20 years. The beech, over 80 years old, is slowly eliminating all other species (approaching a climax community). It is a mature stand with virtually nothing but young beech found in the understory (Appendix B, Figure 2). The height of the trees ranges from 75 to 85 feet and the crown is almost closed. The ground vegetation included the following plants: Indian cucumber-root (*Medeola virginiana* L.) and wild lily-of-the-valley (*Maianthemum canadense* Def.).

Site 3, the "hemlock mor," is situated at about the same elevation as, and southwest of, Site 2 (Figure 1). Like the latter, it is a mature stand, the trees being over 100 years old. Untrimmed, it is approaching climax with no advanced regeneration (Appendix B, Figure 3). The canopy is almost closed but there are a few herbaceous plants in the ground vegetation. The common species are Indian cucumber-root (*Medeola virginiana* L.), wintergreen (*Gaultheria procumbens* L.), Partridge-berry (*Mitchella repens* Ait.) and American bracken (*Pteridium aquilinum* (L.) Kuhn var. *latiusculum* (Desv.) Underw.).

b. Soil:

Site 1, the maple mull, is a Brown Forest soil, a loam of the Ste. Rosalie series. The soils of Sites 2 and 3, the beech mor and hemlock mor, are gleyed-podzols and are stone-free sandy loam of the St. Amable series.

The series referred to are defined by Lajoie and Baril (1954). The description of the individual sites will be found in Appendix B, Figures 4, 5 and 6.

The description of the horizons given below follow the terminology used by Kevan (1962). At the surface is the A layer which sometimes contains the following sub-divisions: (i) the litter (L layer), which is composed of the residue of higher plants in an undecomposed state; (ii) below this, the F layer, or zone of fermentation, which is distinguished from the litter by the beginning of comminution, and which, if considerable, may further be sub-divided into F_1 and F_2, depending on the degree of decomposition; (iii) the H layer, the zone of strongest decomposition and humification, in which the organic matter has lost its original structure; (iv) the A_1 and A_2 layers beginning in the region of the mineral matter. The A_1 layer may be dark, containing organic material, and is separated from the A_2 layer, which, in podzols, is ash-grey due to leaching. Beneath the A layers is the B horizon.

The description of the humus is after the classification of Romell and Heiberg (1931).

Site 1 can be considered to be of a crumb mull. The litter layer is made up of very few leaves in the early spring with the greatest quantity in the autumn. Because of rapid decomposition of the litter by earthworms and other agencies, there is only a very thin A horizon, with an average depth of 0.4 centimetre (Appendix A, Tables IV and V). The organic-mineral complex, forming the B horizon, gradually fades as the organic content decreases with depth. The pH of the mull was approximately 6.7 (Appendix A, Table V) and the reaction showed little variation in that part of the horizon which was sampled.

Site 2, the beech mor, represents a fibrous duff. The litter is made up entirely of beech leaves, twigs and bud scales. With increasing depth the leaves become skeletonized and fragmented. Finally, all trace of their original structure is lost as animal excrement increases in quantity. The F layer is well developed, averaging 5 cm. in depth, and easily divisible into two layers. The upper layer is relatively loose, laminated and threaded together by fungus mycelia. The lower layer is more comminuted, compact and fibrous in texture. The H layer is less evident and merges into a distinct A_2 horizon. The B horizon begins about 10 centimetres beneath the surface. The pH of the sampled profile was acid approximately 4.5 (Appendix A, Table V).

Site 3, the hemlock mor, also represents a fibrous duff. The surface litter is more compact than that of the beech mor, perhaps due to the smaller size of the leaves. It is only with difficulty the sub-divisions of the A horizon can be recognized. However, the H layer is better developed here than on the beech site. Like the latter, the reaction of the sampled profile was acid with a pH of approximately 4.6 (Appendix A, Table V).

B. PROCEDURE

1. SAMPLING

The areas were sampled once a month from June to November, 1960. It was originally intended to sample once monthly for a complete year. However, limited time and the difficulty in obtaining cores during the winter made it impossible to carry out the original programme satisfactorily.

On each site a uniform area of 25 square metres was staked out, using a box compass. This was then subdivided into 25 units (Appendix B, Figure 7). Cores were always taken at approximately the same time on sampling days. On each sampling unit three cores were taken on the same day. The first core was taken in the centre of the unit, the second, 20 centimetres from the first, in a random direction by throwing up an object in the air and noting where it landed. A third core intended for pH measurement, was taken in a similar manner to the second.

The soil samples, 7.5 centimetres in diameter, were taken by means of a tubular borer (Appendix B,

Figure 8) so designed that the soil core cut by the lower edge was slightly smaller in diameter (by approximately 0.3 millimetres) than the main part of the cylinder into which it passed. This feature prevents shearing (Groenewoud, 1960) as well as compaction of the soil core during its passage into the borer. Both these factors may greatly reduce the number of animals recoverable by funnel extraction methods (Macfadyen, 1953:72). Cores were obtained from depths down to about 12 to 20 centimetres.

The cores were then placed in plastic bags, labelled and carefully placed in a cardboard box. The box was taken from the sampling site to the laboratory by car. This point may appear trivial, but it was noted that the majority of Collembola in soil samples transported the same distance by bicycle were dead on arrival at the laboratory, presumably due to jarring. Similar ill-effects on mites during transportation have been observed by Hammer (1952:8).

The same day as they were collected, the samples were extracted in modified Tullgren funnels (Haarløv, 1947, 1955), using small 15-watt bulbs for heating. Each core of the mor samples was divided horizontally into 3 parts, representing L and F_1, F_2 and H, and A_2 and B layers. In the case of the A_2 and B sub-samples, the depth was always limited to 5 centimetres by cutting off the excess from the lower part of the B horizon (Appendix A, Table IV). The samples from the mull site were also divided into 3 layers, representing the litter, 0-5 centimetres and 5-10 centimetres segments of the B horizon. All sub-samples were placed in an inverted position, on 15-mesh wire, in the funnel for extraction, since it is generally believed that this is more likely to facilitate emergence of the fauna (Macfadyen, 1955:320; Kevan, 1962:108; Murphy, 1962:97). There was no ground vegetation contaminating the samples.

Funnel extraction has a number of advantages over other methods especially for forest soils (Evans, 1951; Wallwork, 1957; Murphy, 1962:148). Attention should be drawn here to a somewhat different type of apparatus developed by Kempson _et al_. (1963). Wallwork (1957:11) tested the efficiency of a Haarløv-type funnel after the extraction of soil samples by heat for 45 hours. He shook up the soil in a mixture of benzene and water and made direct counts of the remaining animals. He calculated that 89.3 per cent of the mites and Collembola were extracted during the heat treatment, results which agreed fairly well with those of Drift (1951) and Macfadyen (1953).

The time taken for the recovery of the majority of the population from soil samples is variable (Murphy, 1962:96). During the first extraction it was noted that 72 hours elapsed before emergence of the fauna ceased.

Subsequent samples, therefore, were treated for the same length of time. The procedure followed that of Haarløv (1947, 1955). The cover of the funnel was left open for 24 hours, partly closed for 12 and fully closed for 36 hours. The specimens were collected in "Gisin's fluid C" (Kevan, 1955a)[3] and later stored in 70 per cent alcohol. In some cases mites and more frequently Collembola floated on the surface of the liquid; these were caused to submerge by adding a few drops of ether (Maynard, 1951:15).

Soil pH is usually assumed to be one of the most useful single measurements that can be made for ecological purposes (Pearsall, 1952:50). Therefore, samples of soil taken on the previous day were used for pH determinations by means of a "Beckman Pocket pH meter."[4] A more accurate instrument was not deemed to have any advantages for the purposes of this study. Sub-samples from the cores were placed in a 50-millilitre beaker and made into a paste. Two readings, at 5 minute intervals, were taken to obtain an average figure (Appendix A, Table IV).

At the time of on-site sampling, the temperatures of the sample horizon and of the air immediately above the forest floor were taken using a thermistor

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[3]Ethyl alcohol (95%), 750 ml.; Rectified ether, 250 ml.; Glacial acetic acid, 30 ml.; Formalin (40% formaldehyde solution in water), 3 ml.

[4]Beckman pH-16, Beckman Instruments Inc., Fullerton, California, U.S.A.

"Tele-thermometer."[5] The readings are given in Appendix A, Table II.

2. EXAMINATION

Counting of the fauna was done in a watch glass under a binocular dissecting microscope. The animals were separated from debris by means of a fine serrated needle,[6] picked up with a micropipette, and stored in dental anaesthetics cartridges (see Yunker, 1959).

Mites were for the most part preliminarily classified and sorted to the family level. In order to determine genera and species two different techniques were followed. Lightly sclerotized individuals were cleared in Nesbitt's solution[7] and mounted in Hoyer's solution (Baker and Wharton, 1952),[8] ringed with Gurr's "Glyceel"[9] and examined by phase contrast microscopy.

For heavily sclerotized specimens the procedure

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[5]Model 44 TE, Yellow Springs Instrument Co., Inc., Yellow Springs, Ohio, U.S.A.

[6]Dental pulp canal files, Keer Manuf., Co., Detroit, Michigan, U.S.A.

[7]Chloral hydrate, 40 gm.; Water, 25 cc.; Hydrochloric acid (conc.), 2.5 cc. Also referred to as Chloral Hydrate clearing solution in Beirne (1955:126).

[8]Distilled water, 50 gm.; Gum arabic (clear crystals), 30 gm.; Chloral hydrate, 200 gm.; Glycerin, 20 gm.

[9]G. T. Gurr Ltd., London, S.W. 6, England.

outlined by Balogh (1959, 1963) was adopted. The material was kept in lactic acid for about 6 months, and those which still were not transparent were then depigmented by a warm solution of 1:1 ratio of lactic acid and 30 per cent peroxide (H_2O_2). Temporary mounts were then made with lactic acid and examined by a phase contrast microscope.

At first these procedures were followed with the majority of specimens; thereafter increasing knowledge of the fauna made it possible to pick out most of the more frequent species directly under the binocular microscope. In such cases, however, a sample representing 20 per cent of the individuals of each presumed species was mounted for closer study, in order to ensure, as far as possible in the time available, that additional species were not being missed.

Dr. Marie Hammer (1961, in litt.) pointed out that, in the preparation of permanent mounts of Oribatei, it was necessary to support the cover-glass with pieces of glass, wood or some other such material if the specimens are to stay in good condition. Many of the earlier preparations were crushed beyond recognition within a year, but slides in which the cover-glasses were supported with pieces of "number zero" or "number one" coverslip (depending on the size of the specimen) remained in good condition.

Micro-arthropods other than the Acarina were mounted in PVA[10] and examined as stated for the mites. The microscope slides on which the specimens are mounted, as well as the material preserved in alcohol, and in lactic acid, have been deposited in the Lyman Entomological Museum at Macdonal College.

The author has received help in making identification from many specialists (see Acknowledgments) but the responsibility for any error cannot be attributed to them. It was impossible to follow a single classification system for all species encountered since no such system exists. The principal works consulted for the Acarina were Willmann (1931), Baker and Wharton (1952), Baker *et al*. (1958), Hammer (1952-1962a), and Balogh (1961, 1963); and for the Collembola, Mills (1934), Maynard (1951), Hammer (1953), Gisin (1960) and Stach (1947-1963), but many other papers too numerous to be cited individually, were consulted and some of these will be referred to later where appropriate.

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[10]The formula for preparing PVA was that recommended by Dr. W. R. Richards, Ottawa. It is as follows: 100-150 gm. Polyvinyl ("Polyviol" W 28/20; Reference number 36 07 047, Wacker Chemie Gmbh, München, West Germany) made into a paste with distilled water to which is added 800 ml. lacto-phenol solution (40 gm. of phenol in about 40 ml. of 85% lactic acid (*cf*. Beirne, 1955:128) and the mixture heated on an electric hot plate at 500-700° F. just until the paste is dissolved.

IV. RESULTS AND DISCUSSION

A. SYNOPSIS OF FAUNA

1. GENERAL

Details of the organisms collected are presented in Appendix A, Tables VI-XXIII and are summarized in Table 1 of the text. With the exception of the micro-arthropods, the data presumably represent only a fraction of the fauna. This is particularly true of holometabolous insect larvae since few of these are extracted by the method used. The counts for groups other than micro-arthropods may nevertheless give some idea as to the relative abundance of the groups in the three sites. An account of the Mesostigmata and Trombidiformes has already been given (Marshall, 1963; Marshall and Kevan, in press) and details are not repeated here. In the following sections the Oribatei and Collembola are identified, to species where possible, and analysed. Only a very brief and general account of other groups is given. Enchytraeidae were occasionally observed in the samples, but these were not counted and the water-fauna (Rotatoria, Tardigrada, Copepoda, Nematoda, etc.) have, by their very nature, been disregarded altogether.

Table 1. Total numbers of organisms obtained in the 3 sites -- 1 (maple mull); 2 (beech mor); 3 (hemlock mor) --from June to November, 1960. Figures represent 2 samples taken per month on each site.

Taxa	Site 1	Site 2	Site 3	Total
1. ARACHNIDA				
a. Pseudoscorpionida	12	14	11	37
b. Araneida	7	26	1	34
c. Acarina (all groups)	2416	12321	11993	26730
i Mesostigmata	407	569	713	1689
ii Trombidiformes	916	2354	2977	6247
iii Acaridiae . .	54	153	10	217
iv Oribatei . .	1039	9245	8293	18577
2. MYRIAPODA				
a. Chilopoda	11	1	1	13
b. Diplopoda	28	12	1	41
c. Pauropoda	80	1	1	82
d. Symphyla	3	13	1	17
3. HEXAPODA				
a. Diplura	30	2	0	32
b. Protura	99	0	6	105
c. Collembola (all groups)	587	1021	1169	2777

(table continued)

Table 1 (continued). Total numbers of organisms.

Taxa	Site 1	Site 2	Site 3	Total
i Poduridae . .	12	240	60	312
ii Onychiuridae	124	139	146	409
iii Isotomidae .	246	558	848	1652
iv Entomobryidae	122	38	15	175
v Smynthuridae	83	46	55	184
vi Unidentified	0	0	45	45
d. Pterygota (all groups)	216	146	77	439
i Psocoptera (adults) . .	0	2	2	4
ii Thysanoptera (nymphs) . .	33	0	22	55
iii Hemiptera (nymphs) . .	21	3	0	24
iv Homoptera (nymphs) . .	9	0	0	9
v Lepidoptera (adults) . .	4	0	1	5
vi Coleoptera (adults) . .	5	4	3	12
vii Hymenoptera (adults) . .	2	1	1	4
viii Diptera (adults) . .	115	88	26	229
ix Insect larvae (various Holometabola)	27	48	22	97
TOTAL ARTHROPODA . .	3489	13557	13261	30307
4. GASTROPODA	1	0	1	2
5. LUMBRICIDAE	7	1	1	9

a. Acarina

The mites far outnumbered all other arthropods collected, making up 88.2 per cent of the total. The Mesostigmata made up 6.4 per cent; the Trombidiformes composed 23.3 per cent, and the Sarcoptiformes (of which 0.8 per cent was contributed by the Acaridiae) were responsible for 70.3 per cent of the Acarina.

The three locations differ from each other, but Sites 2 and 3 (mor humus forms) resemble each other more in quantitative composition than they do Site 1 (maple mull). The three suborders are much more equally represented in Site 1 than in the other two sites, where the Sarcoptiformes make up well over half of the total mite population.

The apparent dominance of sarcoptiform mites among the soil Acarina has been recorded by other workers (Salt *et al*., 1948; Evans, 1951; Sheals, 1957; Crossley and Bohnsack, 1960; Maldague, 1961 and others). This group has also received a great deal more taxonomic and ecological attention than the others. However, the importance of the Mesostigmata and Trombidiformes should not be overlooked, for together they made up about 30 per cent of the Acarina recorded. Even so, their numbers may have been underestimated (*cf*. Drift, 1951:89; Macfadyen, 1961; Murphy, 1962:98), for the writer's observations seem to confirm Murphy's (*loc*. *cit*.)

statement that many mesostigmatid mites may escape from the funnel before extraction. Thus, while trying to obtain additional material of a species of Neparholaspis, it was observed that specimens were easily obtainable only when the ground was almost frozen, from which it may be inferred that the cold weather inhibited activity, thereby reducing losses. The morphology of this mite indicates that it is a fast running predator. Similarly, specimens of Tomocerus sp. were easily picked off the ground on the experimental sites, but were only rarely taken in samples removed to the laboratory for extraction.

b. Collembola

The Collembola were next to the mites in numerical abundance, making up 9.2 per cent of the total arthropod fauna. The Poduridae comprised 59.6 per cent; the Onychiuridae, 14.7 per cent; the Isotomidae, 59.6 per cent; the Entomobryidae, 6.3 per cent; the Smynthuridae, 6.6 per cent; and 45 unidentified specimens, which were accidently lost, 1.6 per cent of the Collembola.

Murphy (1953:175) observed that when the ratio of Acarina to Collembola is considered, there was no clear-cut relationship but mites were usually the dominant group especially under mor and infertile conditions as compared with fertile habitats. The results from Morgan Arboretum also indicate that in beech and hemlock mor the ratio of mites to Collembola was 12:1 and 10:1 respectively, while in the maple mull it was only 4:1.

The remainder of the arthropods, which amounted to 2.6 per cent, was made up of a number of groups of relatively small numbers.

c. Pseudoscorpionida

Pseudoscorpions occurred in small numbers throughout the year and seemed to be evenly distributed in all three sites. Although mainly restricted to the upper surface a few specimens were found deeper during the middle of summer.

d. Araneida

Spiders do not belong characteristically to the subterranean fauna, but 1 specimen was collected in the A_2-B layers in August. They were most abundant in the L-F_1 layers in the beech mor.

e. Chilopoda

Centipedes occurred throughout the year in small numbers and in all layers. Those extracted from the samples were minute specimens about 6-12 millimetres long and were most abundant in maple mull.

f. Diplopoda

Many juveniles passed throught the funnel but adults were collected mainly after extraction. Millipedes occurred throughout the year and in all layers. They were most abundant in maple mull.

g. Pauropoda

Pauropods were obtained mainly in the deeper layers in maple mull.

h. Symphyla

At least two species of symphylids were observed. These organisms were most abundant in beech mor.

i. Diplura

The Diplura were most abundant in maple mull and occurred in all three layers.

j. Protura

The Protura were most abundant in the lower layers of the maple mull. Eosentomon sp., ? delicatum Gisin, [Conde, 1954] was identified by Dr. S. L. Tuxen from part of this collection, but other species may also be present. Protura are known to occur in aggregates deep in soil.

k. Pterygota

All the groups taken have previously been recorded from soil. However, the majority of the adult Diptera obtained during extraction were chironomids and it is very unlikely that they actually came from the soil samples.

l. Gastropoda

Only two specimens were collected, and these were on the surface of the samples. Since no attempt was made to observe snails in the field, the numbers are undoubtedly quite unrepresentative.

m. Lumbricidae

Three specimens passed through the funnel; the others were collected from the soil samples after extraction.

It should be noted that while no single group (with the exception of the Homoptera) was restricted to a single humus form there are differences in the numbers that occurred in mull as compared with mor. This is particularly true for the Acarina, Collembola, Myriapoda and and Lumbricidae, and is in agreement with the results of earlier workers (Müller, 1889; Bornebusch, 1930; Eaton and Chandler, 1942; Drift, 1962, 1963) who have observed that earthworms and the larger animals are usually more abundant in mull.

2. LIST OF SARCOPTIFORMES

The Sarcoptiformes of the three sites can best be understood by referring to Appendix A, Tables VI-XI. Records for Canada and Alaska for some of these have been previously published. Species that have not been so recorded are marked with an asterisk (*) in the list given in the text. Of the 97 species collected, at least 19 appear to be new to science. Other new species may be revealed when all the specimens are fully determined. The Sarcoptiformes listed as undetermined were made up mainly of immature forms but there were also present a number of poorly preserved adults. Very few larvae were collected and nymphs were counted with the adults of the species which they were believed to represent when their identity was almost certain.

Identifications were largely made from the literature, but in many cases the material was determined by specialists. Against each species, also, is a very brief note on distribution and ecology. The references given are not intended to be complete; nor do they necessarily refer to the original reports. They are merely intended to indicate the sources of information given. For example, under distribution, if a recent author included records given in an earlier work, the latter is not usually given. The identity of the various site numbers and the letters used in parenthesis to indicate soil horizons follow the classification of Kevan (1962:7) with the exception of L, M and N which represent litter layer and soil of the B horizon at a depth of 0-5 and 5-10 centimetres, respectively (see also pages 38 and 42).

The higher classification of the Oribatei follows the arrangement of Balogh (1961, 1963). The genera and species of the respective families are arranged alphabetically for practical reasons, but also because no well established phylogenetic system has yet been developed. The authorships and dates of the superfamilies and families of Oribatei are those listed by Balogh and, like those of the Acaridiae, are not necessarily correct according to the International Code of Zoological Nomenclature. The Acaridiae are also listed alphabetically.

a. ACARIDIAE Latreille, 1806

ACARIDAE Ewing and Nesbitt, 1942.

Rhizoglyphus sp. -- Site 2 (F_2-H, A_2-B), 2 ex.

Determination: from Hughes (1961).

**Schwiebea cavernicola* Vitzthum, 1932 -- Sites 1, 2, 3 (L, M, N, L-F , F_2-H, A_2-B), 182 ex.

Determination: E. E. Lindquist.

Type described from: Italy.

Distribution: Yugoslavia (Zathvatkin, 1941); Germany, Italy, Belgium (Turk and Turk, 1959).

Habitat: in groundwater, in litter and in humus (Turk and Turk, 1959).

Tyrophagus putrescentiae (Schrank, 1781) -- Sites 1, 2 (L, M, N, L-F_1), 18 ex.

Determination: from Hughes (1961).

Type (Neotype) described from: Netherlands.

Distribution: Cosmopolitan (Hughes, 1961).

Habitat: most frequently found in stored food with a relatively high fat and protein content (Hughes, 1961); in many artificial environments such as emporia, conservatories, laboratories and herbaria, in cultivated mushrooms, in decaying vegetable and animal matter, in pasture soil, in mull type soil, in rotting organic debris (Kevan and Sharma, 1963).

ANOETIDAE Oudemans, 1904.

? Anoetidae sp. -- Sites 1, 3 (M, L-F_1), 3 ex.

Note: These were all hypopi.

ACARIDIAE UNDETERMINED -- Sites 1, 2 (L, L-F_1, A_2-B), 12 ex.

b. ORIBATEI Duges, 1833

i. ORIBATEI INFERIOR

1. PALAEACAROIDEA Grandjean, 1954.

PALAEACARIDAE Grandjean, 1932.

*Palaeacarus hystricinus Trägårdh, 1932 -- Sites 2, 3 (L-F_1, F_2-H, A_2-B), 26 ex.

Determination: from Evans (1952).

Type described from: Sweden.

Distribution: Sweden, England (Evans, 1952); North Carolina (Jacot, 1938, as P. appalachicus); represented in the United States from isolated collections (Woolley, 1961).

Habitat: litter of pine-oak woods (Jacot, 1938);

humus under deciduous and evergreen woodlands (Evans, 1952; Evans *et al.*, 1961).

2. PARHYPOCHTHONOIDEA van der Hammen, 1959.

PARHYPOCHTHONIIDAE Grandjean, 1932.

* *Gehypochthonius rhadamanthus* Jacot, 1936 -- Sites 2, 3 ($L-F_1$, F_2-H, A_2-B), 76 ex.

Determination: J. A. Wallwork.

Type described from: North Carolina.

Distribution: North Carolina (Jacot, 1936a); represented in the United States from isolated collections (Woolley, 1961).

Habitat: in *Andropogon* sod, in old pasture with young pine, in pasture sod, in pine-oak woodland, in root below the surface (Jacot, 1936a).

Note: On the postero-lateral side of the opisthosoma is a "sensory pit" which is absent in Jacot's illustration of this species.

* *Parhypochthonius aphidinus* Berlese, 1904 -- Sites 1, 3 (M, N, $L-F_1$, F_2-H, A_2-B), 229 ex.

Determination: from Baker and Wharton (1952).

Type described from: Italy?

Distribution: Italy, Germany (Willmann, 1931); represented in the United States in isolated collections (Woolley, 1961); these mites [Palaeacaridae *s.l.*] are little known and have been seen by only a few acarologists (Baker and Wharton, 1952).

Habitat: in forest soil and debris (Baker and Wharton, 1952).

3. HYPOCHTHONOIDEA Balogh, 1961.

HYPOCHTHONIIDAE Berlese, 1910.

Hypochthonius rufulus (Koch, 1836) -- Sites 1, 2, 3 (M, N, L-F_1), 111 ex.

Determination: from Willmann (1931).

Type described from: Germany.

Distribution: Iceland, Faroes, Europe (Hammer, 1952); Michigan (Wallwork, 1957); Connecticut (Jacot, 1935, as subsp. *paucipectinatus*); New York State (Jacot, 1935; Sengbusch, 1954; Hartenstein, 1962); Tennessee (Crossley and Bohnsack, 1960); North Carolina (Jacot, 1936a, as subsp. *carolinicus*); Virginia (Sengbusch, 1957); Alaska (Hammer, 1955); in Canada from Yellow Knife in the North West Territories (Hammer, 1952).

Habitat: in moss and lichen (Hammen, 1952; Hammer, 1952); in bog (Tarras-Wahlberg, 1961); in grassland and fen (Evans *et al*., 1961); in forest litter (Wallwork, 1957; Moritz, 1963).

ENIOCHTHONIIDAE, Grandjean, 1957.

Eniochthonius minutissimus (Berlese, 1904) -- Sites 1, 2, 3 (M, L-F_1, F_2-H, A_2-B), 352 ex.

Determination: from Balogh (1963).

Type described from: England.

Distribution: Central Europe (Hammer, 1952, as

Hypochthoniella pallidula); Chile (Hammer, 1962); Michigan (Wallwork, 1957, as *H. pallidula*) and in Canada from Yellow Knife in the North West Territories and Churchill in Manitoba (Hammer, 1952, as *H. pallidula*).

Habitat: in moss (Willmann, 1931; Hammer, 1952, as *H. pallidula*), in litter (Nosek, 1957; Wallwork, 1957, as *H. pallidula*); in moss under vegetation (Hammer, 1962) in fen (Evans *et al.*, 1961).

Note: There has been a great deal of confusion, in the literature, as to the actual name of this species (*cf.* Hammen, 1952; Hammer, 1952, 1962). Recently it has been listed under the name *E. minutissimus*, but D. E. Johnston (*in litt.*, 1964) is of the opinion that *Eniochthonius* is invalid and *Hypochthoniella* should be re-established.

BRACHYCHTHONIIDAE Balogh, 1943.

Brachychthonius berlesei Willmann, 1928 -- Sites 2, 3 ($L-F_1$, F_2-H, A_2-B), 32 ex.

Determination: from Jacot (1938).

Type described from: Italy.

Distribution: Europe (Hammer, 1952); North Carolina (Jacot, 1938, as *Brachychochthonius berlesei*); in Canada from Yellow Knife and Coppermine in the North West Territories (Hammer, 1952, as *Brachychochthonius berlesei*).

Habitat: moss in meadow (Hammer, 1952); in bog (Willmann, 1931); in forest litter (Jacot, 1938; Forsslund, 1945a; Evans, et al., 1961; Moritz, 1963).

Note: Specimens agree with B. berlesei ssp. erosus (Jacot, 1938).

*Brachychthonius italicus, Berlese, 1910 -- Site 3 (L-F_1), 15 ex.

Determination: from Jacot (1936b).

Type described from: Italy.

Distribution: Southern Europe and Germany (Hammen, 1952); North Carolina (Jacot, 1936b; 1938, as Brachychochthonius italicus).

Habitat: in forest litter (Jacot, 1936b; Hammen, 1952; Moritz, 1963).

Note: The specimens agree with the description of B. italicus spiciger Jacot (1936b).

Brachychthonius jugatus (Jacot, 1938) -- Sites 1, 2, 3 (L, N, L-F_1, F_2-H, A_2-B), 765 ex.

Determination: from (Hammer, 1952).

Type described from: North Carolina.

Distribution: Europe (Hammer, 1952); Michigan (Wallwork, 1957); North Carolina (Jacot, 1938, as Brachychochthonius jugatus); in Canada from Yellow Knife and Reindeer Station in the North West Territories (Hammer, 1952, as Brachychochthonius jugatus).

Habitat: in moss, grassland and in woodland (Haarløv, 1957).

<u>Brachychthonius</u> <u>rostratus</u> Jacot, 1936 -- Site 3 (L-F_1), 19 ex.

Determination: from Jacot (1936b).

Type described from: North Carolina.

Distribution: probably in Europe as <u>B</u>. <u>hungarius</u> Balogh, 1934 (<u>cf</u>. Hammer, 1952); North Carolina (Jacot, 1936b); in Canada from Richardson Mountains in the North West Territories (Hammer, 1952, as <u>Brachychochthonius</u> <u>rostratus</u>).

Habitat: in heath vegetation with moss and lichen (Hammer, 1952); in grassland (Jacot, 1936b).

*<u>Brachychthonius</u> <u>zelawaiensis</u> Sellnick, 1928 -- Sites 2, 3 (L-F_1, F_2-H), 76 ex.

Determination: from Willmann (1931).

Type described from: Central Europe.

Distribution: Greenland, Sweden (Forsslund, 1945a); Germany (Willmann, 1931); North Carolina (Jacot, 1938, as <u>Brachychochthonius</u> <u>zelawaiensis</u>).

Habitat: in bog (Willmann, 1931); in forest litter (Forsslund, 1945a; Evans <u>et</u> <u>al</u>., 1961).

*<u>Brachychthonius</u> sp., ? <u>nov</u>. -- Site 3 (L-F), 4 ex.

Determination: from Balogh (1963).

<u>Eobrachychthonius</u> <u>latior</u> Berlese, 1910 -- Sites 1, 2 (L, L-F_1, F_2-H, A_2-B), 140 ex.

Determination: from Forsslund (1957).

Type described from: Florida.

Distribution: Jan Mayen, Spitzbergen, Sweden, Belgium, Germany, Italy and the British Isles, Greenland, Illinois (Forsslund, 1957); North Carolina (Jacot, 1936a, as E. sexnotatus); in Canada from Richardson Mountains, North West Territories (Hammer, 1952, as E. sexnotatus).

Habitat: in moss, in grassland soil, Cassiope, Sphagnum, humus under Calluna, raw humus of needles and mixed wood, especially the H-layer, in heaps of leaves, root-neck of stem (Forsslund, 1957).

*Linochthonius sp., ? altimonticola (Hammer, 1958) -- Site 3 ($L-F_1$), 1 ex.

Determination: from Hammer (1958).

Type (of L. altimonticola) described from: Argentine and Bolivia.

Distribution (of L. altimonticola): Chile, Argentine, Bolivia (Hammer, 1962a).

Habitat (of L. altimonticola): near beach, in moss and soil with low vegetation (Hammer, 1958, 1962), in moss in dense wood (Hammer, 1962a).

*Linochthonius sp., ? latus (Jacot, 1936) -- Sites 2, 3 ($L-F_1$, F_2-H, A_2-B), 249 ex.

Determination: from Jacot (1936b).

Type (of L. latus) described from: North Carolina.

Distribution (of *L. latus*): North Carolina only (Jacot, 1936b, as *Brachychthonius latus*).

Habitat (of *L. latus*): forest litter (Jacot, 1936b).

Note: Jacot (1936b) described and figured a specimen which he referred to as *Brachychthonius perpusillus* sp. *nov*. in the caption to his plate. In the same paper a new species *B. latus* was described but not figured. Since *B. perpusillus* was described by Berlese, 1910 and Jacot's figure of *B. perpusillus* does not agree with the one given by Hammer (1952), it would appear that there is an error in Jacot's publication and the figure of "*B. perpusillus*" was intended for *B. latus*. Furthermore, the description given for *B. latus* seems more applicable to *B. perpusillus* and *vice versa*.

Linochthonius ocellatus (Hammer, 1952) -- Site 2 ($L\text{-}F_1$), 1 ex.

Determination: from Hammer (1952).

Type described from: Yellow Knife, Canada.

Distribution: Northern Canada only (Hammer, 1952, as *Brachychthonius ocellatus*).

Habitat: moss in meadow with *Myrica*, *Betula nana*, *Arctostaphylos*, *Carex*, etc. (Hammer, 1952).

* *Linochthonius pilosetosus* Forsslund, 1942 -- Sites 1, 2, 3 (M, $L\text{-}F_1$, $F_2\text{-}H$), 27 ex.

Determination: D. E. Johnston.

Type described from: Sweden.

Distribution: Sweden (Forsslund, 1942).

Habitat: Soil ?

Linochthonius scalaris Forsslund, 1942 -- Sites 1, 2, 3 (M, L-F_1, F_2-H, A_2-B), 251 ex.

Determination: from Hammer (1952).

Type described from: Sweden.

Distribution: Europe (Hammer, 1952, as Brachychthonius scalaris); Alaska (Hammer, 1955, as B. scalaris); in Canada from Coppermine, Richardson Mountains and Reindeer Station in the North West Territories and Churchill in Manitoba (Hammer, 1952).

Habitat: moss, grassland, moorland (Haarløv, 1957, as B. scalaris).

*Linochthonius sp., ? nov. -- Sites 2, 3 (L-F_1, A_2-B), 11 ex.

Determination: from Balogh (1963).

*Synchthonius crenulatus (Jacot, 1938) -- Sites 2, 3 (L-F_1, F_2-H, A_2-B), 266 ex.

Determination: D. E. Johnston.

Type described from: North Carolina.

Distribution: in Europe (D. E. Johnston, personal communication, 1964); North Carolina (Jacot, 1938).

Habitat: in dogwood litter (Jacot, 1938).

HETEROCHTHONIIDAE Grandjean, 1954.

*Heterochthonius sp., ? nov. -- Site 3 (L-F_1, F_2-H, A_2-B), 45 ex.

Determination: from Balogh (1963).

ATOPOCHTHONIIDAE Grandjean, 1948.

*Atopochthonius artiodactylus Grandjean, 1948 -- Sites 1, 2, 3 (M, L-F_1, F_2-H, A_2-B), 18 ex.

Determination: from Forsslund (1956).

Type described from: Italy.

Distribution: Sweden (Forsslund, 1956); Germany (Moritz, 1963); Italy (Grandjean, 1948).

Habitat: rotting chestnut stump with humus and moss (Grandjean, 1948); in humus under shrubs and grass, in humus under spruce where the species may be found 40 cm. deep; in raw humus under pine (Forsslund, 1956).

PTEROCHTHONIIDAE, Grandjean, 1950.

*Pterochthonius angelus (Berlese, 1910) -- Sites 2, 3 (L-F_1), 38 ex.

Determination: from Baker and Wharton (1952).

Type described from: Italy.

Distribution: western Europe and the mountains of Mexico (Baker and Wharton, 1952).

Habitat: soil ?

4. PHTHIRACAROIDEA Grandjean, 1954.

PHTHIRACARIDAE, Perty, 1841.

*Phthiracarus olivaceum Jacot, 1929 -- Site 1 (L, M, N), 9 ex.

Determination: Jacot (1930).

Type described from: Connecticut.

Distribution: New York State, Connecticut (Jacot, 1930).

Habitat: from wood and from the forest floor (Jacot, 1930).

*Phthiracarus setosellum Jacot, 1929 -- Sites 1, 2 (L, M, L-F_1), 5 ex.

Determination: from Jacot (1930).

Type described from: New York State.

Distribution: New York State, Connecticut (Jacot, 1930).

Habitat: in swamp and in woodland (Jacot, 1930).

*Phthiracarus sp., ? sphaerulum (Banks, 1895) -- Sites 1, 2, 3 (L, M, L-F_1), 16 ex.

Determination: from Jacot (1930).

Type (of Ph. sphaerulum) described from: New York State.

Distribution (of Ph. sphaerulum): New York State, Connecticut (Jacot, 1930).

Habitat (of Ph. sphaerulum): in swamp, in forest litter, under board (Jacot, 1930).

*Phthiracarus sp., ? nov. -- Sites 1, 2 (L, L-F), 2 ex.

Determination: from Balogh (1963).

*Steganacarus diaphanum Jacot, 1930 -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 240 ex.

Determination: D. E. Johnston.

Type described from: Connecticut.

Distribution: Connecticut, Maine (Jacot, 1930); New York State (Hartenstein, 1962, 1962b).

Habitat: in _Sphagnum_ swamp (Jacot, 1930); in woodland litter (Jacot, 1930; Hartenstein, 1962).

EUPHTHIRACARIDAE, Jacot, 1930.

* _Euphthiracarus_ _flavus_ (Ewing, 1908) -- Sites 2, 3 (L-F_1, F_2-H, A_2-B), 14 ex.

Determination: D. E. Johnston.

Type described from: Illinois.

Distribution: Illinois and New York State, Connecticut (Jacot, 1930).

Habitat: in moss (Ewing, 1908); in hemlock leaf mould (Jacot, 1930).

Euphthiracarus sp. -- Sites 2, 3 (L-F_1, F_2-H, A_2-B), 62 ex.

Determination: from Balogh (1963).

Note: These were nymphs, therefore specific identification was impossible.

* _Rhysotritia_ _cf_. _ardua_ (Koch, 1841) -- Sites 1, 2, 3 (M, L-F_1), 14 ex.

Determination: D. E. Johnston.

Type (of _R_. _ardua_) described from: Germany.

Distribution (of _R_. _ardua_): a widely distributed and protean species: common in Europe, throughout temperate Eurasia and most of temperate North

America (Jacot, 1930, as Pseudotritia ardua).

Habitat (of R. ardua): most ubiquitous species of the family being found in all possible situations (Jacot, 1930); moss (Sengbusch, 1951; Hammen, 1952); bog (Tarras-Wahlberg, 1961); in grassland (Wallwork and Rodriguez, 1961), forest litter (Sengbusch, 1957; Hartenstein, 1962; Moritz, 1963). As Pseudotritia ardua by all the above authors.

5. PERLOHMANNIOIDEA Grandjean, 1958.

EPILOHMANNIIDAE Oudemans, 1923.

*Epilohmannia cylindrica Berlese, 1910 -- Site 2 ($L\text{-}F_1$), 1 ex.

Determination: from Baker and Wharton (1952).

Type described from: Italy ?

Distribution: Europe (Wallwork, 1962c); Tennessee (Crossley and Bohnsack, 1960).

Habitat: in forest litter (Crossley and Bohnsack, 1960).

EULOHMANNIIDAE Grandjean, 1931.

Eulohmannia ribagai Berlese, 1910 -- Site 1 (M, N), 9 ex.

Determination: from Willmann (1931).

Type described from: Italy ?

Distribution: Europe (Hammer, 1952); Alaska (Hammer, 1955); in Canada from Reindeer Station, North West Territories (Hammer, 1952).

Habitat: in moss and lichen (Hammer, 1952); in grassland (Evans et al., 1961); in forest litter (Forsslund, 1945a; Dalenius, 1963; Moritz, 1963).

6. NOTHROIDEA Grandjean, 1954.

NOTHRIDAE Berlese, 1896.

*Nothrus gracilis Hammer, 1961 -- Sites 1, 2 (L, M, N, $L-F_1$, F_2-H, A_2-B), 110 ex.

Determination: from Hammer (1961).

Type described from: Marcona, Peru.

Distribution: Peru only (Hammer, 1961).

Habitat: wet meadow with moss and little grass (Hammer, 1961).

*Nothrus silvestris Nicolet, 1855 -- Sites 1, 2, 3 (M, N, $L-F_1$, F_2-H, A_2-B), 95 ex.

Determination: from Sellnick and Forsslund (1955).

Type described from: France ?

Distribution: Jan Mayen, throughout Europe, Algeria, Mexico (Sellnick and Forsslund, 1955), Michigan (Wallwork, 1957); Connecticut (Jacot, 1937); Virginia (Sengbusch, 1957).

Habitat: in moss (Willmann, 1931; Sellnick and Forsslund, 1955); in heathland (Evans et al., 1961); in bog and grassland (Haarløv, 1957); in litter and humus of coniferous and deciduous forest (Evans et al., 1961; Moritz, 1963).

TRHYPOCHTHONIIDAE Willmann, 1931.

<u>Trhypochthonius</u> <u>tectorum</u> (Berlese, 1896) -- Sites 2, 3 (L-F_1, F_2-H, A_2-B), 80 ex.

Determination: from Willmann (1931).

Type described from: Italy.

Distribution: Iceland, Faroes, Europe (Hammer, 1952); Peru (Hammer, 1961); Alaska (Hammer, 1955); in Canada from Richardson Mountains and Yellow Knife in the North West Territories and Churchill in Manitoba (Hammer, 1952).

Habitat: in moss (Willmann, 1931; Hammer, 1952, 1955, 1961); in <u>Cassiope</u>, liverwort and <u>Polytrichum</u>, in grass, in dead leaves (Hammer, 1952).

MALACONOTHRIDAE Berlese, 1916.

<u>Malaconothrus</u> sp., ? <u>molliseptosus</u> Hammer, 1952 -- Sites 2, 3 (L-F_1, A_2-B), 30 ex.

Determination: from Hammer (1952).

Type (of <u>M</u>. <u>molliseptosus</u>) described from: Northern Canada.

Distribution (of <u>M</u>. <u>molliseptosus</u>): Sweden, Argentine (Hammer, 1958); Peru (Hammer, 1961); Alaska (Hammer, 1955); in Canada from Yellow Knife in the North West Territories and Churchill in Manitoba (Hammer, 1952).

Habitat (of <u>M</u>. <u>molliseptosus</u>): in wet <u>Juncus</u> and <u>Ranunculus</u> (Hammer, 1958); in moss (Hammer, 1952, 1958); in meadow (Hammer, 1952); in grassland (Hammer, 1961).

Malaconothrus sp.$_1$ -- Sites 2, 3 (L-F_1, F_2-H), 38 ex.

Determination: from Balogh (1963).

Malaconothrus sp.$_2$ -- Site 2 (L-F_1), 1 ex.

Determination: from Balogh (1963).

Trimalaconothrus sp. -- Site 2 (L-F_1, F_2-H), 6 ex.

Determination: from Balogh (1963).

NANHERMANNIIDAE Sellnick, 1928.

* *Nanhermannia elegantula* Berlese, 1913 -- Sites 1, 2, 3 (L, L-F_1, F_2-H, A_2-B), 59 ex.

Determination: from Woolley and Higgins (1958).

Type described from: Italy.

Distribution: in Europe from southern Sweden to Italy; Washington State, Colorado, Idaho, North Carolina (Woolley and Higgins, 1958); Virginia (Sengbusch, 1957); Tennessee (Crossley and Bohnsack, 1960); New York State (Hartenstein, 1962).

Habitat: saline woods along the sea coast, in detritus and humus (Woolley and Higgins, 1958); in forest soils (Woolley and Higgins, *op. cit.*; Crossley and Bohnsack, 1960; Hartenstein, 1962).

* *Nanhermannia* sp.,? *nana* (Nic., 1855) Berlese, 1913 -- Sites 2, 3 (L-F_1, F_2-H, A_2-B), 43 ex.

Determination: from Woolley and Higgins (1958).

Type (of *N. nana*) described from: France ?

Distribution (of *N. nana*): Europe, Peru (Hammer, 1961); Chile (Hammer, 1962); Washington State, Maryland (Wooley and Higgins, 1958); Virginia (Sengbusch, 1957).

Habitat (of N. nana): in wet situations (Hammen, 1952; Hammer, 1961, 1962); in moss and lichen (Sengbusch, 1957); in forest litter (Nosek, 1957; Wallwork, 1957).

ii. ORIBATEI SUPERIOR

(a) PYCNONOTICAE

7. LIODOIDAE Balogh, 1961.

PLASMOBATIDAE Grandjean, 1961.

*? Plasmobates sp. -- Site 2 (F_2-H), 1 ex.

Determination: from Balogh (1961).

GYMNODAMAEIDAE Grandjean, 1954.

*Gymnodamaeus sp. ? nov. -- Sites 2, 3 (L-F_1), 18 ex.

Determination: from Balogh (1963)

8. DAMAEOIDEA Balogh, 1961.

DAMAEIDAE Berlese, 1896.

Belba sp.$_1$ -- Site 2 (L-F_1), 1 ex.

Determination: from Balogh (1963).

Note: D. E. Johnston (in litt., 1964) is of the opinion that this is an Oppia; see also note under Oppia maculata, page 78.

Belba sp.$_2$ -- Site 3 (L-F_1), 1 ex.

Determination: from Balogh (1963).

9. CEPHEOIDEA Balogh, 1961.

CEPHEIDAE Berlese, 1896.

Cepheus corae Jacot, 1928 -- Sites 2, 3 ($L-F_1$, A_2-B),

Determination: from Hammer (1955).

Type described from: Maine and Connecticut.

Distribution: Alaska (Hammer, 1955); Minnesota (Freeman, 1952); Michigan (Wallwork, 1957); Maine and Connecticut (Jacot, 1928); *C. corae* appears to be indigenous to North America (Woolley, 1961).

Habitat: in moss, lichen, dead trees, under grass, in spruce needles, *Sphagnum*, wood (Hammer, 1955); in humus (Wallwork, 1957); in laboratory (?)[a] (Hammer, 1955).

Note: This species is an intermediate host of tapeworms (Freeman, 1952).

[a]The question mark by Hammer (1955).

10. EREMAEOIDEA, Woolley, 1956.

EREMOBELBIDAE Balogh, 1961.

Eremobelba flagellaris Jacot, 1938 -- Sites 1, 2 (M, N, $L-F_1$), 25 ex.

Determination: D. E. Johnston.

Type described from: North Carolina.

Distribution: North Carolina only (Jacot, 1938a, as *E. leprosus flagellaris*).

Habitat: white oak litter (Jacot, 1938a).

11. LIACAROIDEA Balogh, 1961.

LIACARIDAE Sellnick, 1928.

*<u>Adorestes</u> <u>ovatus</u> (Koch, 1840) -- Sites 2, 3 ($L-F_1$, F_2-H), 48 ex.

Determination: from Willmann (1931).

Type described from: Germany.

Distribution: Sweden (Forsslund, 1945a; Tarras-Wahlberg, 1961); Denmark (Haarløv, 1957); Netherlands (Hammen, 1952); Germany (Moritz, 1963); England (Evans <u>et</u> <u>al</u>., 1961).

Habitat: in moss, fallen trees, leaves (Willman, 1931); in bog (Tarras-Wahlberg, 1961); moorland and woodland (Haarløv, 1957; Evans <u>et</u> <u>al</u>., 1961).

Note: This species is an intermediate host of tapeworms (Allred, 1954).

<u>Liacarus</u> $sp._1$ -- Site 1 (M), 3 ex.

Determination: from Balogh (1963).

Note: Species in the genus <u>Liacarus</u> are badly in need of revision (D. E. Johnston, <u>in</u> <u>litt</u>., 1964).

<u>Liacarus</u> $sp._2$ -- Site 1 (M), 1 ex.

Determination: from Balogh (1963).

Note: See <u>Liacarus</u> $sp._1$ above.

ASTERGISTIDAE Balogh, 1961.

*<u>Cultroribula</u> <u>trifurca</u> Jacot, 1939 -- Sites 1, 2 (L, M, N, $L-F_1$, F_2-H, A_2-B), 42 ex.

Determination: D. E. Johnston.

Type described from: North Carolina.

Distribution: North Carolina only (Jacot, 1939b, as subsp. trifurcatus).

Habitat: litter ?

12. CARABODOIDEA Woolley, 1956.

CARABODIDAE, Willmann, 1931.

Carabodes labyrinthicus (Michael, 1879) -- Site 3 ($L-F_1$), 1 ex.

Determination: from Sellnick and Forsslund (1953).

Type described from: England.

Distribution: Europe (Sellnick and Forsslund, 1953); Greenland, Lapland (Hammer, 1952); Alaska (Hammer, 1955); in Canada from Yellow Knife in the North West Territories (Hammer, 1952).

Habitat: in moss and lichen (Hammer, 1952, 1955); in soil under coniferous and deciduous trees, under bark, in rotting wood in moss, in litter (Sellnick and Forsslund, 1953); "ground cover leaves, lab." (?)[a] (Hammer, 1955).

[a]The question mark by Hammer (1955).

*Carabodes sp. ? nov. -- Site 3 (A_2-B), 2 ex.

Determination: from Balogh (1963).

TECTOCEPHEIDAE Grandjean, 1954.

Tectocepheus velatus (Michael, 1880) -- Sites 1, 2, 3 (L, M, N, $L-F_1$, F_2-H, A_2-B), 2060 ex.

Determination: D. E. Johnston.

Type described from: England.

Distribution: Jan Mayen, throughout Europe, Greenland (Hammer, 1952); Michigan (Wallwork, 1957); New York State (Jacot, 1937, as subsp. expansus); Tennessee (Crossley and Bohnsack, 1960); Virginia (Sengbusch, 1957); Kentucky (Wallwork and Rodriguez, 1961); throughout Northern Canada (Hammer, 1952).

Habitat: an almost ubiquitous species: pond shore (Haarløv, 1957); moss, liverwort, lichen (Hammer, 1952); bog (Tarras-Wahlberg, 1961); mineral soil (Davis, 1963); forest litter (Nosek, 1957; Crossley and Bohnsack, 1960; Moritz, 1963, and others).

Note: This genus contains several very similar species which have been confused with *T. velatus* (Johnston, *in litt.*, 1964). More than one species may be represented in the material from Morgan Arboretum. Both "impressed" and "smooth" forms referred to by Jacot (1937) were observed.

13. OPPIOIDEA Balogh, 1961.

OPPIIDAE Grandjean, 1954.

Oppia maculata Hammer, 1952 -- Sites 1, 2 (L, L-F_1), 26 ex.

Determination: from Hammer (1952).

Type described from: Northern Canada.

Distribution: Reindeer Station and Yellow Knife in the North West Territories, and Churchill in Manitoba

(Hammer, 1952).

Habitat: moss, lichen, liverwort, in Sphagnum, in heath-like vegetation (Hammer, 1952).

Note: Balogh (1961) listed Dissorhina Hull, 1916 as a synonym of Oppia Koch, 1836. However, D. E. Johnston (in litt., 1964) is of the opinion that the small Oppiae, such as O. nova, are more properly placed in Dissorhina.

Oppia manifera Hammer, 1952 -- Sites 2, 3 ($L-F_1$, F_2-H, A_2-B), 82 ex.

Determination: from Hammer (1955).

Type described from: Alaska.

Distribution: Alaska only (Hammer, 1955).

Habitat: lichen, grass, wood (Hammer, 1955).

Oppia minor (Paoli, 1908) -- Sites 1, 2, 3 (L, $L-F_1$, F_2-H, A_2-B), 2499 ex.

Determination: Hammer (1952).

Type described from: Italy and North America ?

Distribution: Europe (Hammer, 1952); North Carolina (Jacot, 1938a, as subsp. simplex); in Canada from Yellow Knife in the North West Territories (Hammer, 1952).

Habitat: pond shore, flooded pasture (Haarløv, 1957); in leaf litter with Vaccinum, moss and liverwort (Hammer, 1952); in woodland (Haarløv, 1957; Moritz, 1963, as O. minus); "an Rebwurzeln" (Willmann, 1931). This species may occur down to a depth of 15 cm. in soil (Haarløv, 1957).

Oppia nova (Oudemans, 1902) -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 3613 ex.

Determination: from Hammen (1952).

Type described from: Netherlands.

Distribution: widely distributed in Europe (Hammen, 1952; Hammer, 1952, as O. neerlandica); Sunda Islands (Hammen, 1952); Peru, Bolivia, Argentina, Chile (Hammer, 1962, as O. neerlandica); Patagonia (Hammer, 1962a, as Oppiella nova); Minnesota (Woodring and Cook, 1962, as O. neerlandica); Michigan (Wallwork, 1957, as O. neerlandica); New York State (Hartenstein, 1962); Kentucky (Wallwork and Rodriguez, 1961); Virginia (Sengbusch, 1957); throughout Northern Canada (Hammer, 1952).

Habitat: almost ubiquitous: pond shore (Haarløv, 1957); in moss, Sphagnum (Hammen, 1952); in grassland (Wallwork and Rodriguez, 1961; Woodring and Cook, 1962); in mineral soil (Davis, 1963); in forest litter (Hammen, 1952; Moritz, 1963 and others).

Note: O. nova seems to be a variable species and has been recorded under a number of different names (cf. Hammen, 1952). Oppia washburni Hammer, 1952, 1955, for example, appear to be crushed specimens of O. nova.

*Oppia unicarinata (Paoli, 1908) -- Sites 2, 3 (L-F_1,

A_2-B), 150 ex.

Determination: from Willmann (1931).

Type described from: Italy and North America ?

Distribution: Germany (Willmann, 1931); Netherlands (Hammen, 1952); Italy, North America (Paoli, 1908).

Habitat: in moss (Willmann, 1931; Hammen, 1952); in forest (Willmann, 1931).

*Oppia sp., ? nov. -- Sites 2, 3 (L-F_1, A_2-B), 37 ex.

Determination: from Balogh (1963).

*Quadroppia circumita (Hammer, 1961) -- Sites 1, 2, 3 (M, L-F_1), 35 ex.

Determination: from Hammer (1961).

Type described from: Peru.

Habitat: in moss (Hammer, 1961).

Note: This is probably the same species mentioned as Oppia quadricarinata ferrumequina by Jacot (1938a).

SUCTOBELBIDAE Grandjean, 1954.

*Suctobelba frothinghami (Jacot, 1937) -- Sites 2, 3 (L-F_1, F_2-H, A_2-B), 263 ex.

Determination: from Jacot (1937).

Type described from: North Carolina.

Distribution: North Carolina only (Jacot, 1937, as Suctobelbella frothinghami).

Habitat: in deciduous and coniferous woodland litter (Jacot, 1937).

Suctobelba gigentea Hammer, 1955 -- Site 2 (L-F_1), 2 ex.

Determination: from Hammer (1955).

Type described from: Alaska.

Distribution: Alaska only (Hammer, 1955).

Habitat: "no information as to biotope" (Hammer, 1955).

**Suctobelba hurshi* (Jacot, 1937) -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 367 ex.

Determination: from Jacot (1937).

Type described from: North Carolina.

Distribution: North Carolina only (Jacot, 1937, as *Suctobelbella hurshi*).

Habitat: in pasture sod (Jacot, 1937).

**Suctobelba laxtoni* (Jacot, 1937) -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 1205 ex.

Determination: from Jacot (1937).

Type described from: North Carolina.

Distribution: North Carolina only (Jacot, 1937, as *Suctobelbella laxtoni*).

Habitat: in pasture sod (Jacot, 1937).

**Suctobelba longicuspis* (Jacot, 1937) -- Sites 1, 2, 3 (L, M, L-F_1, F_2-H, A_2-B), 599 ex.

Determination: from Jacot (1937).

Type described from: North Carolina.

Distribution: North Carolina (Jacot, 1937, as *Suctobelbella longicuspis*); New Hampshire (Jacot, 1939a, as *Suctobelbella longicuspis lanceolata*).

Habitat: in litter and humus (Jacot, 1937, 1939a).

**Suctobelba* sp.$_1$, ? *nov*. -- Sites 2, 3 (F_2-H), 7 ex.

Determination: from Balogh (1963).

**Suctobelba* sp.$_2$, ? *nov*. -- Sites 1, 2, 3 (L, L-F_1, F_2-H, A_2-B), 507 ex.

Determination: from Balogh (1963).

**Suctobelba* sp.$_3$, ? *nov*. -- Sites 1, 2, 3 (M, L-F_1, F_2-H), 118 ex.

Determination: from Balogh (1963).

**Suctobelba* sp.$_4$, ? *nov*. -- Sites 1, 2, 3 (L, L-F_1, F_2-H, A_2-B), 315 ex.

Determination: from Balogh (1963).

**Suctobelba* sp.$_5$, ? *nov*. -- Sites 2, 3 (F_2-H), 90 ex.

Determination: from Balogh (1963).

**Suctobelba* sp.$_6$, ? *nov*. -- Sites 1, 2, 3 (L, L-F_1), 8 ex.

Determination: from Balogh (1963).

**Suctobelba* sp.$_7$, ? *nov*. -- Sites 2, 3 (L-F_1, F_2-H, A_2-B), 32 ex.

Determination: from Balogh (1963).

**Suctobelba* sp.$_8$, ? *nov*. -- Site 2 (F_2-H), 12 ex.

Determination: from Balogh (1963).

**Suctobelba* sp.$_9$, ? *nov*. -- Site 2 (L-F_1, F_2-H), 6 ex.

Determination: from Balogh (1963).

**Suctobelba* sp.$_{10}$, ? *nov*. -- Sites 1, 3 (L, N, F_2-H), 13 ex.

Determination: from Balogh (1963).

*Suctobelba sp.$_{11}$, ? nov. -- Site 2 (L-F_1), 1 ex.

Determination: from Balogh (1963).

*Suctobelba sp.$_{12}$, ? nov. -- Site 3 (L-F_1), 2 ex.

Determination: from Balogh (1963).

*Suctobelba sp.$_{13}$, ? nov. -- Sites 1, 2, 3 (L, N, L-F_1, F_2-H, A_2-B), 32 ex.

Determination: from Balogh (1963).

*Suctobelba sp.$_{14}$, ? nov. -- Site 2 (L-F_1, F_2-H), 62 ex.

Determination: from Balogh (1963).

(b) PORONOTICAE

14. ORIBATELLOIDEA Woolley, 1957.

ACHIPTERIIDAE Thor, 1929.

Achipteria coleoptrata (Linné) -- Site 3 (A_2-B), 1 ex.

Determination: from Hammer (1952).

Type described from: Europe.

Distribution: Iceland, Faroes, Europe (Hammer, 1952); an almost ubiquitous species (Haarløv, 1957); Michigan (Wallwork, 1959); in Canada from Churchill, Manitoba (Hammer, 1952).

Habitat: in moss (Willmann, 1931, as Notaspis coleoptrata); in meadow (Hammer, 1952); in pasture, thicket and pond shore (Haarløv, 1957); in forest litter (Moritz, 1963).

ORIBATELLIDAE Jacot, 1925.

Oribatella reticuloides Hammer, 1955 -- Site 2 (L-F_1), 6 ex.

Determination: from Hammer (1955).

Type described from: Alaska.

Distribution: Alaska only (Hammer, 1955).

Habitat: AIP Lab. in 83 Gen. Hosp. (?)[a]

[a]The question mark is by Hammer (1955).

15. CERATOZETOIDEA Balogh, 1961.

CERATOZETIDAE Jacot, 1925.

Ceratozetes sp. -- Sites 1, 2, 3 (L, M, L-F_1, F_2-H, A_2-B), 493 ex.

Determination: from Balogh (1963).

*Fuscozetes bidentatus (Banks, 1895) -- Sites 2, 3 (L-F_1, F_2-H), 47 ex.

Determination: D. E. Johnston.

Type described from: New York State.

Distribution: New York State only (Banks, 1895, as Oribatella bidentata).

Habitat: moss (Banks, 1895).

CHAMBOBATIDAE, Grandjean, 1954.

Chambobates sp. -- Sites 1, 2, 3 (L, M, L-F_1), 8 ex.

Determination: from Balogh (1963).

16. GALUMNOIDEA Balogh, 1961.

PARAKALUMNIDAE Grandjean, 1936.

? Neoribates sp. -- Site 1 (N), 1 ex.

Determination: from Balogh (1963).

Note: This specimen was badly crushed.

*Protokalumna depressum (Banks, 1895) -- Site 3 (L-F_1), 1 ex.

Determination: D. E. Johnston.

Type described from: New York State.

Distribution: New York State only (Banks, 1895, as *Oribata depressa*).

Habitat: in moss on tree (Sengbusch, 1951).

GALUMNIDAE Grandjean, 1936.

**Pergalumna emarginatus* (Banks, 1895) -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 96 ex.

Determination: D. E. Johnston.

Type described from: United States.

Distribution: Illinois, New York State, Texas (Banks, 1895, as *Oribata emarginata*).

Habitat: moss (Banks, 1895).

17. ORIBATULOIDEA Woolley, 1956.

ORIBATULIDAE Jacot, 1929.

**Oribatula minuta* (Ewing, 1909) -- Site 3 (L-F_1, F_2-H), 58 ex.

Determination: from Woolley (1961a).

Type described from: Illinois.

Distribution: Illinois (Woolley, 1961a); New York State (Sengbusch, 1951; Hartenstein, 1962); Maryland (Kates and Runkel, 1948); Texas (Melvin, 1952); Virginia (Sengbusch, 1957).

Habitat: in moss (Sengbusch, 1957); in grassland (Kates and Runkel, 1948; Melvin, 1952); forest litter (Hartenstein, 1962).

Note: This species is an intermediate host of tapeworms (Kates and Runkel, 1948; Melvin, 1952).

Scheloribates pallidulus (Koch, 1840) -- Sites 1, 2, 3 (L, M, L-F_1, F_2-H, A_2-B), 333 ex.

Determination: from Hammer (1952).

Type described from: Germany.

Distribution: Europe (Hammer, 1952); Bolivia (Hammer, 1958); Alaska (Hammer, 1955); Michigan (Wallwork, 1957); New York State (Hartenstein, 1962); Virginia (Sengbusch, 1957); in Canada from Yellow Knife, Richardson Mountains and Reindeer Station in the North West Territories; Churchill, Manitoba and Banff, Alberta (Hammer, 1952).

Habitat: in moss (Willmann, 1932; Hammen, 1952; Sengbusch, 1957); in meadow with grass and clover, in Dryas vegetation on sand (Hammer, 1952); in mineral soil (Davis, 1963); in forest litter (Forsslund, 1945a; Nosek, 1957; Wallwork, 1957; Hartenstein, 1962); in dead trees (Willmann, 1931; Hammer, 1955).

HAPLOZETIDAE Grandjean, 1936.

*Peloribates americanus Jacot, 1939 -- Sites 2, 3 (L-F_1), 40 ex.

Determination: D. E. Johnston.

Type described from: New Hampshire.

Distribution: New Hampshire only (Jacot, 1939a, as P. europaeus americanus).

Habitat: in spruce litter (Jacot, 1939a).

*Protoribates capucinus Berlese, 1908 -- Sites 1, 3 (L, M, N, F_2-H), 114 ex.

Determination: from Hammer (1961).

Type described from: Europe or North America ?

Distribution: Italy (Jacot, 1937); Germany (Willmann, 1931); Netherlands, Austria (Hammen, 1952); Peru, "Washington, North America" (Hammer, 1961); Missouri (Jacot, 1937); Virginia (Sengbusch, 1957, as Xylobates capucinus).

Habitat: in moss (Hammen, 1952; Sengbusch, 1957; Hammer, 1961); "an Rebwurzeln" (Willmann, 1931).

*Protoribates lophotrichus Berlese, 1904 -- Sites 1, 2, 3 (M, L-F_1, F_2-H, A_2-B), 291 ex.

Determination: from Willmann (1931).

Type described from: Italy and North America ?

Distribution: Germany (Willmann, 1931); New York State (Hartenstein, 1962, 1962a); Tennessee Crossley and Bohnsack, 1960, as Protoribates lobotrichus [sic.] Berlese); Virginia (Sengbusch, 1957, as Xylobates lophotrichus).

Habitat: in moss (Sengbusch, 1957); in Sphagnum (Willmann, 1931); in forest litter (Sengbusch, 1957; Crossley and Bohnsack, 1960; Hartenstein, 1962).

ORIBATEI UNDETERMINED -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 1199 ex.

3. LIST OF COLLEMBOLA

The Collembola of the three sites is listed in Appendix A, Tables XII-XVII. Fifty-eight species were recorded and they are treated in a similar manner to the Sarcoptiformes above. The families are arranged according to Gisin (1960). At least 5 species appear to be new to science, but further studies are necessary to ascertain their exact status. The authorships and dates of the families are those listed by Maynard (1951) and are not necessarily correct according to the International Code of Zoological Nomenclature.

a. ARTHROPLEONA Börner, 1901

PODURIDAE Lubbock, 1870.

*Anurida caeca (Folsom, 1916) -- Sites 2, 3 (L-F_1, A_2-B), 12 ex.

Determination: W. R. Richards.

Type described from: Illinois.

Distribution: Illinois, Iowa (Mills, 1934).

Habitat: leaf mould (Mills, 1934).

Anurida sp., ? A. granaria Nicolet, 1847 -- Sites 2, 3 (L-F_1, F_2-H), 4 ex.

Determination: W. R. Richards.

Type (of A. granaria) described from: France.

Distribution (of A. granaria): Europe, Asia, Australia, Illinois, Massachusetts, Minnesota, Iowa, New York (Maynard, 1951); in Canada it is known from Ontario (James, 1933), Richardson Mountains, Reindeer Station and Coppermine in the North West Territories (Hammer, 1953); Slidre Fjord, Ellesmere Island (Hammer, 1953a).

Habitat (of A. granaria): under limestone on the Lake Ontario (James, 1933); in lichen, moss, clay soil, in wet ooze with leaves and moss, in heath (Hammer, 1953), from humus soil (Nosek, 1960).

Anurida sp., nr. pygmaea (Börner, 1901) -- Sites 1, 2, 3 (L, L-F_1, F_2-H, A_2-B), 62 ex.

Determination: W. R. Richards.

Type (of A. pygmaea) described from: Germany.

Distribution (of A. pygmaea): from Greenland and Lapland to England, Brittany, Switzerland and Austria (Gisin, 1960); Iowa (Mills, 1934), as Micanurida pygmaea), Connecticut (Bellinger, 1954, as M. pygmaea); in Canada it is known from Reindeer Station and Yellow Knife in the North West Territories and Churchill in Manitoba (Hammer, 1953, as M. pygmaea).

Habitat (of A. pygmaea): in moss, under loose bark of mouldy tree trunks, in needle litter, and vegetable soil (Stach, 1949, as M. pygmaea); in peaty soil (Hammer, 1953, as M. pygmaea), in humus of grassland and forest (Bellinger, 1954, as M. pygmaea; Nosek, 1960).

Friesea sublimis Macnamara, 1921 -- Sites 2, 3 (L-F_1), 31 ex.

Determination: from Gisin (1960).

Type described from: Ontario.

Distribution: New York, Ontario (Maynard, 1951).

Habitat: under bark (Macnamara, 1921).

Hypogastrura sp., ? H. armata (Nicolet, 1841) -- Sites 2, 3 (L-F_1, F_2-H, A_2-B), 111 ex.

Determination: from Gisin (1960).

Type (of H. armata) described from: France ?

Distribution (of H. armata): Europe, Sumatra, Australia, New Zealand, South America, Cuba, widely distributed throughout the United States, Alaska and in Canada from Ontario and British Columbia (Maynard, 1951); Richardson Mountains and Coppermine from the North West Territories and Churchill in Manitoba (Hammer, 1953, as Ceratophysella armata); Slidre Fjord, Ellesmere Island (Hammer, 1953a, as C. armata).

Habitat (of H. armata): on pools of water, in moss, among leaves on moist soil, under bark (Maynard, 1951).

Hypogastrura sp., ? H. manubrialis - group -- Site 2 (L-F_1), 1 ex.

Determination: W. R. Richards.

Note: It is difficult to determine species of this group satisfactorily at present and it would serve no purpose to indicate distribution or habitat since what was formerly known as _H_. _manubrialis_ is now known to comprise a complex of species. The group is widely distributed in the world and occurs in a variety of damp places. It is conceivable that it may have been recorded previously in Canada.

* _Hypogastrura_ sp., ? _nov_. -- Site 2 (L-F_1), 3 ex.

Determination: from Gisin (1960).

Neanura sp., ? _N_. _muscorum_ (Templeton, 1835) -- Site 1 (M), 1 ex.

Determination: from Gisin (1960).

Type (of _N_. _muscorum_) described from: England?

Distribution (of _N_. _muscorum_): Europe, Australia, New Zealand, Mexico, middle and eastern United States (Maynard, 1951); in Canada from Ontario (James, 1933).

Habitat (of _N_. _muscorum_): in moss and humus (Nosek, 1960); under birch bark, cedar stump, damp log (James, 1933); rotten logs, under logs, and leaves in moist soil (Maynard, 1951).

Odontella sp.$_1$ -- Site 2 (L-F_1), 2 ex.

Determination: from Gisin (1960).

Note: The characters for specific determination were not clearly visible. It may have been recorded previously in Canada.

Odontella sp.$_2$ -- Site 2 (F_2-H), 3 ex.

Determination: from Gisin (1960).

Note: As above for Odontella sp.$_1$,

*Pseudachorutes sp., ? P. aurefasciatus (Harvey, 1898) -- Sites 1, 2 (L, L-F_1), 2 ex.

Determination: from Maynard (1951).

Type (of P. aurefasciatus) described from: State of Maine.

Distribution (of P. aurefasciatus): Maine, New York State, Iowa (Maynard, 1951).

Habitat (of P. aurefasciatus): decaying wood (Maynard, 1951).

Note: This material appears to be referable to P. aurefasciatus f. millsi Maynard, 1951, but the determination is still uncertain.

*Pseudachorutes sp., ? P. dilatatus (MacGillivary, 1893) -- Site 2 (L-F_1), 1 ex.

Determination: from Maynard (1951).

Type (of P. dilatatus) described from: New York State.

Distribution (of P. dilatatus): New York State only (Maynard, 1951).

Habitat (of P. dilatatus): soil ?

*Pseudachorutes sp., ? P. simplex Maynard, 1951 -- Sites 1, 2 (M, L-F_1), 2 ex.

Determination: from Maynard (1951).

Type (of P. simplex) described from: New York State.

Distribution (of P. simplex): New York State only (Maynard, 1951).

Habitat (of P. simplex): in moss and on sticks (Maynard, 1951).

*Pseudachorutes sp., ? nov. -- Site 2 (L-F_1), 1 ex.

Determination: from Gisin (1960).

Note: Dr. W. R. Richards (in litt., 1964) is of the opinion that this species is probably new.

Willemia anophthalma Börner, 1901 -- Sites 1, 2, 3 (M, N, L-F_1, F_2-H, A_2-B), 71 ex.

Determination: from Gisin (1960).

Type described from: Germany.

Distribution: from Lapland to Algeria and from the Pyrenees to Poland (Gisin, 1960); Iowa (Mills, 1934, as W. intermedia); Connecticut (Bellinger, 1954, as W. intermedia); from Canada at Reindeer Station, Yellow Knife and Coppermine in the North West Territories (Hammer, 1953).

Habitat: in moss, liverwort, lichen (Hammer, 1953); in grassland (Bellinger, 1954); in forest litter (Stach, 1949; Bellinger, 1954); in humus and in hothouses (Stach, 1949).

ONYCHIURIDAE Börner, 1913.

Onychiurus absoloni (Börner, 1901) Sites 2, 3 (L-F_1, F_2-H), 28 ex.

Determination: from Gisin (1960).

Type (of O. absoloni) described from: Germany.

Distribution (of O. absoloni): from Scandinavia and England to France, Italy and the Caucasus (Gisin, 1960); in Canada from the Rocky Mountains at Banff in Alberta, Yellow Knife in the North West Territories and Churchill in Manitoba (Hammer, 1953).

Habitat (of O. absoloni): moss, liverwort, lichen, in meadow, in clay (Hammer, 1953); in acid soil (Gisin, 1960).

Onychiurus sp., ? O. armatus (Tullberg, 1869) -- Sites 1, 2, 3 (M, L-F_1, F_2-H, A_2-B), 115 ex.

Determination: from Gisin (1960).

Type (of O. armatus) described from: Sweden ?

Distribution (of O. armatus): one of the most widely distributed of Collembola: Europe, Siberia, East Africa, Australia, New Zealand, Chile, widely distributed throughout the United States (Maynard, 1951) and from Canada at Richardson Mountains, Reindeer Station and Coppermine in the North West Territories (Hammer, 1953); Perry River, North West Territories (Mills and Richards, 1953).

Habitat (of O. armatus): on the shore under moss, under leaves and pieces of wood in moist situations, under bark and decaying logs, under stones and flower pots and under debris (Maynard, 1951); in heath and clay soil (Hammer, 1953); heather clump (Mills and Richards, 1953).

Onychiurus sp., O. fimetarius - group -- Sites 1, 2, 3 (M, L-F_1, F_2-H, A_2-B), 61 ex.

Determination: W. R. Richards.

Note: It is difficult to determine species of this group satisfactorily at the present time. This species may have been recorded previously from Canada and elsewhere, but it is not yet possible to be sure. The group is widely distributed in the world and occurs in a variety of damp places including flowerboxes in houses and greenhouses.

Onychiurus subtenuis Folsom, 1917 -- Sites 1, 2, 3 (M, N, L-F_1, F_2-H), 43 ex.

Determination: from Maynard (1951).

Type described from: New York, Pennsylvania, Illinois ?

Distribution: Pennsylvania, Montana, New York, Illinois, Iowa, Utah (Mills, 1934); North Carolina, Maryland (Maynard, 1951); Connecticut (Bellinger, 1954); in Canada from Ontario (James, 1933) and Reindeer Station and Coppermine in the North West Territories (Hammer, 1953).

Habitat: in moss and reindeer lichen, in dead leaves (Hammer, 1952); in leaf mould, under logs and stones (Maynard, 1951); in forest litter (Bellinger, 1954).

Note: Maynard (1951) spells the specific name "subtenius."

*Tullbergia clavata Mills, 1934 -- Sites 1, 2 (L, M, L-F_1, F_2-H), 60 ex.

Determination: from Mills (1934).

Type described from: Iowa.

Distribution: Iowa, New York State (Maynard, 1951).

Habitat: beneath decaying wood and in humus (Mills, 1934); under sticks and stones on sandy soil (Maynard, 1951).

Tullbergia collis Bacon, 1914 -- Site 1 (M, N), 3 ex.

Determination: from Mills (1934).

Type described from: California.

Distribution: Mexico, California, Washington State, Iowa (Mills, 1934); Connecticut (Bellinger, 1954); and in Canada from Reindeer Station, Yellow Knife and Coppermine in the North West Territories (Hammer, 1953).

Habitat: in moss, in lichen, dung out peaty soil, in dead leaves and needles, dry reindeer lichen heath (Hammer, 1953); in humus (Mills, 1934); in grassland and forest litter (Bellinger, 1954).

Tullbergia granulata Mills, 1934 -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 49 ex.

Determination: from Mills (1934).

Type described from: Iowa.

Distribution: Iowa (Mills, 1934); Connecticut (Bellinger, 1954); and in Canada from Churchill in Manitoba (Hammer, 1953).

Habitat: moss and humus (Mills, 1934), in low lawn-like heath vegetation (Hammer, 1953); in grassland and forest litter (Bellinger, 1954).

*Tullbergia sp., ? T. granulata - group -- Site 2 ($L-F_1$, F_2-H, A_2-B), 6 ex.

Determination: W. R. Richards.

Note: This species appears to be new.

Tullbergia krausbaueri (Börner, 1901) -- Sites 1, 2, 3, (M, N, $L-F_1$, F_2-H, A_2-B), 30 ex.

Determination: from Gisin (1960).

Type described from: Germany.

Distribution: whole of Europe, Greenland (Gisin, 1960); Iowa (Mills, 1934, as T. iowensis); Connecticut (Bellinger, 1954, as Mesaphorura iowensis); in Canada from the Rocky Mountains at Banff in Alberta and Richardson Mountains, Reindeer Station and Yellow Knife in the North West Territories (Hammer, 1953).

Habitat: in reindeer lichen and liverwort, in dead leaves, dug out peaty soil (Hammer, 1953, as T. iowensis); in grassland and forest litter (Bellinger, 1954).

ISOTOMIDAE Börner, 1913.

Folsomia sp. nr. *duodecimsetosa* Hammer, 1952 -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 481 ex.

Determination: from Hammer (1953).

Type (of *F. duodecimsetosa*) described from: northern Canada.

Distribution (of *F. duodecimsetosa*) Yellow Knife and and Coppermine in the North West Territories and Churchill in Manitoba.

Habitat (of *F. duodecimsetosa*): in moss, lichen, in damp depression among willow bushes, soil in heath vegetation, on *Dryas* plain near the beach and on tussocks in tundra partly grown with heath vegetation (Hammer, 1953).

**Folsomia sensibilis* Kseneman, 1936 -- Sites 2, 3 (L-F_1, F_2-H, A_2-B), 104 ex.

Determination: from Gisin (1960).

Type described from: Czechoslovakia.

Distribution: Austrian and Swiss Alps, Jeseniky Mountains, Carpathians, Pyrenees, Swedish Lapland (Nosek, 1961).

Habitat: soil ?

**Folsomides* sp. nr. *inequalis* (Bagnall, 1949) -- Site 2 (L-F_1), 1 ex.

Determination: W. R. Richards.

Type (of *F. inequalis*) described from: British Isles.

Distribution (of F. inequalis) England and Northern Ireland (Gisin, 1960).

Habitat (of F. inequalis): soil ?

*Isotoma andrei Mills, 1934 -- Sites 1, 2 (L, N, L-F_1, F_2-H), 24 ex.

Determination: from Mills, (1934).

Type described from: Iowa.

Distribution: Iowa only (Mills, 1934).

Habitat: moss (Mills, 1934).

Isotoma grandiceps Reuter, 1891 -- Sites 1, 3 (M, L-F_1, F_2-H), 18 ex.

Determination: W. R. Richards.

Type described from: Siberia.

Distribution: Russia, Siberia, Alaska, United States (Gisin, 1960); in Canada from Ontario (James, 1933); and Richardson Mountains and Reindeer Station in the North West Territories (Hammer, 1953).

Habitat: in leaf mould (James, 1933); in withered Cassiope, moss and liverwort, lichen heath, wet dead leaves (Hammer, 1953).

Isotoma notabilis Schäffer, 1896 -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 163 ex.

Determination: from Gisin (1960).

Type described from: Germany.

Distribution: widely distributed: apart from Europe it is known in the northern hemisphere from Greenland to Costa Rica and in the southern hemisphere from Australia and New Zealand (Sharma and Kevan, 1963); in Canada it is known from the Rocky Mountains near Banff in Alberta, Yellow Knife and Coppermine in the North West Territories, Churchill in Manitoba (Hammer, 1953); from Ontario and Quebec (Sharma and Kevan, 1963). It is probably cosmopolitan (Nosek, 1961).

Habitat: on river banks, in meadows, in heath (Hammer, 1953); almost ubiquitous species but with a preference for woodland (Haarløv, 1957); general inhabitant of litter but also found in moss, old tree stumps, moist humus soil, under flower pots in greenhouses, and in caves (Sharma and Kevan, 1963).

<u>Isotoma</u> <u>olivacea</u> Tullberg, 1871 -- Sites 1, 3 (L, M, N, F_2-H, A_2-B), 7 ex.

Determination: from Gisin (1960).

Type described from: Europe.

Distribution: Holarctic (Nosek, 1961); including the United States from Illinois, Iowa, New York (Maynard, 1951); in Canada from Ontario (James, 1933); Richardson mountains, Yellow Knife and Coppermine in the North West Territories and Churchill in Manitoba (Hammer, 1953); Ellesmere Island (Hammer, 1953a); Queen Elizabeth Islands (Oliver, 1963).

Habitat: sea and lake shore, moss, lichen, grassland, moorland and woodland (Hammer, 1953; Haarløv, 1957), in humus (James, 1933).

Note: Two of these specimens may be regarded as var. stachi, Denis, 1929.

Isotoma violacea Tullberg, 1876 -- Site 1 (F_2-H), 1 ex.

Determination: W. R. Richards.

Type described from: northern Europe.

Distribution: Holarctic (Nosek, 1961), including New York State and in Canada from Ontario (Maynard, 1951); Richardson Mountains, Reindeer Station, Yellow Knife and Coppermine in the North West Territories and Churchill in Manitoba (Hammer, 1953); Ellesmere Island (Hammer, 1953a); Isachsen, Ellef Ringnes Island (McAlpine, 1964).

Habitat: in heath (Hammer, 1953); in moss and lichen and in forest in needle litter and dead leaves (Nosek, 1961).

*Isotoma sp., ? nov. -- Sites 1, 3 (L, M, L-F_1, F_2-H), 29 ex.

Determination: from Gisin (1960).

*Isotomiella minor (Schäffer, 1896) -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 571 ex.

Determination: from Gisin (1960).

Type described from: Germany.

Distribution: whole of Europe, Caucasus, Iceland, Greenland, Japan, Hawaii, South America, Australia, New Zealand, probably cosmopolitan (Nosek, 1961); in North America it is known from Massachusetts, Illinois (Folsom, 1937, as Isotoma minor); Connecticut (Bellinger, 1954).

Habitat: in grassland and forest litter (Bellinger, 1954); in mineral soil where it is able to penetrate relatively deeply (Haarløv, 1957).

*Isotomodes trisetosus Denis, 1932 -- Sites 1, 3 (M, L-F_1, F_2-H, A_2-B), 51 ex.

Determination: from Gama (1963).

Type described from: France.

Distribution: France, Czechslovakia, Yugoslavia, Moravia, Madeira, Azores and Peru (Gama, 1963).

Habitat: in moss, under stone, in young eucalyptus forest, dead leaves and in soil (Gama, 1963).

*Micrisotoma achromata Bellinger, 1952 -- Sites 1, 2, 3 (M, L-F_1, F_2-H, A_2-B), 91 ex.

Determination: from Bellinger (1952).

Type described from: Connecticut.

Distribution: Connecticut only (Bellinger, 1952).

Habitat: humus under Cathedral pines, humus in a mature white pine-hemlock stand (Bellinger, 1952).

Note: This species probably belongs in the genus Isotomina as given by Gisin (1960), but since the latter author did not mention M. achromata in his "Collembolenfauna Europas," it is left in the genus in which it was originally described.

*<u>Proisotoma</u> sp. nr. <u>borealis</u> (Axelson, 1950) -- Site 3 (L-F_1, F_2-H), 84 ex.

Determination: W. R. Richards.

Type (of <u>P</u>. <u>borealis</u>): described from Finland.

Distribution (of <u>P</u>. <u>borealis</u>): Finnish and Swedish Lapland (Gisin, 1960).

Habitat (of <u>P</u>. <u>borealis</u>): in soil ?

Note: Dr. W. R. Richards (<u>in litt</u>., 1964) is of the opinion that this species is probably new.

*<u>Proisotoma</u> <u>minima</u> (Absolon, 1901) -- Site 1 (M), 3 ex.

Determination: W. R. Richards.

Type described from: Moravia.

Distribution: northern and central Europe, Iowa (Stach, 1947).

Habitat: mostly under the bark of mouldy stumps, in caves (Stach, 1947).

<u>Proisotoma</u> (<u>Ballistura</u>) $sp._1$ -- Site 3 (L-F_1, F_2-H), 2 ex.

Determination: W. R. Richards.

Note: These specimens were juveniles, therefore specific identification is impossible at the present time. It is possible that this species has been recorded previously in Canada.

<u>Proisotoma</u> (<u>Ballistura</u>) sp.$_2$ -- Site 1 (M), 3 ex.

Determination: W. R. Richards.

Note: Specimens were poorly mounted and the characters necessary for specific determination could not be seen. It is possible that this species has been recorded previously in Canada.

ENTOMOBRYIDAE (Börner) Gisin, 1944.

<u>Entomobrya</u> <u>clitellaria</u> Guthrie, 1903 -- Sites 1, 2 (L, M, N, L-F_1, A_2-B), 24 ex.

Determination: W. R. Richards.

Type described from: Minnesota.

Distribution: Australia, Illinois, Minnesota, New York, Ontario in Canada (Mills, 1934).

Habitat: common beneath maple and elm bark (James, 1933).

Note: There is some confusion as to the exact taxonomic status of this species (<u>cf</u>. Stach, 1963).

<u>Entomobrya</u> sp.$_1$ -- Site 1 (N), 1 ex.

Determination: from Gisin (1960).

Note: This specimen was poorly mounted, therefore the characters necessary for specific identification could not be seen. It is possible it has been recorded previously in Canada.

<u>Entomobrya</u> sp.$_2$ -- Sites 2, 3 (L-F_1), 6 ex.

Determination: from Gisin (1960).

Note: These were juveniles, therefore specific identification is difficult. It may have been recorded previously in Canada.

Entomobrya sp.$_3$ -- Sites 2, 3 (L-F_1, A_2-B), 3 ex.

Determination: from Gisin (1960).

Note: As above for Entomobrya sp.$_2$.

Pseudosinella alba (Packard, 1873) -- Site 1 (L, M, N), 77 ex.

Determination from: Gisin (1960).

Type described from: Massachusetts.

Distribution: throughout Europe, Australia, widely distributed in North America (Sharma and Kevan, 1963b). In Canada it is known from Ontario (James, 1933, as Lepidocyrtus albus); Quebec (Sharma and Kevan, 1963b).

Habitat: grassland (Haarløv, 1957); under stone on sandy soil (Maynard, 1951); under conifer stand (Bellinger, 1954); in litter and mull-type soil (Sharma and Kevan, 1963b).

Pseudosinella petterseni Börner 1901 -- Site 1 (L, M, N), 7 ex.

Determination: from Gisin (1960).

Type described from: Germany.

Distribution: Europe, Costa Rica, widely distributed throughout the United States and in Canada from

Ontario and Quebec (Sharma and Kevan, 1963b).

Habitat: grassland and woodland (Haarløv, 1957); rather dry soil, under stone and logs, in litter, mull type soil and in caves (Sharma and Kevan, 1963b).

Tomocerus flavencens (Tullberg, 1871) -- Site 1 (L, M), 8 ex.

Determination: from Gisin (1960).

Type described from: Europe.

Distribution: Europe (Nosek, 1962); widely distributed throughout the United States including Alaska (Maynard, 1951) and in Canada from Ontario (James, 1933, as var. americanus); Richardson Mountains, Reindeer Station and Yellow Knife in the North West Territories (Hammer, 1953); Perry River, North West Territories (Mills and Richards, 1953).

Habitat: on lichen heath, in meadow (Hammer, 1953); woodland areas (Haarløv, 1957).

Note: This material appears to be referable to var. americanus, Schott, 1896. According to Knight (1958), this might be a distinct species.

Willowsia nigromaculata (Lubbock, 1873) -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 49 ex.

Determination: from Gisin (1960).

Type described from: England.

Distribution: Southern Scandinavia, England, southern France (Gisin, 1960); Czechoslovakia and Australia (Nosek, 1962); Illinois, Kansas, Louisiana, Massachusetts, Maine, Minnesota, Texas, New York (Mills, 1934, as a form of Sira plantani (Nicolet, 1841)); in Canada from Ontario (James, 1933, as Sira nigromaculata); Ungava Bay in Labrador (Hammer, 1953, as S. nigromaculata).

Habitat: in reindeer lichen and moss (Hammer, 1953); bunches of grass (Nosek, 1962); rarely beneath bark (Mills, 1934); on dry board (James, 1933); in buildings (James, 1933; Mills, 1934; Maynard, 1951).

Note: This species was found to be common in the laboratory from May to September and may not actually have come from the soil, although it has been recorded from similar habitats by Mills (1934), Hammer (1953) and Nosek (1962). According to Haarløv (1957), Lepidocyrtinus domesticus (Nicolet, 1941) could be collected with Tullgren funnels without [soil] samples.

b. SYMPHYPLEONA Börner, 1901

SMYNTHURIDAE Lubbock, 1862.[1]

Arrhopalites sp., A. pygmaeus - group$_1$ -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 18 ex.

Determination: W. R. Richards.

Note: All specimens were juveniles, therefore specific identification is difficult. This species may have been recorded previously in Canada. The group is widely distributed with many representatives living in caves.

Arrhopalites sp., A. pygmaeus - group$_2$ -- Sites 2, 3 (L-F_1, A_2-B), 4 ex.

Determination: W. R. Richards.

Note: All specimens were juveniles, therefore specific identification is difficult. This species may have been recorded previously in Canada.

Bourletiella sp. -- Site 2 (L-F_1, F_2-H), 2 ex.

Determination: from Gisin (1960).

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[1]Salmon (1951:31) states that, "the original spelling . . . given by Latreille in 1804, when he founded the genus, was Smynthurus. It would appear to have been derived from the Greek words Sminthos (meaning a mouse) and oura (meaning a tail), in which case the amendment which has been made by most authors to the spelling Sminthurus is grammatically correct and allowable under the International Rules of Zoological Nomenclature." However, there seems to be no Article in the 1961 Code which allows for such a change, therefore the original spelling is retained here in deriving the family name.

Note: Both specimens were males, therefore specific identification was difficult. This species may have been recorded previously in Canada.

Dicyrtoma sp., ? D. unicolor (Harvey, 1893) -- Site 1 (L, N), 2 ex.

Determination: W. R. Richards.

Type (of D. unicolor) described from: Maine.

Distribution (of D. unicolor): Maine, New Hampshire, Massachusetts, Illinois, Wisconsin, Iowa, Ohio, New Jersey, Minnesota, North Carolina, Montana, New York (Maynard, 1951); in Canada from Ontario (James, 1933).

Habitat (of D. unicolor): under rubbish, in the woods on agarics and boleti, under the loose bark of stumps, under boards and rubbish in meadows and pastures (Harvey, 1893); in woodland (Maynard, 1951).

*Neelus incertus Börner, 1903 -- Sites 1, 2, 3 (M, L-F_1), 8 ex.

Determination: from Scott (1964).

Type described from: Sicily ?

Distribution: France, Sicily, Hangary, Yugoslavia, Australia (Gisin, 1960); California, Iowa, Louisiana, Florida (Mills, 1934, as Megalothorax incertoides).

Habitat: in humus (Mills, 1934).

Neelus minimus Willem, 1900 -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 130 ex.

Determination: from Scott (1964).

Type described from: Europe ?

Distribution: from Lapland and Greenland to Madeira and Hungary (Gisin, 1960); in Canada from Reindeer Station, Yellow Knife and Coppermine in the North West Territories (Hammer, 1953); Lake Hazen area, Ellesmere Island (Hammer, 1953a, as Megalothorax minimus; Oliver, 1963).

Habitat: in moss, liverwort, in dead leaves, in heath (Hammer, 1953); in soil (Gisin, 1960).

Neelus sp. -- Site 1 (L, M), 3 ex.

Determination: from Gisin (1960).

Note : These specimens were poorly preserved, therefore positive identification was difficult. This species may have been recorded previously in Canada.

Sminthurides sp., ? S. occultus Mills, 1934 -- Site 3 (L-F_1), 1 ex.

Determination: from Mills (1934).

Type (of S. occultus) described from: Iowa.

Distribution (of S. occultus): Iowa, New York, and in Canada from Ontario, Manitoba (Maynard, 1951); Reindeer Station and Yellow Knife in the North West Territories (Hammer, 1953).

Habitat: on river bank in mud, in _Sphagnum_, in meadow with sparse moss (Hammer, 1953); in humus (Mills, 1934); on sticks lying on the ground (Maynard, 1951).

Sminthurinus aureus (Lubbock, 1862) -- Sites 1, 3 (M, N, L-F_1), 6 ex.

Determination: W. R. Richards.

Type described from: England.

Distribution: Europe, Australia, New Zealand, Iowa, Illinois, Massachusetts, Texas, Utah, Maryland, Pennsylvania, Delaware, North Carolina (Maynard, 1951); in Canada from Ontario (James, 1933).

Habitat: in moss (Stach, 1956); in grassland and forest litter (Bellinger, 1954); old tree stumps, on rocks, under bark of trees, on low plants of meadows and gardens, under flower pots in dwellings (Stach, _loc_. _cit_.).

Sminthurinus elegans (Fitch, 1863) -- Site 1, (L, M, N), 9 ex.

Determination: W. R. Richards.

Type described from: New York State.

Distribution: Finland to Madeira (Gisin, 1960); Maine, Massachusetts, Illinois, Iowa, Tennessee, Washington State? ; in Canada from Ontario (James, 1933).

Habitat: in moss (James, 1933); common soil species in lawns and pastures (Maynard, 1951).

COLLEMBOLA UNDETERMINED -- Sites 1, 2, 3 (L, M, N, L-F_1, F_2-H, A_2-B), 84 ex.

4. COMMENTS ON HABITAT AND GEOGRAPHICAL DISTRIBUTION

Studies on the micro-arthropod fauna in North America are quite limited and very few of these have determined the material to species. Some data on the Oribatei is available but published information on the soil Mesostigmata and Trombidiformes is almost non-existent. These last two groups are nevertheless rich in species; at least 40 species of Mesostigmata and over 70 species of Trombidiformes have been isolated from the samples treated (Marshall, 1963; Marshall and Kevan, in press).

Balogh (1961), in his keys for the identification of oribatids of the world, lists 25 Superfamilies and 87 Families. During the course of this study 17 of the former and 33 of the latter, containing 93 species, were represented. This probably represents but a small part of the local soil fauna. Hammer (1952) collected 106 species from northern Canada but only 19 of these were present in the Morgan Arboretum. Although some of the species are indigenous, many are Holarctic in distribution. Hammer (op. cit.) found that 55.6 per cent of the Canadian oribatid fauna also occurred in Europe and the present study indicates that at least 37.6 per cent of the species found have already been reported from Europe.

The situation for the Collembola is similar. As pointed out by Knight (1958), Guthrie's monograph published in 1903, Mills' contribution of 1934 and Maynard's publication of 1951, are the only definitive works on the collembolan fauna of extensive geographical regions in North America. Maynard (1951) recorded 200 species of Collembola from New York State, yet only about 15 of these have been found in southern Quebec. Of the 58 species examined, 43 per cent have also been recorded in Europe. Mills (1939) estimated that 31 per cent of North American species were Holarctic or cosmopolitan in distribution.

The micro-arthropod fauna of even a relatively restricted area is quite rich in species, many of which exhibit a wide range of habitats. Some are found in moss, grasslands, forests soils and even in dwellings. This will probably make it very difficult to select indicator species as opposed to species complexes in the characterization of different soil types. Even where such indicator species are suggested, various ecological forms may have to be differentiated, offering ample opportunity for further research in taxonomy, biology and ecology.

B. DISTRIBUTION OF THE FAUNA

1. HORIZONTAL DISTRIBUTION

a. General Remarks

Few natural animal populations are randomly distributed (Waters, 1959; Debauche, 1962:12). The exact causes of this are unknown, but in the case of Collembola, Poole (1961:133) puts forward three possible reasons: (1) restricted wandering of the animals from the original egg-cluster; (2) the gregarious nature of animals; and (3) certain environmental factors, for example, favourable food sites (Hartenstein, 1961:191), may be important.

Such aggregated or "contagious" distributions have been observed for various arthropods (Glasgow, 1939; Sheals, 1957; Macfadyen, 1952; Bellinger, 1954; Murphy, 1955) and in particular, for some oribatid mites by Hartenstein (1961), and Collembola by Poole (1961, 1962). Haarløv (1960:63) has observed that while there is a general tendency for micro-arthropods to show an aggregated distribution pattern, a different picture is presented when the species are considered individually. It would seem that the better developed the locomotory organs, the less the aggregation of the species (Raw, 1956:19; Macfadyen, 1963:101). This corroborates the preliminary results of the author (Marshall, 1963) that a random distribution seems to be more characteristic of the predatory and largely surface-dwelling forms, while saprophagous species, as well as deep-dwelling forms tend to be aggregated in their distribution.

Wallwork and Rodriguez (1961) observed that in a sheep pasture and cow pasture in Kentucky the different species of Oribatei did not show a high degree of aggregation. However, it should be remembered that a non-significant result can never establish randomness with any degree of certainty. It may be that the actual departure from randomness is too small because of inadequate sampling or a type of non-randomness is present for which the technique used was inappropriate (Healy, 1962:7). In this connection, the procedure put forward by Hughes (1962) should prove useful.

b. <u>The Micro-arthropods from Morgan Arboretum</u>

The total numbers and frequency percentages of the Sarcoptiformes and Collembola in the three sites are tabulated in Appendix A, Tables XXIV and XXV. The frequency index is the proportion in which a given species occurs in a series of samples taken in a standard manner (Dice, 1955:43). This may be expressed as a percentage rather than as a decimal. It is calculated here by dividing the number of samples in which the species is present by the total number of samples taken, and the result multiplied by one hundred.

Examination of these data, as well as those in

Appendix A, Tables VI-XVII, indicates that in some samples there was no specimen of a given species, while others contained small or large numbers. For example, only single specimens of Carabodes labyrnthicus, Plasmobates sp. and Achiptera coleoptera were collected during the entire sampling period, whereas Proisotoma sp. nr. borealis was collected twice, on the first occasion as a single specimen, on the second 83 examples were obtained.

Debauche (1962) advocated the use of an expression for estimating the degree of aggregation of a population. This is based on the assumption that a randomly distributed population shows a distribution of the Poisson form with variance equal to the mean. This can be taken as a basis for randomness, departure from which indicates either regularity of distribution or aggregation. As aggregation tends to increase the variance, it can be evaluated by comparing the observed variance with that of the expected when the distribution is random. This comparison can be expressed in a number of ways, but the Lewis index, λ, is the most convenient:

$$\lambda = \frac{s}{m}$$

where s = standard deviation

m = mean of a set of values.

For a regular distribution, $\lambda \rightarrow 0$, and for a randomly distributed population, $\lambda = 1$. Its significance can be tested by transforming it into the dispersion index of Fisher (1941-42):

$$X^2 = \lambda(n-1)$$

with (n-1) degrees of freedom.

Tables 2 and 3 give estimates of Lewis' index for 10 species of mites and Collembola. In the case of the mites the 10 most abundant species were selected from samples taken the same day. According to Debauche (1962:15), the ecological tolerance of a species changes with the condition of the habitat and time, especially during reproduction. It was not always possible to obtain samples taken at the same date, of the more dominant species of Collembola, therefore species with fewer numbers but with a higher frequency had to be chosen.

The results obtained in the present study are in agreement with those of earlier workers. All the species analysed showed aggregated distributions significant at the 1 per cent level of probability. The index varied, some species showing a much higher degree of clumping than others. The values were made much larger by the difference in the numbers of individuals on the two humus forms. However, when the figures for Oppia nova, which showed the greatest homogeneity, were analysed for the

Table 2. The ten most abundant species of Oribatei, arranged in descending numerical order, showing Lewis' index of aggregation.

No. of Samples	Species	Mean (m)	Variance (S^2)	Index of aggregation (λ)
6	Oppia nova	129	9,716	8
6	Oppia minor	58	6,822	10
6	Tectocepheus velatus . . .	111	25,930	14
6	Suctobelba laxtoni	126	18,299	11
6	Brachychthonius jugatus .	75	14,054	13
6	Suctobelba longicuspis . .	24	649	5
6	Suctobelba sp.$_2$	38	2,959	9
6	Ceratozetes sp.	19	3,343	4
6	Suctobelba hurshi	39	1,692	6
6	Eniochthonius minutissimus	25	1,480	8

For 5 degrees of freedom P 0.01 = 15.09

Table 3. Ten species of Collembola, arranged in descending numerical order, showing Lewis' index of aggregation.

No.of Samples	Species	Mean (m)	Variance (S^2)	Index of aggregation (λ)
6	*Isotomiella minor*	56.0	3493.0	7.9
6	*Folsomia* sp. nr. *duodecimsetosa*	13.7	245.0	4.2
6	*Isotoma notabilis*	4.3	59.5	3.7
6	*Neelus minimus*	7.5	77.0	3.2
6	*Onychiurus* sp. ? *armatus* .	9.7	459.0	6.8
6	*Hypogastrura* sp. ? *armata*	4.2	45.0	3.3
4	*Folsomia sensibilis* . . .	24.5	1488.0	22.0
6	*Micrisotoma achromata* . .	10.5	153.0	3.8
6	*Willemia anophthalma* . . .	8.3	95.1	3.4
6	*Anurida* sp. nr. *pygmaea* .	7.3	93.6	3.6

For 5 degrees of freedom P 0.01 = 15.09
" 3 " " " P 0.01 = 11.34

mor sites an index of 5 was obtained as opposed to 8 for the two different humus forms. This was also highly significant statistically.

It is quite possible that the horizontal distribution of soil animals changes from one soil type to another. Hairston (1959:410) stated that the degree of clumping is not necessarily a character of the species but also depends upon the type of habitat in which it is found. Because of the small number of samples analysed the results here cannot be considered to be conclusive, but merely an indication of what is to be expected from much more accurate sampling.

2. VERTICAL DISTRIBUTION

a. General Remarks

In order to penetrate the soil, most microarthropods are dependent on existing passages, interstices related to soil structure or channels made by roots or animals such as earthworms (Kühnelt, 1955:4, 1963:118). According to Haarløv (1960:50), correlations between the size of soil animals and structure of the soil have been found by Schimitschek (1938), Stöckli (1946) and Weis-Fogh (1948), while Klima (1956) pointed out that species of small breadth are the most numerous in deeper soil layers. Similar observations have been made by Haarløv

(1955a); Kühnelt (1961:206) and Murphy (1955:113). Macfadyen (1952:97) and Eaton and Miller (1954:485) realized that the larger species are confined more to the upper layers of the soil.

In estimating the vertical distribution of the soil fauna it is usual to separate a sample into a number of horizontal subsamples. This procedure is subject to certain errors which have been pointed out by Bellinger (1954:48): (1) where horizons are not sharply delineated variations in the various sub-samples are inevitable; (2) seasonal variation in the centres of distribution of the different species; and (3) occasional contamination of lower sub-samples by material spilling to lower areas during collection. This last source of error can perhaps be minimized by inserting a sample holder inside the corer (*cf*. Alexander and Jackson, 1955; Auerbach and Crossley, 1960; Macfadyen, 1961; Murphy, 1962:161).

Despite these shortcomings, most workers agree that the majority of the organisms is concentrated in the upper layers of the soil and they decrease with increasing depth. This pattern of distribution seems to be characteristic of most soils and has been demonstrated for temperate forest soils by Ghilarov (1947), Drift (1951), Murphy (1953) and others; in temperate agricultural grassland by Glasgow (1939), Dhillon and Gibson (1962); and for tropical grassland and forests by Strickland (1945, 1947), Delamare Deboutteville (1951), Belfield (1956), and Imadaté and Kira (1964). However, as Christiansen (1964) observed, most of the data are given in terms of depth alone and there is little indication as to whether the samples include the L layer, F layer, H layer or part of the B horizon.

b. Vertical distribution of the Micro-arthropods in Morgan Arboretum

The results obtained from Morgan Arboretum are given in Figure 2. They seem to agree with those of earlier workers and the following points are evident:

1. The micro-arthropods are concentrated in the upper layers of the soil and decline in numbers with increasing depth. It may be noted that, while the lower sub-samples are equal in size to, or even larger than, the upper ones, the number of organisms they contain is, nevertheless, smaller.
2. The vertical distributions in Sites 2 and 3 (mor humus forms) are more similar to each other than either is to that of Site 1 (mull). In the latter site the distribution is particularly affected by the small quantity of litter, which is available only from autumn to early spring (see Appendix A, Table IV) and which is so important in providing food and shelter. As would be expected, the numbers of micro-arthropods occurring in comparable layers in the three sites would

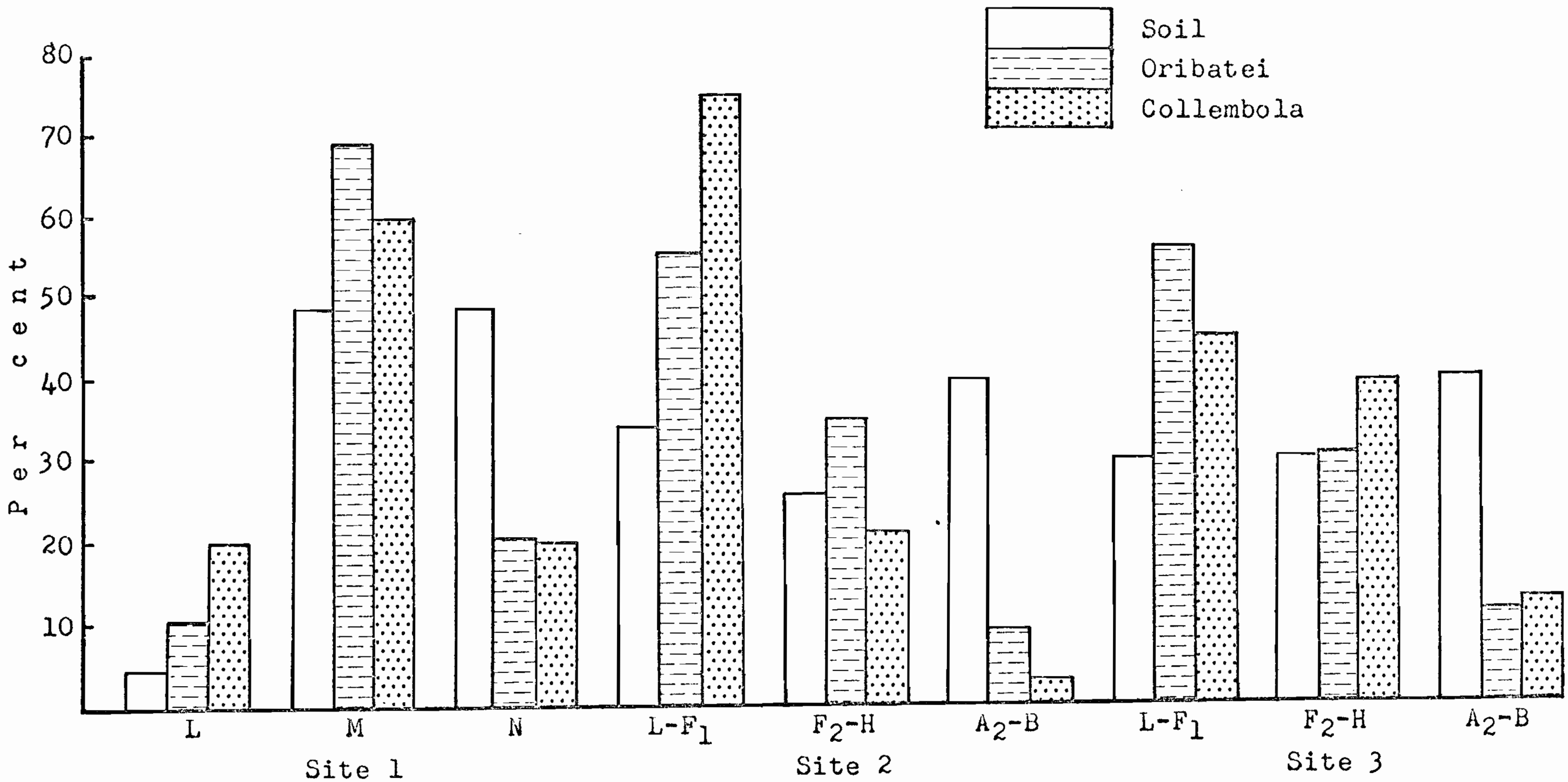

Figure 2. Overall percentage distribution of the Oribatei and Collembola in the three sites in relationship to the average sample size. For explanation of lettering see text, page 56.

be quite different, and this is well demonstrated in the interaction between sites and horizons (Tables 4 and 5), which is significant at the 1 per cent level of probability for both mites and Collembola.

The distribution of the organisms in the soil profile is, of course, different when the species are considered individually (Table 6). In Site 1 the M layer was effectively the upper layer, since only a small quantity of litter was present during the sampling period. The surface concentration was particularly marked in the case of the larger, better sclerotized mites such as Adorestes ovatus, Protoribates lophotrichus, and Scheloribates pallidulus. As Haarløv (1955:176) observed, the size of the organism is not the only limiting factor, but food and humidity are also important. Species such as Parhypochthonius aphidinus, Palaeacarus hystricinus and Gehypochthonius rhadamanthus, which are primitive mites with soft, pallid cuticles, are found in larger numbers in the deeper layers.

Murphy (1955:113) observed that in raw humus, where living space is limited, the commoner genera of oribatid mites were represented by their smaller species and he had earlier theorized (Murphy, 1953:178) that the same species may grow to different sizes in order to adapt to restricted space in the soil. In the present investigation this has been observed for Oppia nova.

Table 4. Analysis of variance of the Oribatei (details in Appendix A, Table XXVIII). Procedure follows Goulden (1956).

Source	D.F.	S.S.	M.S.	F.	Level 0.5	Level 0.1
Sites	2	1962	981	89.18[a]	3.17	5.01
Horizons	2	1006	503	45.72[a]	3.17	5.01
Sites x Horizons	4	740	185	16.81[a]	2.54	3.68
Months	5	1200	240	21.81[a]	2.38	3.37
Horizons x Months	10	234	23	2.09[b]	2.00	2.66
Sites x Months	10	709	71	6.45[a]		
Error (Horizons x Sites x Months)	20	121	6			
Error (between sub-samples within experimental units)	54	619	11[c]			
Total	107	6691				

[a]Significant at the 1%,
[b]Significant at the 5% level of probability.
[c]Experimental error, _cf_. Goulden (1952:76).

Table 5. Analysis of variance of the Collembola (details in Appendix A, Table XXIX). Procedure follows Goulden (1956).

Source	D.F.	S.S.	M.S.	F.	Level 0.5	Level 0.1
Sites	2	21.8	10.9	2.53	3.49	5.85
Horizons	2	155.2	77.6	18.40[a]	3.49	5.85
Sites x Horizons	4	172.3	43.1	10.02[a]	2.87	4.43
Months	5	160.9	32.2	7.48[a]	2.71	4.10
Horizons x Months	10	43.8	4.4	1.02	2.35	
Sites x Months	10	105.7	10.6	2.46[b]	2.35	3.37
Error (Horizons x Sites x Months)	20	86.7	4.3			
Error (between sub-samples within experimental units)	54	177.1	3.3			
Total	107	923.5				

[a]Significant at the 1%,
[b]Significant at the 5% level of probability.

Table 6. Relationship between the size of some micro-arthropods and percentage distribution in the different soil horizons. Percentages represent specimens collected more than once on the same site; measurements represent the mean of 20 adult specimens.

	Size diameters in $\mu \times 10^3$	Mull			Mor		
		L	M	N	$L\text{-}F_1$	$F_2\text{-}H$	$A_2\text{-}B$
ORIBATEI							
Adorestes ovatus	194	-	-	-	98	2	0
Protoribates lophotrichus	163	-	-	-	77	19	4
Scheloribates pallidulus	86	18	82	-	88	9	3
Protoribates capucinus	83	8	52	40	-	-	-
Parhypochthonius aphidinus	77	-	11	89	25	50	25
Ceratozetes sp.	67	13	87	0	58	34	8
Eniochthonius minutissimus	57	-	100	-	70	14	16
Palaeacarus hystricinus	45	-	-	-	38	35	27
Eobrochychthonius latior	42	-	-	-	11	73	16
Gehypochthonius rhadamanthus	29	-	-	-	14	58	28
Suctobelba forthinghami	28	-	-	-	41	55	3
Oppia nova	22	4	71	25	47	42	11
Linochthonius sp., ? *latus*	18	-	-	-	68	30	2
Oppia minor	13	-	-	-	8	63	29
Brachychthonius jugatus	12	50	-	50	46	35	19
COLLEMBOLA							
Onychiurus subtenuis	87	-	73	27	91	9	-
Hypogastrura sp., ? *armata*	76	-	-	-	78	16	6
Tullbergia clavata	70	3	88	9	55	50	-
Isotomiella minor	48	15	47	38	57	36	7
Micrisotoma achromata	44	-	100	-	25	47	28
Isotoma notabilis	37	28	66	6	88	0	12
Anurida sp. nr. *pygmaea*	18	100	-	-	34	62	4

In the L and F_1 layers this species measured, on an average, 244 μ (length) by 115 μ (breadth); in the F_2 and H layers, 210 μ by 92 μ; and in the A_2 and B layers, only 208 μ by 88 μ.

Small species were found to inhabit all layers and the relative position of such species in the soil horizon can sometimes be attributed to changes in response to weather.

3. POPULATION FLUCTUATION

a. General Remarks

The response of a population to environmental factors depends to a large extent on the different species present (Glasgow, 1939; Strenzke, 1949; Bellinger, 1954). However, a common feature of a number of independent studies, especially in temperate regions, has been that the peaks in populations usually occur during the winter and spring, while the numbers are at their lowest during summer (Thompson, 1924; Glasgow, 1939; Pearse, 1946; Overgaard Nielsen, 1955). Other authors have recorded similar population changes, but have also noted double peaks during the winter months (Ford, 1935; Lunn, 1939; Evans, 1955).

The summer minimum is usually attributed to drought. There is evidence that some members of the soil fauna do not migrate and those in the upper layers of the soil may die during dry periods (Springett, 1963:419). Overgaard Nielsen (1955:206) and Gasdorf and Goodnight (1963:263) are of the opinion that desiccation alone cannot explain the entire phenomenon and Wallwork (1959) suggests that natural death of some adult Oribatei and predation of soft-bodied nymphal mites and of Collembola may contribute to this low summer level. Gasdorf and Goodnight (*op. cit.*) postulated that low points in population curves may be due to the absence of immature forms. Since many larvae of Oribatei are endophagous they probably die from desiccation before being able to leave the debris in the extraction funnels.

According to Macfadyen (1952) the sudden increase in the population size after the summer minimum is probably due to two causes: better moisture conditions and improved food supply. Kendrick and Burges (1962:336) believed that the autumnal peak was directly connected with the great reduction in numbers of conidiophores of various fungi in the F layer. On the other hand, this increase is related to the hatching of eggs laid during the late summer and early fall (Overgaard Nielsen, 1955; Wallwork, 1959).

Some exceptional observations differ from those of the workers just cited. Drift (1951) found little variation in the microfauna of a beech forest floor and

Stöckli (1957), quoted by Dhillon and Gibson (1962), obtained peak populations of mites and Collembola during summer. Dhillon and Gibson (op. cit.) observed that the Collembola in agricultural soils were at their lowest in December of one year and then gradually increased to a maximum between August and December of the following year; the total mite population attained a maximum in June, with minima at the beginning and end of the year.

Different population curves will, of course, be obtained depending on the geographical region. The results of Delamare Deboutteville (1951) from tropical Africa indicated a "summer" low, which he attributed to excess heat. Limited information from Strickland (1947) and Belfield (1956) suggested that, in the tropics, increase in population size is closely related to rainfall. On the other hand, in very cold climates the short warm season results in active breeding during the summer (Agrell, 1941; Hammer, 1944; Lindquist, 1961).

b. Population Fluctuations in Morgan Arboretum

The changes in the micro-arthropod population in relation to some environmental factors are presented in Figure 3. The Oribatei and Collembola showed the same general trend. Late in the spring the populations rapidly decreased, remained relatively low during the rest of the summer, and again began to increase after September. The fluctuation in the numbers of the individual species

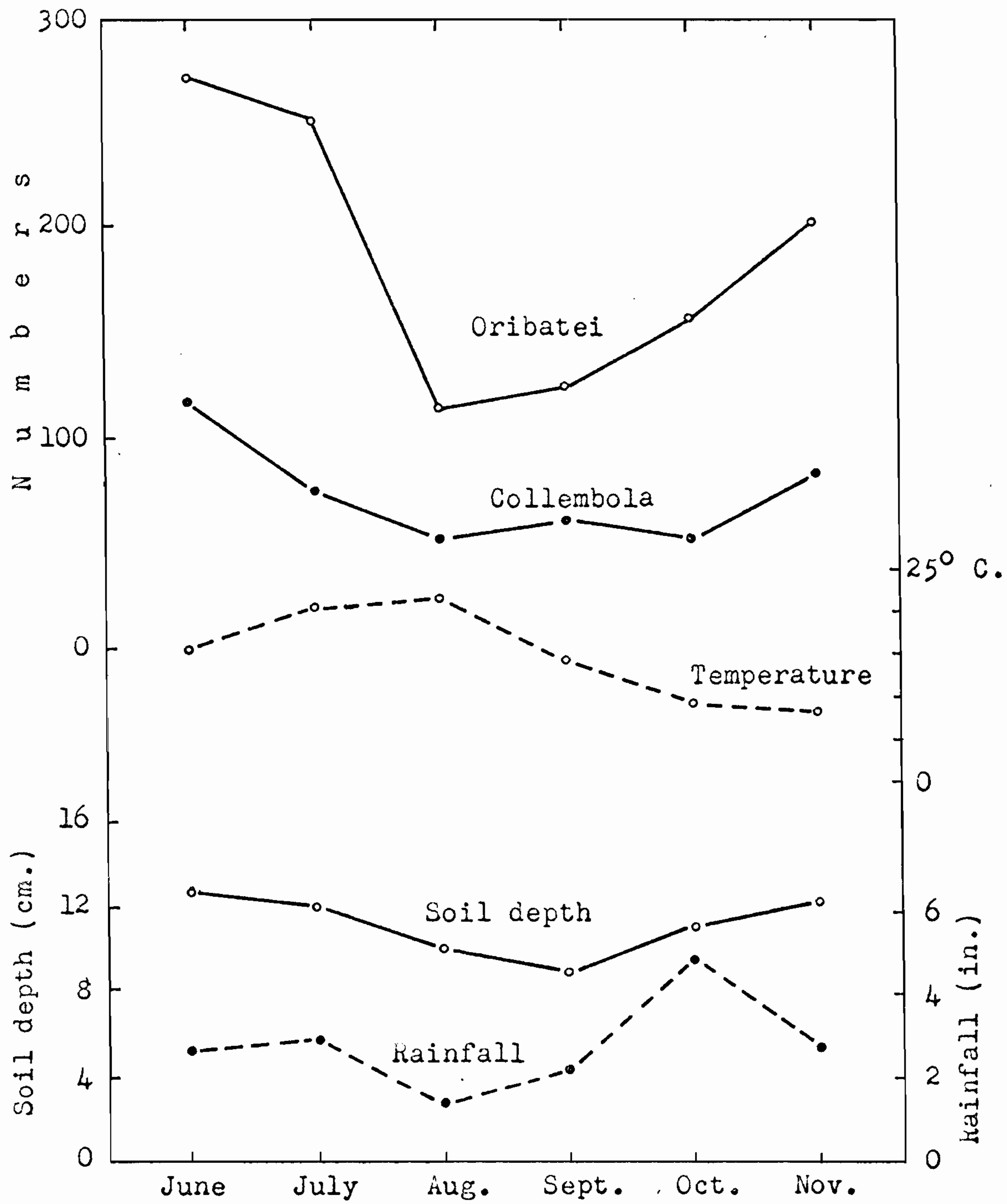

Figure 3. Relationship between total number of micro-arthropods ($\sqrt{\frac{1}{2} + x}$ transformed), average sample depth, temperature and rainfall.

showed similar trends (see Appendix A, Tables VI-XVII).

The variation in the monthly totals of both mites and Collembola was significantly different at the 1 per cent level of probability (Tables 4 and 5). Discrepancies in the comparison of soil population are sometimes attributed to different techniques. The time of year in which the samples were taken, however, may also be of great importance as the present results indicate.

As far as is known, food was plentiful, especially in the mor sites, and temperature, in itself, was within tolerance limits during the summer. However, it should be remembered that, as the temperature rose, the rainfall simultaneously decreased (Figure 3). Under the forest conditions being studied, this was probably coupled with increased transpiration and evaporation and a consequent heavy drain on the soil water supply, which was reflected in the shrinking of the organic layers in Sites 2 and 3 (Appendix A, Table IV). The decrease in the sample size (Figure 3) was caused mainly by the reduction of the organic layers since the inorganic layer remained more or less constant during the sampling period.

The somewhat more even distribution of the micro-arthropods in Site 1 (much more evident in Figure 4 than in Figure 5) may have been due to more stable conditions of food and water. According to Romell (1932), the actual quantity of organic material in the mull profile

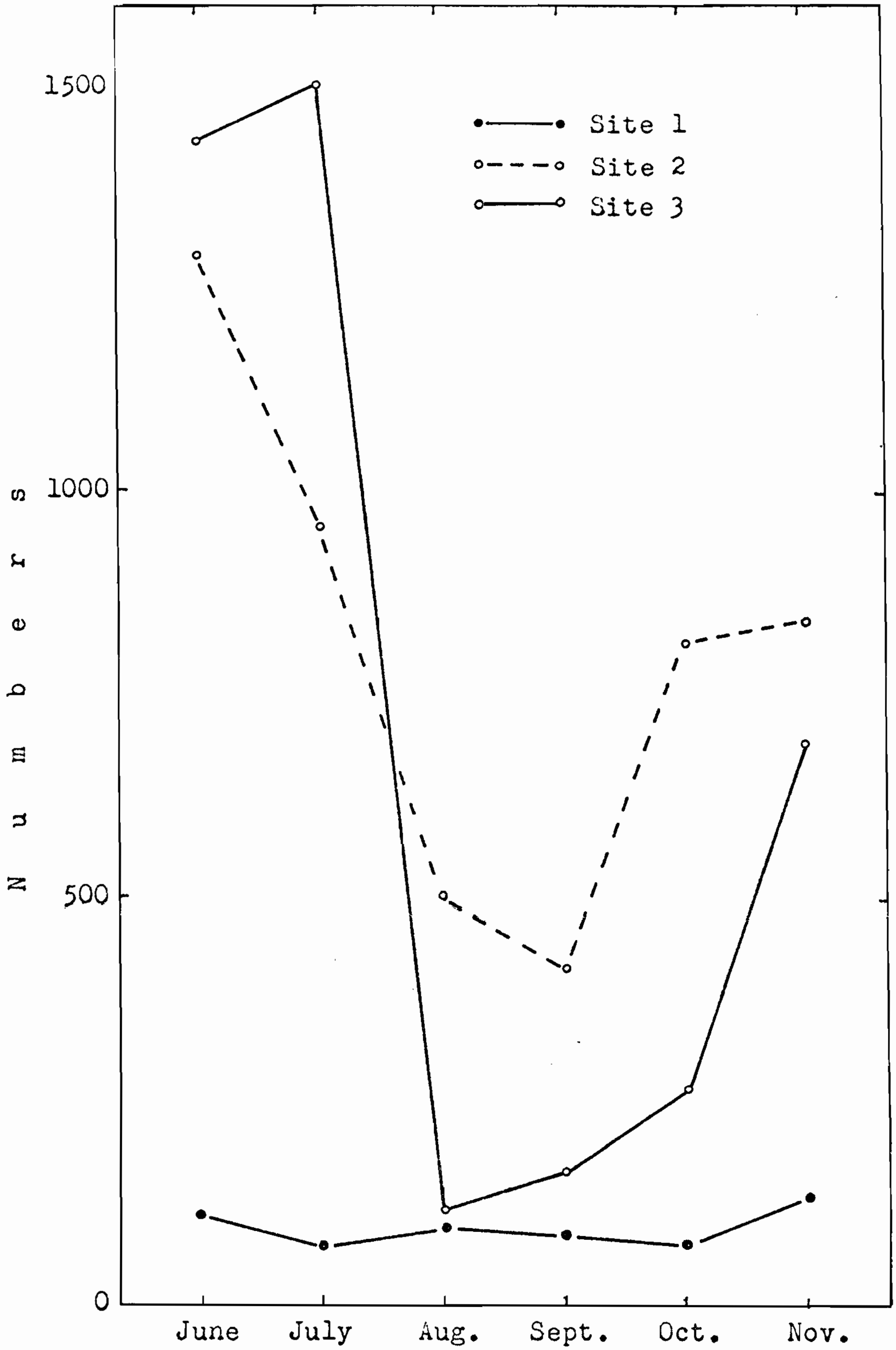

Figure 4. Population changes in the Oribatei in the three sites. Figures represent averages of 2 samples.

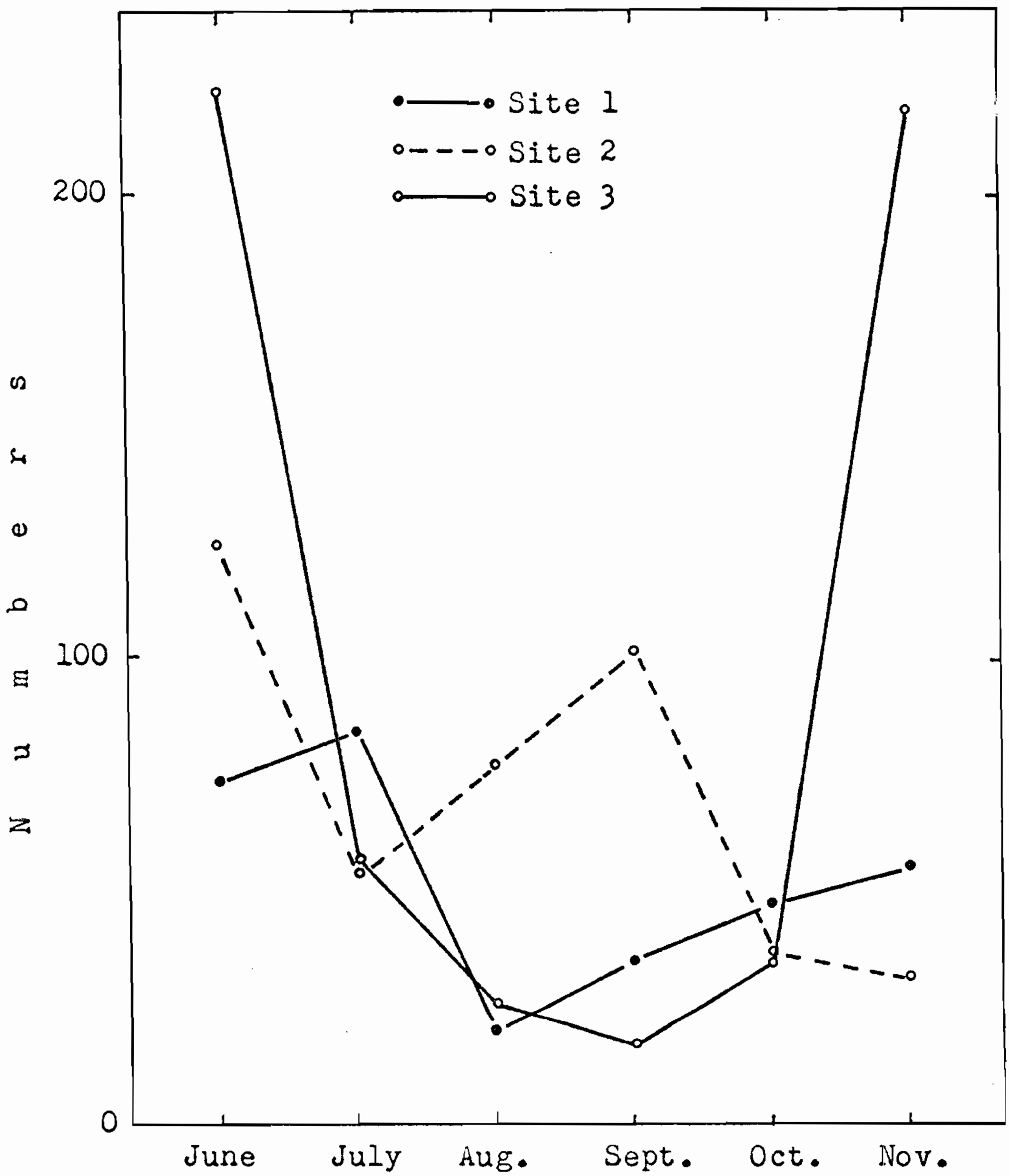

Figure 5. Population changes in the Collembola in the three sites. Figures represent averages of 2 samples.

does not differ much from that in mor. Some of this material may still be available as food for some arthropods. In addition, the size of soil particles is of great importance to water conduction in the soil (Kühnelt, 1961:210). The clay soil probably had better upward capillary movement of water, compared with the mor sites, which were situated on sandy substrates. Furthermore, the active soil water varied with the type of soil (Dalenius, 1962). According to Lyon *et al*. (1952:143), in heavy clay soil the hydroscopic coefficient may be as low as 1 to 2 per cent by weight, while in peat soils it may be as high as 60 to 70 per cent. Also, the size of the sample was more constant from this site than from the other two (see Appendix A, Table IV).

The fluctuation in the Oribatei and Collembola in the different soil horizons is shown in Figures 6 to 11. The populations in the different layers, but especially in the upper ones, reflect similar changes to those described above: a drop in spring, low numbers in summer, with an increase as autumn sets in. The populations in the deep layers, in all cases, seem to have been less affected during the summer months, presumably due to more stable physical and biotic factors.

The September peaks in Sites 1 and 2, which seem to run contrary to the general population trend, may be explained in a number of ways. As already pointed out,

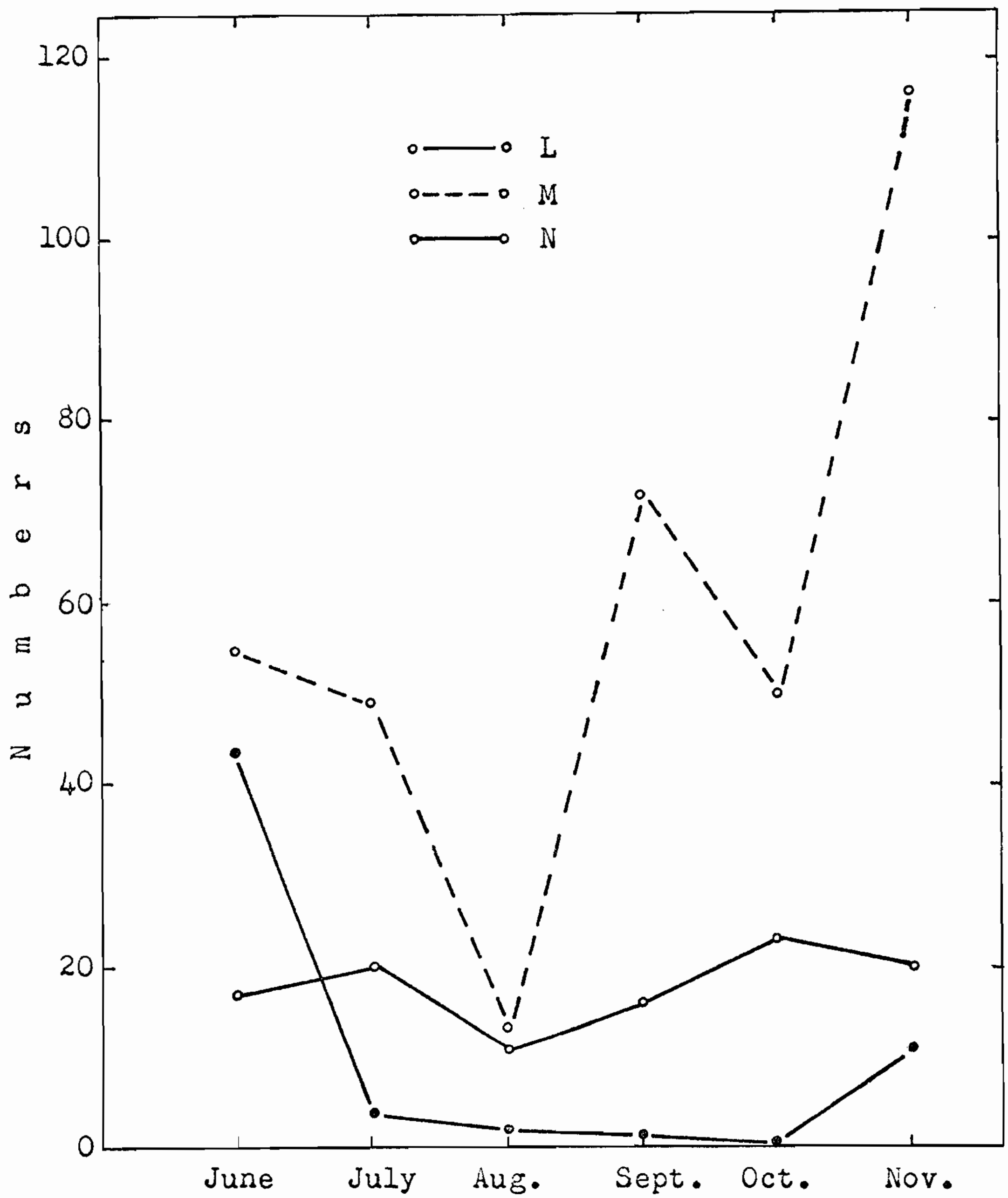

Figure 6. Fluctuation in the numbers of Oribatei in the sub-samples in Site 1 (maple mull). Figures represent averages of 2 samples. For explanation of lettering see Figure 2.

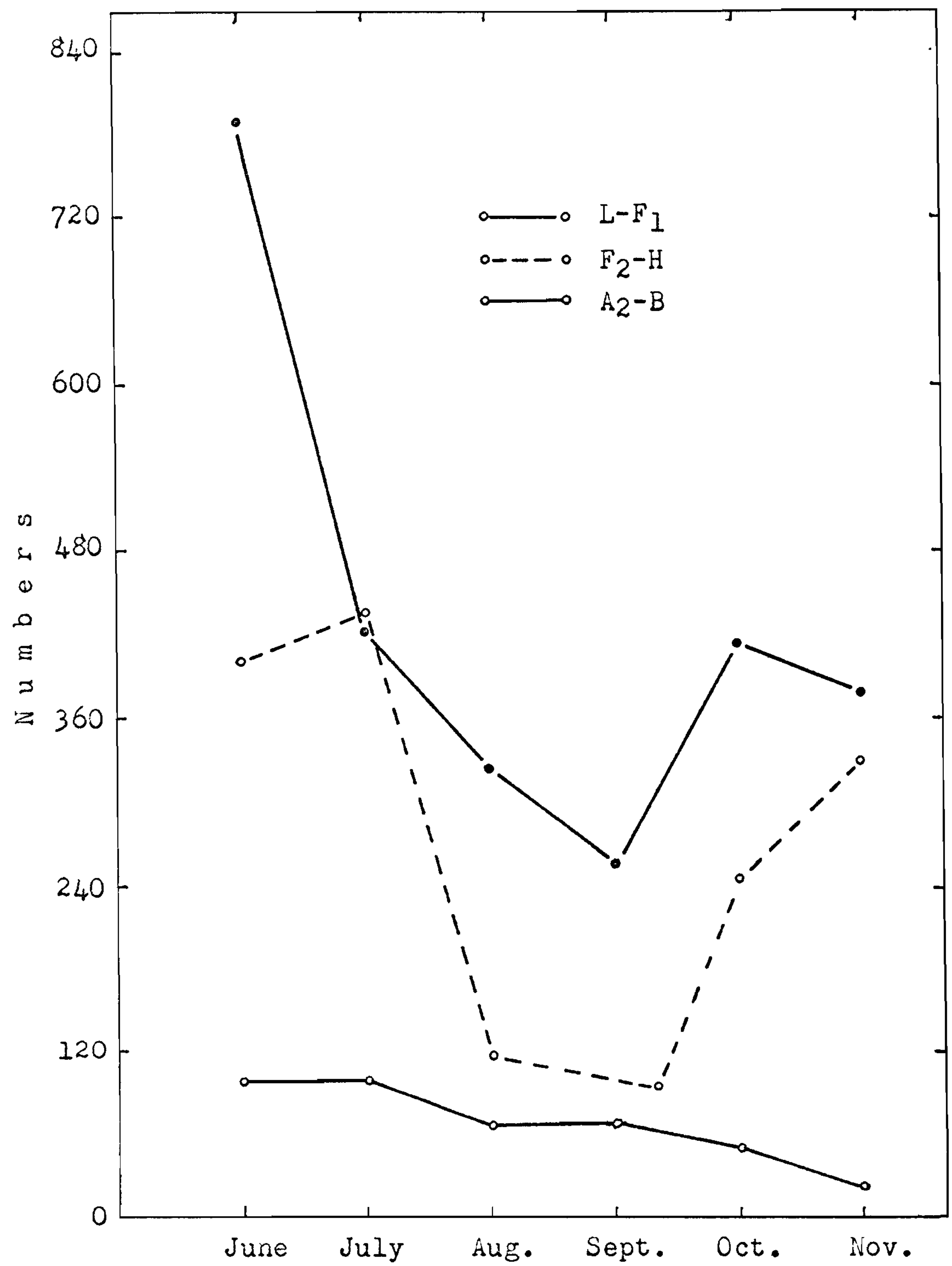

Figure 7. Fluctuation in the numbers of Oribatei in the sub-samples in Site 2 (beech mor). Figures represent averages of 2 samples. For explanation of lettering see Figure 2.

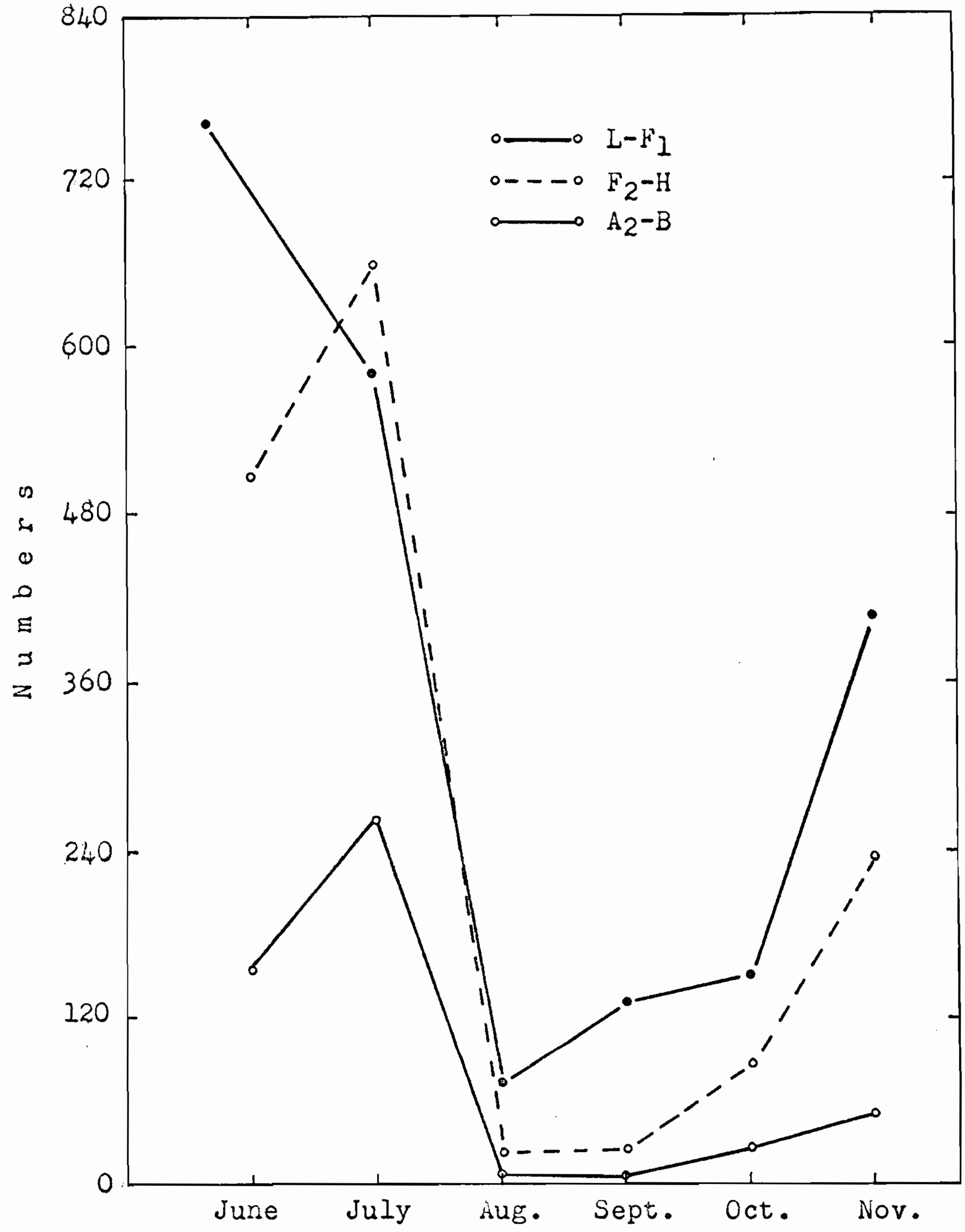

Figure 8. Fluctuation in the numbers of Oribatei in the sub-samples in Site 3 (hemlock mor). Figures represent averages of 2 samples. For explanation of lettering see Figure 2.

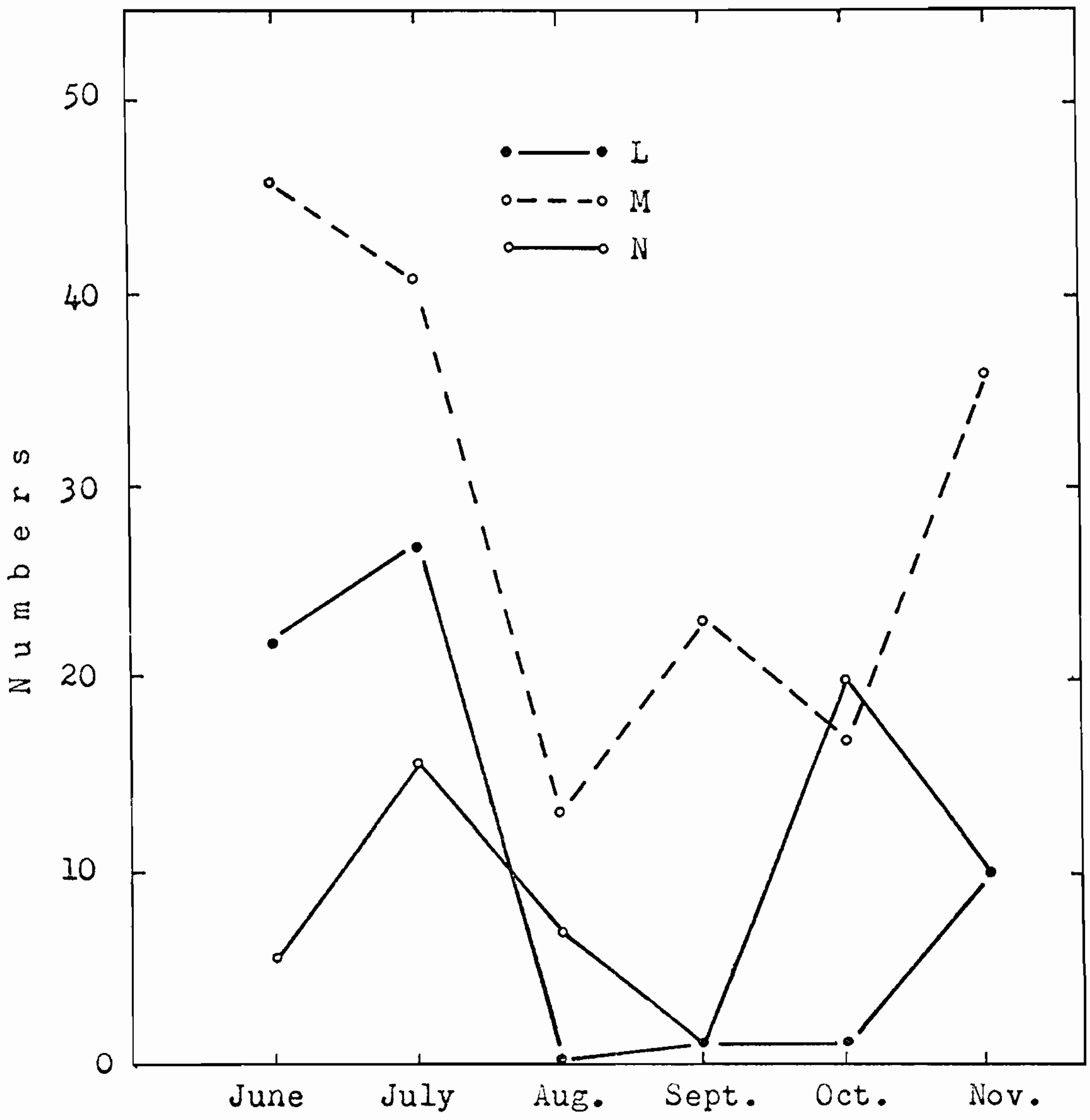

Figure 9. Fluctuation in the numbers of Collembola in the sub-sample in Site 1 (maple mull). Figures represent averages of 2 samples. For explanation of lettering see Figure 2.

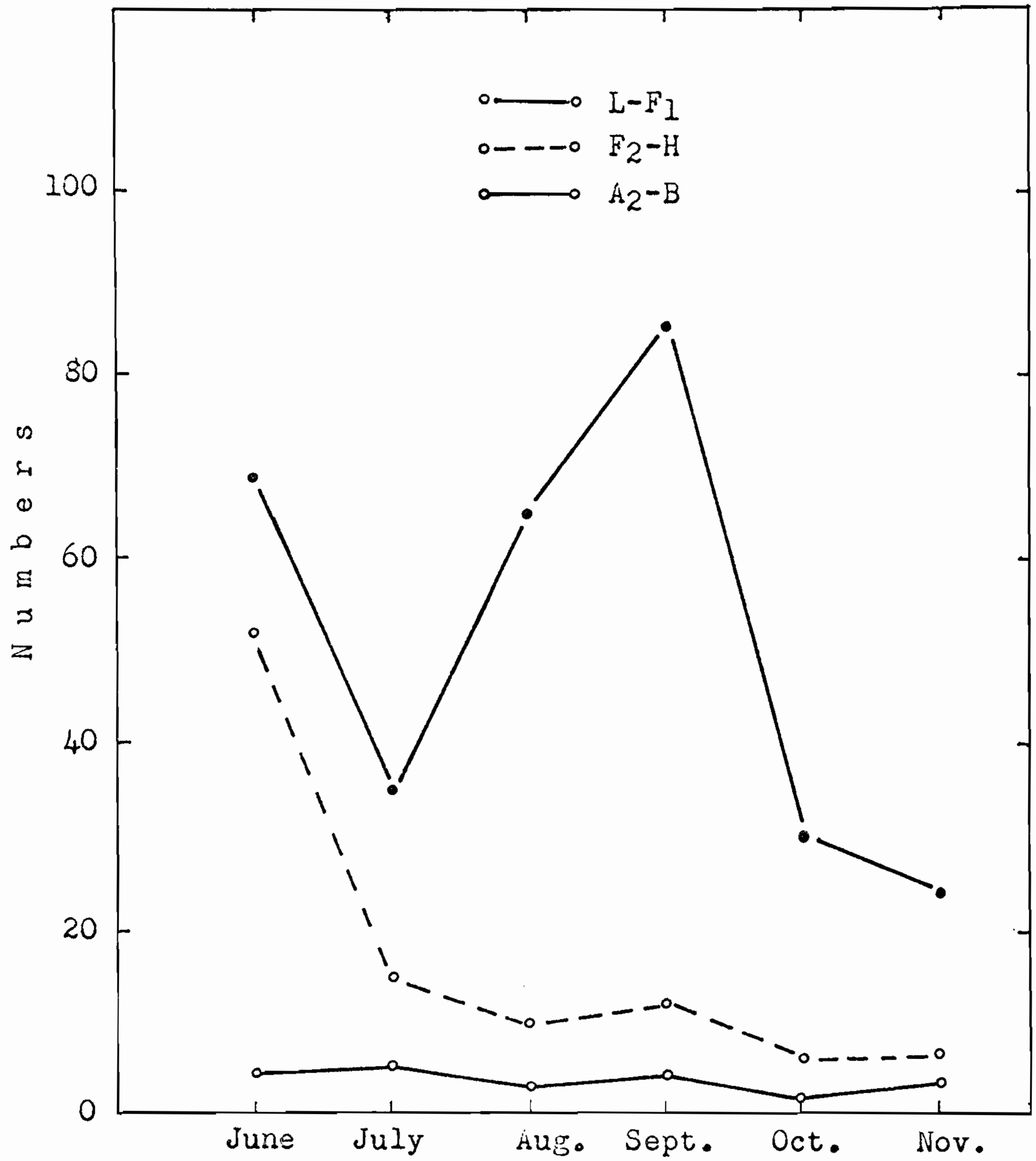

Figure 10. Fluctuations in the numbers of Collembola in the sub-sample in Site 2 (beech mor). Figures represent averages of 2 samples. For explanation of lettering see Figure 2.

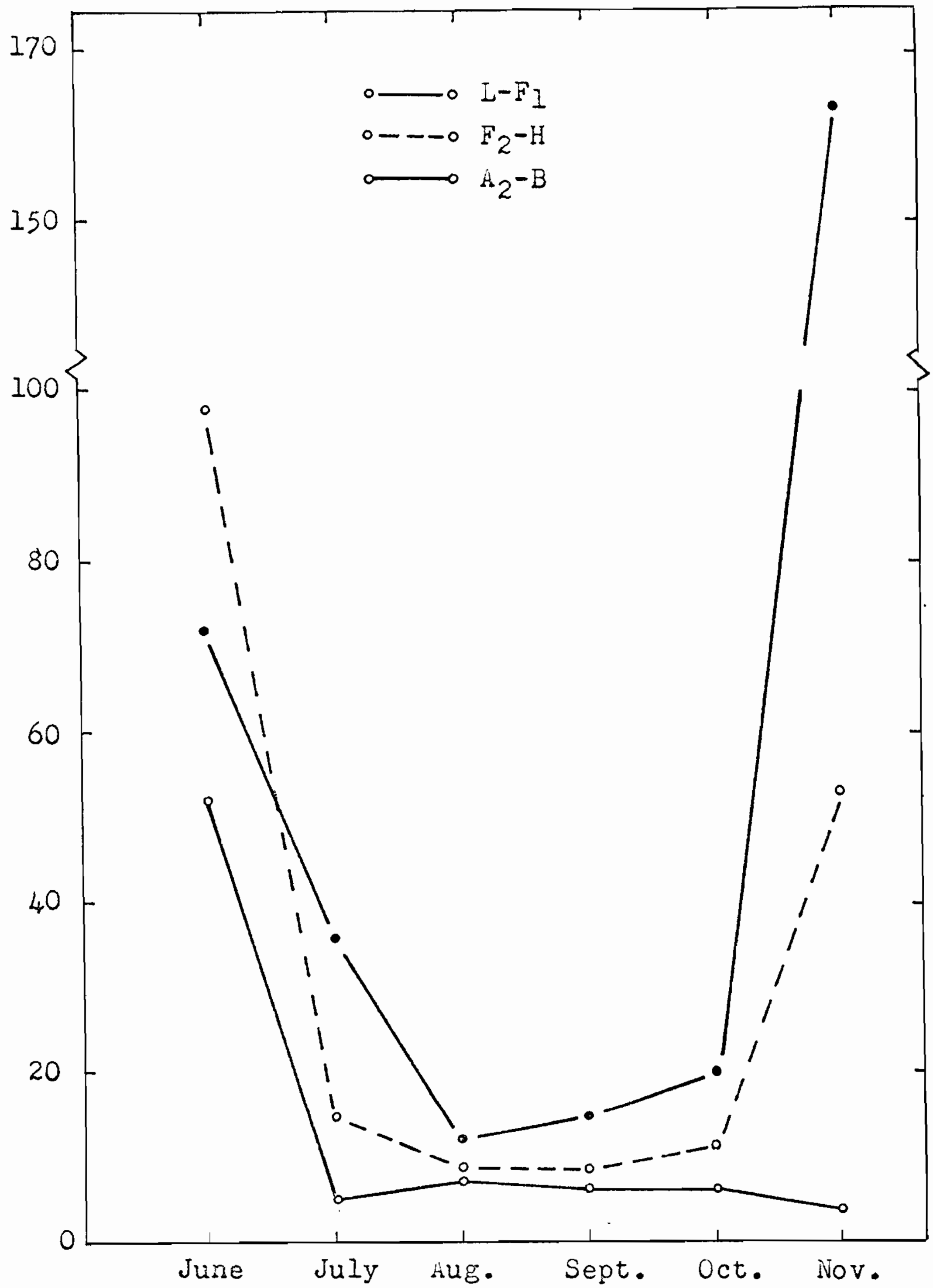

Figure 11. Fluctuation in the numbers of Collembola in the sub-sample in Site 3 (hemlock mor). Figures represent averages of 2 samples. For explanation of lettering see Figure 2.

populations in the soil are highly aggregated and such variation is to be expected, especially with limited sampling. In these cases, exceptionally high counts may have resulted from the inclusion of large numbers of nymphs which did not have time to disperse fully.

In no case did these curves suggest any downward migration of the fauna. It should also be noted from Tables 4 and 5 that the interaction factor of months times horizons, which gives a measure of the change in the population of the different soil layers during the sampling period, is not significant for the Collembola and barely significant at the 5 per cent level of probability for the mites.

The subject of migration is in need of thorough investigation. Greater numbers of individuals found in the lower strata during winter and summer, as compared with higher numbers in the upper layers in spring and autumn, have often been attributed to migration. However, it has been pointed out (cf. Springett, 1963:419) that unless all individuals can be aged, downward migration cannot be demonstrated with any certainty. Milne (1962) obtained results which indicate that so-called downward migration, in some cases, may well be due to increase in the younger forms which tend to occur at lower depths. Much information on migration could be obtained if "marked populations" are studied and this should be possible by some of the techniques outlined by Dobson (1962).

C. RELATIONSHIP BETWEEN FAUNA AND HABITAT

1. GENERAL REMARKS

It has been observed repeatedly that, under coniferous forest stands organic matter usually accumulates, giving rise to mor humus forms. Under such conditions decomposition is slow, and much nutrient material remains locked up in the litter. Under hardwood stands, on the other hand, the breakdown of organic matter is usually rapid, releasing nutrients for re-utilization a year or so after leaf fall. This division is not always clear-cut, and Murphy (1953:187) has pointed out that, in Europe, beech (*Fagus sylvatica* L.) is associated with mull and mor humus forms. In parts of the United States, on the other hand, red oak (*Quercus rubra* L. [= *borealis* Michx. f.], var. *maxima* Ashe) is associated with mor, and the conifers, red and white cedar (*Juniperus virginiana* L. and *Thuja occidentalis* L.) are associated with mull conditions (Murphy, *loc. cit.*).

It is also known that the faunas of these two humus forms, mull and mor, are quite different (Bornebusch, 1930; Eaton and Chandler, 1942; Murphy, 1953; Handley, 1954; Drift, 1961, 1962). Therefore, a thorough understanding of the composition and biology of the species commonly found under mull and mor is one of the first requirements in discovering the relationship between the fauna and flora.

In recent years interest has increased regarding the possible use of indicator species to predict changes in the soil (Balogh, 1960). According to Kevan (1962:200), King (1939) pointed out that the best indicators need not necessarily be the most abundant species, and that all forms should therefore be considered. Gisin (1955) and Franz (1956) drew attention to the exacting requirements of the soil fauna and Gisin (1956, 1956a) provided evidence that the qualitative rather than quantitative composition of the fauna appears to be associated with the fertility of vineyard soils.

The importance of the microfauna in studying the historical development of soil has been demonstrated by Marcuzzi (1956) and Ghilarov (1956, 1958), and from a point of view of conservation by di Castri (1960), di Castri et al. (1961), Maldague (1961) and Davis (1963). Davis and Murphy (1962) analysed the fauna of reclaimed soil from opencast iron-stone mining and concluded that the comparison of soil on the basis of animal population is feasible provided the analysis is carried out at the species level.

2. QUALITATIVE COMPOSITION

Few species were found to occur exclusively on any one humus form. Among the Oribatei with a relatively high frequency percentage and density, *Protoribates capucinus* seems to have a preference for the mull site, while *Synchthonius crenulatus*, *Gehypochthonius rhadamanthus* and *Palaeacarus hystricinus* were collected only on the mor sites. The Collembola also seem to be even more widely distributed, although some species especially in the Poduridae, for example, *Anurida caeca* and certain Entomobryidae such as *Pseudosinella alba* and *P. petterseni*, were only recovered from the mull site.

It would, however, be erroneous to suggest that such species might be "indicators" of soil condition since they are all known from a wide range of habitats (see synopsis of fauna). It would seem preferable to take into consideration the presence and absence of numerous species together; this approach would seem more likely to yield results indicative of the actual conditions in the soil.

Various techniques may be used to show similarity between habitats. Some of these are discussed in Macfadyen (1957, 1963), Crossley and Bohnsack (1960), Haarløv (1960), Maldagne (1961), Drift (1962), Murphy (1962), Davis (1963), Doeksen and Drift (1963), and Imadaté and Kira (1964). Mountford (1962) proposed an index of similarity and a method of classifying sites into groups. This index is based on the logarithmic-series distribution and was shown by him to be superior to those previously suggested as it was independent of sample size. The defining relationship of "I" (index of similarity) is as follows:

$$e^{aI} + e^{bI} = 1 + e^{(a + b - j)I}$$

A good approximation of I could be obtained by using the value

$$\frac{2j}{2ab - (a + b)j}$$

where a is the number of species in the sample drawn from the first site, b the number from the second site, and j the number common to both species lists.

The method for classifying the sites makes use of the index of similarity (initially prepared in a trellis table) between single sites and groups of sites. The index of similarity between a site B and a group composed of Sites A_1 and A_2 is defined as

$$I(A_1A_2;B) = \frac{1}{2}\left[I(A_1\ B) + I(A_2\ B)\right]$$

and in general between two groups of sites as

$$I(A_1 \ldots A_m;\ B_1 \ldots B_n) = 1/mn\left[I(A_1\ B) + \ldots I(A_m\ B_1) + I(A_m\ B_n)\right]$$

To begin, the sites sharing the highest values are combined to form a single group. The indices of similarity between this new group and each of the other sites are evaluated according to the definition of the index between groups and sites. In this way a new table is formed and the procedure is repeated until there is a single value. The value of the index between two groups of sites which are joined together is taken as a measure of the degree of association between the two groups.

The method has been applied to the data for the Oribatei and Collembola from Morgan Arboretum. The number of species found in each site and those common to pairs of sites are given in Appendix A, Tables XXX and XXXI, and indices of similarity, I, in Appendix A, Tables XXXII and XXXIII. The latter are graphically represented in the text in Figures 12 and 13.

The results for both Oribatei and Collembola are similar. The primary grouping is made between the pairs of samples, indicating that the composition of the fauna on any one site has more in common with that of its own site than with the composition of the fauna of other sites. The secondary grouping is between the mor sites with an overall division into mull and mor sites.

This type of index of similarity has been criticized by some soil workers because it does not take into account the abundance of the different species

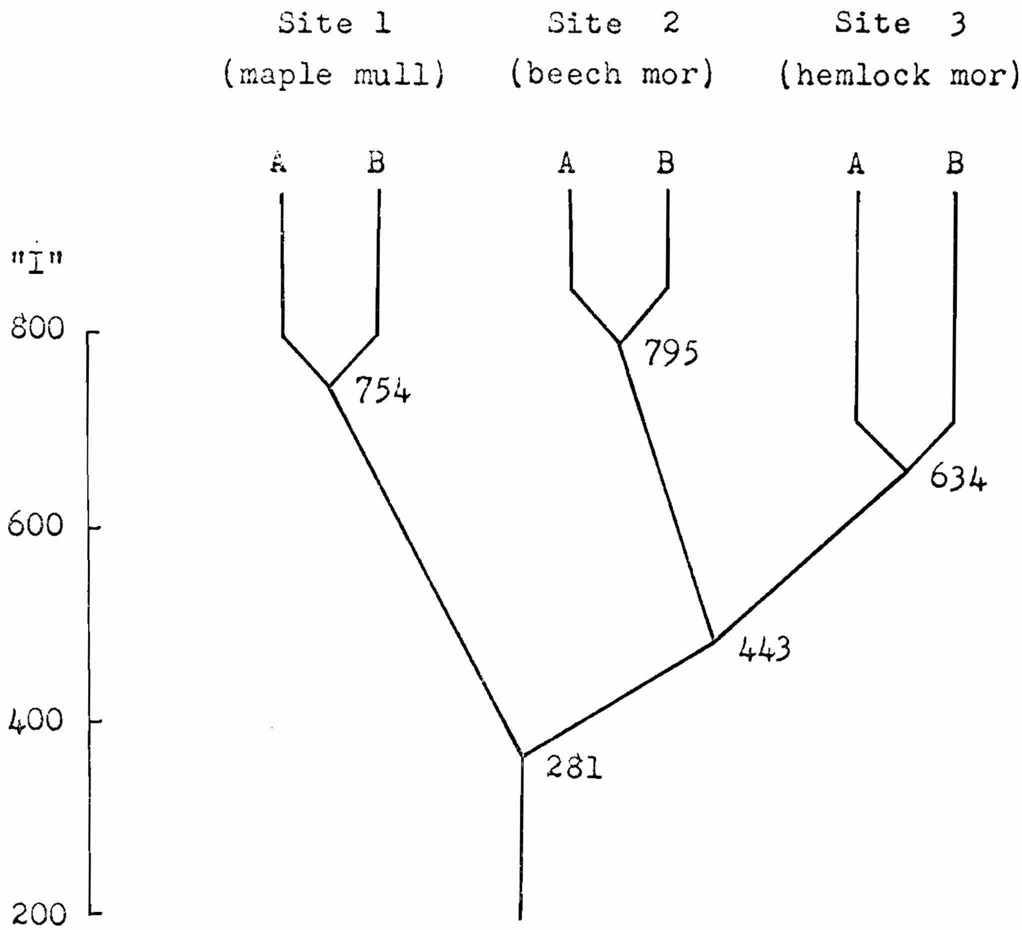

Figure 12. Classification of the three sites based on two series of samples (A and B) of Oribatei and values of indices of similarity between groups of sites. The samples were taken monthly from June to November, 1960.

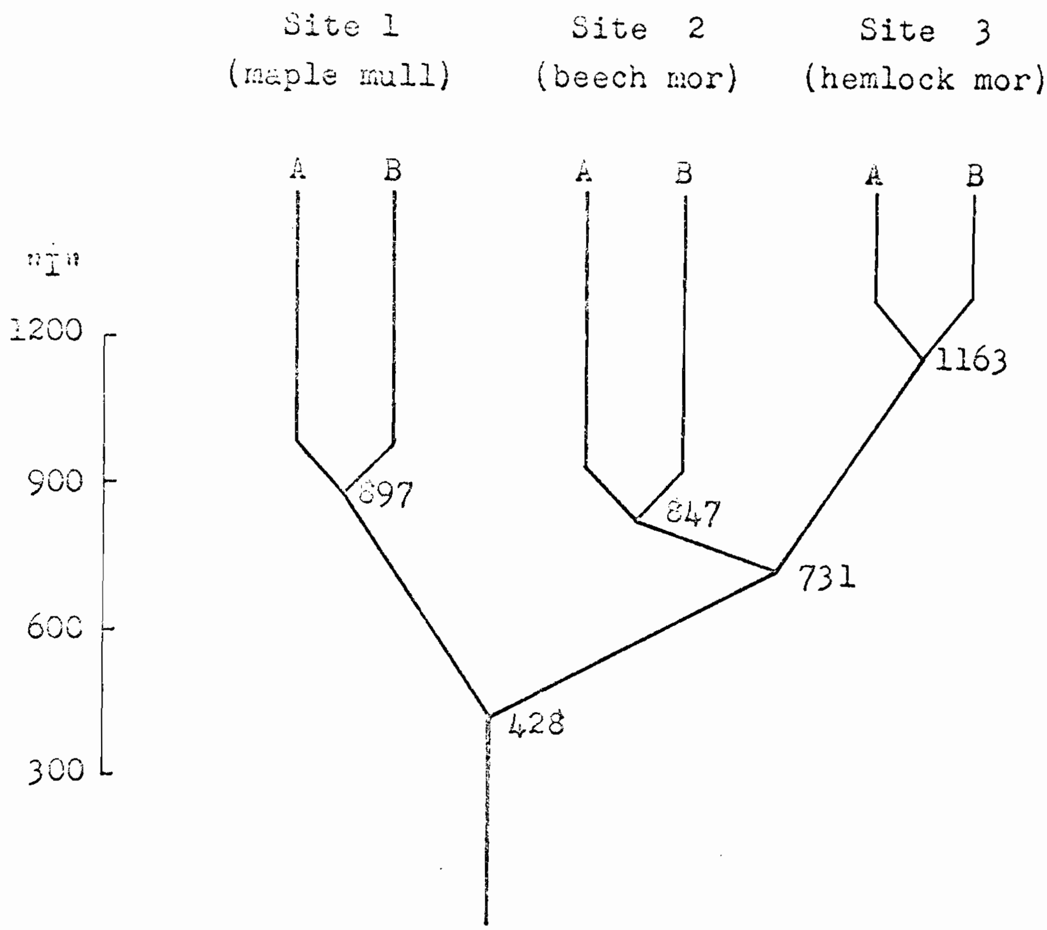

Figure 13. Classification of the three sites based on two series of samples (A and B) of Collembola and values of indices of similarity between groups of sites. The samples were taken monthly from June to November, 1960.

(*cf.* Franz, 1963:336). On the other hand, Davis (1963) compared a number of these techniques and concluded that relative abundance and frequency gave virtually the same results as did the techniques of Sørensen (1948) and Mountford (1962), provided sufficient species are considered.

The index proposed by Mountford (*op. cit.*) seems to be quite sensitive and separated the soils into groups with the closest affinity as far as could be ascertained at the beginning of the experiment.

3. QUANTITATIVE COMPOSITION

The numbers of Oribatei and Collembola recovered from the two humus forms are given in Table 7. Both groups appear to occur in larger numbers on the mor sites. Since the numbers of animals varied so greatly between samples and between sites, an analysis of variance was carried out (Tables 4 and 5). In the case of the Oribatei the results were significant at the 1 per cent level of probability and the Duncan Multiple Range Test (Duncan, 1955) indicated that the mor sites contained a significantly higher number of organisms as compared with the mull. The Collembola showed no significant difference from one humus form to the other.

Taking into account the fact that different techniques, as well as time of sampling will yield different results, the estimate of the micro-arthropod population compares favourably with those of other North American workers. The total numbers of Acarina (Table 7), which represent 1.86 and 2.18 per cubic centimetre, for beech and hamlock mor, respectively, are slightly lower than that of Wallwork's (1959) summer figure of 2.32 per cubic centimetre. The very small yields from the A_2 and B horizons effectively reduced the population estimates when expressed on a volumetric basis. When the figures are converted to numbers per square metre (233,000 and 227,000), they are in excess of his summer total of 176,200 but lower than his winter count (410,000). The figures are again well in excess of the total number of arthropods per square metre (102,000) obtained by Crossley and Bohnsack (1960). In the mull site the number of 45,000 per square metre is somewhat larger than the 37,000 Acarina estimated by Hoffmann _et al_. (1949), or the annual average of 42,000 arthropods obtained by Bohnsack (1954), cited by Crossley and Bohnsack (_loc_. _cit_.), and is much higher than the 3,500 micro-arthropods suggested by Allee _et al_. (1949). Pearse (1946) recorded 22,100 mites per square metre from a deciduous-coniferous forest which seems to have been of a mor humus form, but it is becoming evident that, under mull conditions, the acarine population is often in the region of 40,000 per

Table 7. Total numbers of Acarina, Collembola and Arthropoda from the two humus forms. Mean numbers of 12 samples taken from June to November, 1960.

	No./ Sample	No./ cm^3	No./ m^2
Oribatei			
Site 1	86	0.1879	19,545
Site 2	770	1.3889	175,000
Site 3	691	1.5102	157,064
Total Acarina			
Site 1	201	0.4327	45,682
Site 2	1027	1.8561	233,863
Site 3	999	2.1831	227,045
Collembola			
Site 1	49	0.1071	11,136
Site 2	85	0.1533	19,318
Site 3	97	0.2120	22,045
Total Arthropoda			
Site 1	291	0.6359	66,136
Site 2	1130	2.0382	256,818
Site 3	1105	2.4147	251,136

square metre, while in mor it may be well over 200,000.

Only a few figures are available in the literature for the quantitative comparison of the Collembolan fauna in mull and mor. The figure of 900 per square metre from mull obtained by Bornebusch (1930) is generally regarded as an underestimation. The figure of 14,000 per square metre, calculated from the counts of Hoffmann _et al_. (1949) is likely to be more representative, and is higher than the 11,136 obtained by the present author (Table 7). Figures for mor humus forms have also shown great variation. The average number (20,600) per square metre obtained from mor is lower than that of Wallwork's (1959) summer figure (43,000) or Poole's figure of 46,000, but is higher than the 8,450 calculated from the data of Crossley and Bohnsack (1960).

If significant differences exist between the Collembolan fauna in mull and mor, this presumably did not show up for a number of reasons, the most important of which may have been inadequate sampling. Only a small area on the different humus forms was sampled and this could not take into account the range of variation which exists over a wider region. If sampling had been carried out along a transect or catena divided into sub-areas or "strata" (_cf_. Macfadyen, 1962), the results would probably have been more representative.

Unfortunately this type of programme is often limited by the equipment and time available for study. Different extracting methods operate with varying efficiency in different types of soil (Müller, 1962; Satchell and Nelson, 1962). Funnel extractors are generally regarded as being better for soils rich in organic material, but are not so efficient in heavy clay soils. In the case of the maple mull the populations may have been underestimated. However, Satchell and Nelson (*op. cit.*) did not obtain significant differences in the number of Acarina in a mull site when the Tullgren-funnel and flotation methods were compared.

Bearing these restrictions in mind, the results can only be considered as preliminary. In order to obtain satisfactory estimates of soil populations it is not only necessary to analyse large numbers of samples, but different methods would also have to be employed where different soils are being compared. Such an approach would involve a great deal of work, and, in the present state of soil arthropod taxonomy, it would seem advisable to restrict soil zoological studies to smaller groups, especially where quantitative data are required.

V. SUMMARY AND CONCLUSION

V. SUMMARY AND CONCLUSION

1. This study was carried out with the object of obtaining information concerning the relationship between the soil Oribatei and Collembola and their habitats, in two Quebec woodland humus forms, and also to begin an initial survey of local soil arthropods for reference in future research.
2. Three sample sites were selected: a mull humus form, on clay, under a mixed hardwood stand in which sugar maple (*Acer saccharum* Marsh) predominated, and two mor humus forms, on sand, one under beech (*Fagus grandifolia* Ehrh.) and the other under hemlock (*Tsuga canadensis* L.).
3. Two series of samples, 7.5 centimetres in diameter, divided into three horizontal sub-samples, were taken with a steel corer, at monthly intervals from June to November, 1960. The sub-samples were extracted in modified Tullgren funnels for 72 hours. The fauna was studied in part under a binocular microscope, but in many cases representative samples of the total "catch" were prepared as temporary mounts or as permanent slides for detailed taxonomic study. The specimens

mounted on microscope slides, as well as specimens preserved in lactic acid are in the Lyman Entomological Museum, Macdonald College, Quebec.

4. At the time of sampling, the temperature of the soil and air and the pH of the sampled horizons were also measured.
5. The major ecological factors which affect the soil fauna are discussed.
6. Thirty thousand, three hundred and seven specimens of arthropods were studied, of which the Acarina composed 88.2 per cent, the Collembola 9.2 per cent, and the other groups 2.6 per cent. In the present study only the Oribatei and Collembola were determined to species and analysed. Many of the 93 species of Oribatei and 58 species of Collembola are reported for the first time from Canada. At least 19 species of Oribatei and 5 species of Collembola appear to be new to science.
7. Important information on new taxa can still be obtained from widespread soil collection without regard to quantitative considerations.
8. Lewis' index indicated that the more abundant species of Oribatei and Collembola are aggregated in their distribution. Since both these groups of micro-arthropods are in general saprophagous, their distribution is probably affected by favourable food sites, and horizontal distribution may vary from one soil to

another. However, there is little information in the literature concerning this aspect, which should provide an interesting facet for future research.

9. The vertical distribution of the Oribatei and Collembola showed that the numbers greatly declined with increasing depth and the populations in the different layers differed significantly. The larger species were more confined to the surface regions, but distribution is probably also affected by other factors such as food and humidity. Primitive Oribatei, which are pallid, such as the Palaeacaridae and Parhypochthoniidae were more numerous in deeper layers. Adults of *Oppia nova*, which occurred in the surface layers were larger than those found deep in the soil. This species seem to have evolved different size forms to suit the different soil layers.

10. Populations fluctuated during the sampling period, especially on the mor sites. Late in spring the numbers suddenly dropped, remained relatively low during summer, but began to climb late in autumn. The monthly totals were significantly different. Although a number of reasons has been given for these changes the exact causes remain unknown.

11. There was no indication of movement through the soil profile during the summer months, and suggestions of so-called downward migration may, in some cases, be

due to increase in the numbers of younger forms which tend to occur in deeper layers.

12. In expressing soil faunal populations, it is very important to give, in addition to the technique used, the time of sampling as well as the horizons sampled.
13. Few species occurred exclusively in a single site. The commoner Oribatei and Collembola occurred in a very wide range of habitats and it appears to be very difficult to recognize indicator species.
14. Habitats were classified into groups by Mountford's index. Both the Oribatei and Collembola indicated that the mor sites were faunistically more similar to each other than either was to the mull.
15. Some arthropods, especially the Myriapoda, Diplura and Protura, were more abundant in mull than in mor. The latter sites had a significantly higher number of Oribatei than the former, but the numbers of Collembola appear to be evenly distributed in all sites.
16. The estimation of the acarine population compared favourably with those of other North American workers. It is becoming evident that under mull conditions the population is often in the region of 40,000 per square metre, while in mor it may well be over 230,000 per square metre. Under all conditions the Oribatei seem to be the dominant group.
17. There are fewer figures available for the Collembola

and those which exist show too wide a variation in similar habitats to form any reasonable estimate of their numbers.

18. There is a general tendency for more recent authors, working in similar habitats, to obtain larger estimates of the numbers of soil animals than their predecessors. This is partly a reflection of better techniques and we may expect even larger counts in future.

19. Because of the restrictions imposed by a limited number of samples, by the method of extraction used, and by the time-consuming nature of the work, the results must be considered as preliminary. Much additional work is required before valid conclusions can be drawn.

20. The comparison of different soil types will require different techniques as well as extensive sampling. Therefore, in soil zoological work where preliminary data are already available, it seems advisable to study a relatively small group of organisms, the taxonomy of which is well known or which can be relatively easily worked out.

21. Studies in soil zoology have been increasing in recent years but there are still many problems to be solved. During the present investigation some of these became apparent. There is evidence that rapid

moving species escape from the funnel before extraction. Some attempts should be made in future to capture such forms by other means. The food of most soil micro-arthropods is poorly known and, before adequate interpretations can be made concerning the relationship between the fauna and the habitat, information on this is greatly needed. This in turn rests on much better knowledge of the taxonomy of the different groups than is at present available, particularly in North America. Many of the Canadian species appear to be Holarctic in their distribution and some apparently new ones may have already been described from Europe or elsewhere. There is great need for keys to, and reliable local check lists of, about all North American micro-arthropods, since the fauna of even relatively restricted areas may be extremely rich. There is ample opportunity and great need for future research in taxonomy and biology of the soil fauna, without which ecological studies are severely hampered.

VI. REFERENCES

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VII. APPENDICES

APPENDIX A

TABLES

Table I. Meteorological data for the Montreal region. (Long term averages)

Month	Air Temp. Mean Daily ° F.	Precipitation Mean amount in.	Wind		Bright sunshine Mean No. of hours
			Av. m.p.h.	Direction	
Jan.	15.4	3.54	12.6	SW	97
Feb.	16.4	2.72	12.7	W	102
Mar.	28.0	3.26	12.5	SW	145
Apr.	41.6	3.37	12.3	SW	167
May	55.6	3.30	11.2	SW	203
June	65.6	3.76	9.9	SW	222
July	70.4	3.97	9.3	SW	244
Aug.	68.2	3.48	9.1	SW	223
Sept.	59.6	3.72	9.7	SW	170
Oct.	48.0	3.40	10.5	SW	126
Nov.	35.2	3.92	11.5	SW	69
Dec.	20.7	3.36	11.9	W	61
Year	43.7	41.80	11.1	SW	1811

Data taken from "Canada Year Book" 1960:45.

Table II. Monthly temperatures (^{o} C.) of horizons of sample sites, taken on the day of sampling. The characterization of the soil horizons is explained on page 56.

Horizons	Months					
	June	July	Aug.	Sept.	Oct.	Nov.
			Site 1 (maple mull)			
L	17.0	24.0	22.0	15.1	10.5	7.9
0-5 cm.	16.0	20.0	21.5	14.0	8.2	6.9
5-10 cm.	15.5	18.0	21.3	13.5	8.5	7.1
Total	48.5	62.0	64.8	42.6	27.2	21.9
Average	16.2	20.6	21.6	14.2	9.1	7.3
			Site 2 (beech mor)			
L-F_1	16.5	21.0	21.0	15.0	10.0	7.0
F_2-H	15.0	19.0	21.0	14.5	9.8	7.5
A_2-B	14.0	18.0	19.1	14.0	9.1	7.5
Total	45.5	58.0	61.1	43.5	28.9	22.0
Average	15.2	19.3	20.4	14.5	9.6	7.3
			Site 3 (hemlock mor)			
L-F_1	15.9	23.0	24.2	14.2	7.4	6.5
F_2-H	15.0	20.0	23.5	14.2	7.1	7.1
A_2-B	14.5	18.0	22.0	14.5	5.2	7.5
Total	45.4	61.0	69.7	42.9	19.7	21.1
Average	15.1	20.3	23.2	14.3	6.6	7.0

Table III. Average monthly temperatures of sample sites. Figures for the soil represent the mean of 3 readings taken approximately in the region of each sub-sample (see Appendix A, Table II).

	Month	Location			Average	
		Site 1	Site 2	Site 3	° C.	° F.
Air	June	18.0	17.9	18.0	18.0	64.4
	July	29.0	22.0	29.0	29.0	84.1
	Aug.	22.1	25.0	24.5	23.9	75.0
	Sept.	15.5	15.0	16.0	15.5	59.0
	Oct.	14.0	12.5	11.0	12.5	54.5
	Nov.	8.0	4.5	5.5	6.0	42.8
Soil	June	16.2	15.2	15.1	15.5	60.0
	July	20.6	19.3	20.3	20.1	68.2
	Aug.	21.6	20.4	23.2	21.7	71.0
	Sept.	14.2	14.5	14.3	14.3	57.8
	Oct.	9.1	9.6	6.6	8.4	47.2
	Nov.	7.3	7.3	7.0	7.2	45.2

Table IV. Depths and pH of horizons sampled. For characterization of soil horizons see Appendix A, Table II.

Month	Site 1 (maple mull)					
	Depth (cm.)			pH		
	L	0-5	5-10	L	0-5	5-10
June	0.0	5.0	5.0	-	6.8	6.8
July	0.3	5.0	5.0	-	7.5	6.5
Aug.	0.2	5.0	5.0	-	6.5	6.4
Sept.	0.0	5.0	5.0	-	7.2	6.5
Oct.	1.0	5.0	5.0	-	6.7	6.4
Nov.	1.0	5.0	5.0	-	6.7	6.9
Average	0.4	5.0	5.0	-	6.9	6.6

Month	Site 2 (beech mor)					
	Depth (cm.)			pH		
	$L-F_1$	F_2-H	A_2-B	$L-F_1$	F_2-H	A_2-B
June	4.0	4.0	5.0	4.7	3.9	4.1
July	6.0	4.0	5.0	4.9	4.2	4.4
Aug.	4.0	3.0	5.0	4.6	4.4	4.2
Sept.	1.7	0.5	5.0	4.2	4.1	4.5
Oct.	5.0	3.5	5.0	4.5	4.6	5.1
Nov.	5.0	4.5	5.0	4.7	4.4	4.5
Average	4.3	3.3	5.0	4.6	4.3	4.5

Month	Site 3 (hemlock mor)					
	Depth (cm.)			pH		
	$L-F_1$	F_2-H	A_2-B	$L-F_1$	F_2-H	A_2-B
June	6.0	6.0	5.0	4.8	4.6	4.6
July	2.3	2.5	5.0	3.8	4.5	5.0
Aug.	2.0	1.5	5.0	4.5	4.2	4.8
Sept.	2.0	2.0	2.0	4.5	4.2	-
Oct.	3.0	3.0	2.5	4.2	4.5	5.2
Nov.	4.0	3.5	5.0	4.9	4.2	4.2
Average	3.2	3.1	4.1	4.5	4.4	4.8

Table V. Average and total depth, and average pH of horizons sampled. Data summarized from Appendix A, Table IV. For explanation of horizons see Appendix A, Table II.

			Depth				pH			
	Horizon		L	0-5 cm.	5-10 cm.	Total	L	0-5 cm.	5-10 cm.	Average
Mull	Site 1	(cm.)	0.4	5.0	5.0	10.4	-	6.9	6.6	6.7
		(%)	4	48	48					

	Horizon		$L-F_1$	F_2-H	A_2-B	Total	$L-F_1$	F_2-H	A_2-B	Average
Mor	Site 2	(cm.)	4.3	3.3	5.0	12.6	4.6	4.3	4.5	4.5
		(%)	34	26	40					
	Site 3	(cm.)	3.2	3.1	4.1	10.4	4.5	4.5	4.8	4.6
		(%)	30	30	40					

Table VI. Site 1 (maple mull). Numbers of Sarcoptiformes per sample (series A) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples; L, M and N refer to the litter layer and the soil of the B horizon at depths of 0-5 and 5-10 cm.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ACARIDIAE									
ACARIDAE									
Rhizoglyphus sp.	-	0	0	0	0	0	0	0	0
	L	2	0	0	0	0	0	2	
	M	2	0	0	0	0	4	6	
Schwiebea cavernicola	N	0	0	2	0	0	0	2	10
Tyrophagus putrescentiae	M	0	0	0	0	0	3	3	3
ANOETIDAE sp.	M	0	1	0	0	0	1	2	2
ACARIDAE undet.	-	0	0	0	0	0	0	0	0
ACARIDIAE TOTAL	-	4	1	2	0	0	8	15	15

[1]H = Horizon

[2]Tss = Sub-sample total

[3]Ts = Sample total

(table continued)

Table VI (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ORIBATEI									
PALAEACARIDAE									
Palaeacarus hystricinus	-	0	0	0	0	0	0	0	0
PARHYPOCHTHONIIDAE									
Gehypochthonius rhadamanthus . .	-	0	0	0	0	0	0	0	0
	M	0	0	0	1	0	0	1	
Parhypochthonius aphidinus . . .	N	0	0	1	4	2	1	8	9
HYPOCHTHONIIDAE									
	M	2	5	0	12	4	12	35	
Hypochthonius rufulus	N	0	0	4	0	0	0	4	39
ENIOCHTHONIIDAE									
Eniochthonius minutissimus . . .	M	0	0	0	0	1	0	1	1
BRACHYCHTHONIIDAE									
Brachychthonius berlesei	-	0	0	0	0	0	0	0	0
B. italicus	-	0	0	0	0	0	0	0	0
B. jugatus	-	0	0	0	0	0	0	0	0
B. rostratus	-	0	0	0	0	0	0	0	0
B. zelawaiensis	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p.210.

(table continued)

Table VI.(continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
<u>Brachychthonius</u> sp., ? <u>nov</u>. . .	-	0	0	0	0	0	0	0	0
<u>Eobrachychthonius</u> <u>latior</u>	-	0	0	0	0	0	0	0	0
<u>Linochthonius</u> sp., ? <u>altimonticola</u>	-	0	0	0	0	0	0	0	0
<u>L</u>. sp. ? <u>latus</u>	-	0	0	0	0	0	0	0	0
<u>L</u>. <u>ocellatus</u>	-	0	0	0	0	0	0	0	0
<u>L</u>. <u>pilososetosus</u>	M	1	0	0	0	0	0	1	1
<u>L</u>. <u>scalaris</u>	M	0	0	0	0	0	19	19	19
<u>Linochthonius</u> sp., ? <u>nov</u>. . . .	-	0	0	0	0	0	0	0	0
<u>Synchthonius</u> <u>crenulatus</u>	-	0	0	0	0	0	0	0	0
HETEROCHTHONIIDAE									
<u>Heterochthonius</u> sp., ? <u>nov</u>. . .	-	0	0	0	0	0	0	0	0
ATOPOCHTHONIIDAE									
<u>Atopochthonius</u> <u>artiodactylus</u> . .	M	0	0	5	0	0	0	5	5
PTEROCHTHONIIDAE									
<u>Pterochthonius</u> <u>angelus</u>	-	0	0	0	0	0	0	0	0
PHTHIRACARIDAE									
<u>Phthiracarus</u> <u>olivaceum</u>	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p.210

(table continued)

Table VI (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Ph. setosellum	L	1	0	0	0	0	0	1	
	M	1	0	0	0	0	1	2	3
Ph. sp., ? *sphaerulum*	L	0	0	0	0	0	1	1	
	M	1	0	0	0	0	2	3	4
Phthiracarus sp., ? *nov*.	-	0	0	0	0	0	0	0	0
Steganacarus diaphanum	L	2	0	0	0	0	0	2	
	M	6	2	1	5	2	2	18	20
EUPHTHIRACARIDAE									
Euphthiracarus flavus	-	0	0	0	0	0	0	0	0
Euphthiracarus sp.	-	0	0	0	0	0	0	0	0
Rhysotritia cf. ardua	-	0	0	0	0	0	0	0	0
EPILOHMANNIIDAE									
Epilohmannia cylindrica	-	0	0	0	0	0	0	0	0
EULOHMANNIIDAE									
Eulohmannia ribagai	M	0	0	0	0	2	1	3	
	N	1	1	0	0	0	0	2	5
NOTHRIDAE									
Northus gracilis	M	4	1	2	7	4	13	31	
	N	0	0	1	0	0	0	1	32

[1;2;3] See footnote p. 210

(table continues)

Table VI (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	M	0	0	0	6	0	6	12	
N. silvestris	N	0	0	0	1	0	6	7	19
TRHYPOCHTHONIIDAE									
Trhypochthonius tectorum	-	0	0	0	0	0	0	0	0
MALACONOTHRIDAE									
Malaconothrus sp., ? molliseptosus	-	0	0	0	0	0	0	0	0
Malaconothrus sp.$_1$	-	0	0	0	0	0	0	0	0
Malaconothrus sp.$_2$	-	0	0	0	0	0	0	0	0
Trimalaconothrus sp.	-	0	0	0	0	0	0	0	0
NANHERMANNIIDAE									
Nanhermannia elegantula	-	0	0	0	0	0	0	0	0
N. sp., ? nana	-	0	0	0	0	0	0	0	0
PLASMOBATIDAE									
Plasmobates sp.	-	0	0	0	0	0	0	0	0
GYMNODAMAEIDAE									
Gymnodameus sp. ? nov.	-	0	0	0	0	0	0	0	0
DAMAEIDAE									
Belba sp.$_1$	-	0	0	0	0	0	0	0	0

1;2;3 See footnote p. 210

(table continued)

Table VI (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Belba sp.$_2$	-	0	0	0	0	0	0	0	0
CEPHEIDAE									
Cepheus corae	-	0	0	0	0	0	0	0	0
EREMOBELBIDAE									
Eremobelba flagellaris	-	0	0	0	0	0	0	0	0
LIACARIDAE									
Adorestes ovatus	-	0	0	0	0	0	0	0	0
Liacarus sp.$_1$	M	0	0	0	0	0	1	1	1
Liacarus sp.$_2$	M	0	0	0	0	1	0	1	1
ASTERGISTIDAE									
	L	1	1	0	0	0	0	2	
Cultroribula trifurca	M	0	0	0	1	1	0	2	4
CARABODIDAE									
Carabodes labyrinthicus	-	0	0	0	0	0	0	0	0
Carabodes sp., ? *nov.*	-	0	0	0	0	0	0	0	0
TECTOCEPHEIDAE									
	M	0	1	5	1	1	29	37	
Tectocepheus velatus	N	0	0	2	1	1	0	4	41

1;2;3 See footnote p.210

(table continued)

Table VI (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
OPPIIDAE									
Oppia maculata	-	0	0	0	0	0	0	0	0
O. manifera	-	0	0	0	0	0	0	0	0
O. minor	-	0	0	0	0	0	0	0	0
	L	2	0	0	0	0	0	2	
	M	11	9	0	26	2	18	66	
O. nova	N	11	3	5	1	6	3	29	97
O. unicarinata	-	0	0	0	0	0	0	0	0
Oppia sp., ? *nov*.	-	0	0	0	0	0	0	0	0
Quadroppia circumita	M	1	0	0	0	0	0	1	1
SUCTOBELBIDAE									
Suctobelba frothinghami	-	0	0	0	0	0	0	0	0
S. gigentea	-	0	0	0	0	0	0	0	0
	M	11	0	3	0	0	0	14	
S. hurshi	N	3	0	0	0	0	0	3	17
S. laxtoni	M	0	1	0	0	0	0	1	1
S. longicuspis	M	0	1	0	0	0	0	1	1

[1;2;3] See footnote p. 210

(continued)

Table VI (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Suctobelba sp.$_{1}$, *nov*. ?	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{2}$, ? *nov*.	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{3}$, ? *nov*.	M	7	0	0	0	0	0	7	7
Suctobelba sp.$_{4}$, ? *nov*.	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{5}$, ? *nov*.	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{6}$, ? *nov*.	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{7}$, ? *nov*.	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{8}$, ? *nov*.	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{9}$, ? *nov*.	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{10}$, ? *nov*.	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{11}$, ? *nov*.	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{12}$, ? *nov*.	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{13}$, ? *nov*.	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{14}$, ? *nov*.	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 210

(table continued)

Table VI. (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ACHIPTERIIDAE									
Achipteria coleoptera	-	0	0	0	0	0	0	0	0
ORIBATELLIDAE									
Oribatella reticulatoides . . .	-	0	0	0	0	0	0	0	0
CERATOZETIDAE									
Ceratozetes sp.	M	0	0	0	3	0	0	3	3
Fuscozetes bidentatus	-	0	0	0	0	0	0	0	0
CHAMBOBATIDAE									
	L	-	1	0	0	0	0	1	
Chambobates sp.	M	0	0	0	1	0	0	1	2
PARAKALUMNIDAE									
? *Neoribates* sp.	-	0	0	0	0	0	0	0	0
Protokalumna depressum	-	0	0	0	0	0	0	0	0
GALUMNIDAE									
	M	0	0	0	2	0	1	3	
Pergalumna emarginatus	N	0	0	2	0	0	0	2	5
ORIBATULIDAE									
Oribatula minuta	-	0	0	0	0	0	0	0	0
Scheloribates pallidulus	M	0	0	0	13	0	1	14	14

1;2;3 See footnote p.210

(table continued)

Table VI (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
HAPLOZETIDAE									
Peloribates americanus	-	0	0	0	0	0	0	0	0
	L	4	0	0	0	0	0	4	
	M	8	5	1	3	2	10	29	
Protoribates capucinus	N	3	3	1	4	2	4	17	50
P. lophetrichus	M	0	0	0	6	0	0	6	6
	L	6	0	0	0	0	0	6	
	M	7	1	4	8	5	0	25	
ORIBATEI undet.	N	1	0	0	0	0	0	1	32
ORIBATEI TOTAL		95	35	37	106	36	131		440
SARCOPTIFORMES TOTAL		99	36	39	106	36	139		455

[1;2;3] See footnote p. 210.

Table VII. Site 1 (maple mull). Numbers of Sarcoptiformes per sample (series B) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples; L, M and N refer to the litter layer and the soil of the B horizon at depths of 0-5 and 5-10 cm.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ACARIDIAE									
ACARIDAE									
Rhizoglyphus sp.	-	0	0	0	0	0	0	0	0
	L	1	7	0	0	4	5	17	
	M	3	2	2	0	1	4	12	
Schwiebea cavernicola	N	0	0	0	0	0	0	0	29
	L	0	0	0	1	0	0	1	
	M	0	3	0	0	0	0	3	
Tyrophagus putrescentiae	N	1	3	0	0	0	0	4	8
ANOETIDAE sp.	-	0	0	0	0	0	0	0	0
ACARIDAE undet.	L	2	0	0	0	0	0	2	2
ACARIDIAE TOTAL		7	15	2	1	5	9	39	39

[1]H = Horizon
Tss = Sub-sample total
Ts = Sample total

(table continued)

Table VII (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
<u>ORIBATEI</u>									
PALAEACARIDAE									
Palaeacarus hystricinus	-	0	0	0	0	0	0	0	0
PARHYPOCHTHONIIDAE									
Gehypochthonius rhadamanthus . .	-	0	0	0	0	0	0	0	0
	M	0	0	0	0	1	10	11	
Parhypochthonius aphidinus . . .	N	0	0	0	0	0	5	5	16
HYPOCHTHONIIDAE									
	M	1	5	0	3	11	16	36	
Hypochthonius rufulus	N	0	0	0	0	1	0	1	37
ENIOCHTHONIIDAE									
Eniochthonius minutissimus . . .	M	0	0	0	1	6	2	9	9
BRACHYCHTHONIIDAE									
Brachychthonius berlesei	-	0	0	0	0	0	0	0	0
B. italicus	-	0	0	0	0	0	0	0	0
	L	1	0	0	0	0	0	1	
B. jugatus	N	1	0	0	0	0	0	1	2
B. rostratus	-	0	0	0	0	0	0	0	0
B. zelawaiensis	-	0	0	0	0	0	0	0	0

1;2;3 See footnote p. 220

(table continued)

Table VII (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Brachychthonius sp., ? nov. . . .	-	0	0	0	0	0	0	0	0
Eobrachychthonius latior	L	8	0	0	0	0	0	8	8
Linochthonius sp., ? altimonticola	-	0	0	0	0	0	0	0	0
L. sp. ? latus	-	0	0	0	0	0	0	0	0
L. ocellatus	-	0	0	0	0	0	0	0	0
L. pilososetosus	-	0	0	0	0	0	0	0	0
L. scalaris	M	0	0	0	0	0	3	3	3
Linochthonius sp., ? nov.	-	0	0	0	0	0	0	0	0
Synchthonius crenulatus	-	0	0	0	0	0	0	0	0
HETEROCHTHONIIDAE									
Heterochthonius sp., ? nov. . . .	-	0	0	0	0	0	0	0	0
ATOPOCHTHONIIDAE									
Atopochthonius artiodactylus . . .	-	0	0	0	0	0	0	0	0
PTEROCHTHONIIDAE									
Pterochthonius angelus	-	0	0	0	0	0	0	0	0

1;2;3;See footnote p.220

(table continued)

Table VII (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
PHTHIRACARIDAE									
	L	1	0	0	0	0	0	1	
	M	2	0	2	3	0	0	7	
Phthiracarus olivaceum	N	0	0	0	0	1	0	1	9
Ph. setosellum	-	0	0	0	0	0	0	0	0
	L	1	0	0	0	0	0	1	
Ph. sp., ? sphaerulum	M	0	1	0	0	0	0	1	2
Phthiracarus sp., ? nov.	L	1	0	0	0	0	0	1	1
	M	3	4	1	1	0	7	16	
Steganacarus diaphanum	N	0	2	0	0	0	2	4	20
EUPHTHIRACARIDAE									
Euphthiracarus flavus	-	0	0	0	0	0	0	0	0
Euphthiracarus sp.	-	0	0	0	0	0	0	0	0
Rhysotritia cf. ardua	M	0	0	0	1	0	1	2	2
EPILOHMANNIIDAE									
Epilohmannia cylindrica	-	0	0	0	0	0	0	0	0
EULOHMANNIDAE									
Eulohmannia ribagai	M	1	0	0	0	0	1	2	
	N	0	1	1	0	0	0	2	4

[1;2;3] See footnote p. 220

(table continued)

Table VII (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
NOTHRIDAE									
	L	1	0	0	0	0	0	1	
	M	4	1	2	3	3	11	24	
Northus gracilis	N	0	0	0	0	9	0	9	34
N. silvestris	M	0	0	0	0	4	0	4	4
TRHYPOCHTHONIIDAE									
Trhypochthonius tectorum	-	0	0	0	0	0	0	0	0
MALACONOTHRIDAE									
Malaconothrus sp., ? molliseptosus	-	0	0	0	0	0	0	0	0
Malaconothrus sp.$_1$	-	0	0	0	0	0	0	0	0
Malaconothrus sp.$_2$	-	0	0	0	0	0	0	0	0
Trimalaconothrus sp.	-	0	0	0	0	0	0	0	0
NANHERMANNIIDAE									
Nanhermannia elegantula	L	1	0	0	0	0	0	1	1
N. sp., ? nana	-	0	0	0	0	0	0	0	0
PLASMOBATIDAE									
Plasmobates sp.	-	0	0	0	0	0	0	0	0
GYMNODAMAEIDAE									
Gymnodamaeus sp.	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 220

(table continued)

Table VII (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
DAMAEIDAE									
Belba sp.$_1$	-	0	0	0	0	0	0	0	0
Belba sp.$_2$	-	0	0	0	0	0	0	0	0
CEPHAEIDAE									
Cephus corae	-	0	0	0	0	0	0	0	0
EREMOBELBIDAE									
	M	0	0	0	0	2	4	6	
Eremobelba flagellaris	N	0	0	0	0	3	0	3	9
LIACARIDAE									
Adorestes ovatus	-	0	0	0	0	0	0	0	0
Liacarus sp.$_1$	M	1	0	0	0	0	1	2	2
Liacarus sp.$_2$	-	0	0	0	0	0	0	0	0
ASTERGISTIDAE									
	M	0	0	0	0	3	0	3	
Cultroribula trifurca	N	0	1	0	0	0	0	1	4
CARABODIDAE									
Carabodes labyrinthicus	-	0	0	0	0	0	0	0	0
Carabodes sp., ? *nov*.	-	0	0	0	0	0	0	0	0
TECTOCEPHEIDAE									
	L	1	0	1	0	0	7	9	
Tectocepheus velatus	M	0	1	0	4	3	0	8	17

[1;2;3] See footnote p. 220

(table continued)

Table VII (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
OPIIDAE									
Oppia maculata	L	0	1	0	0	0	0	1	1
O. manifera	-	0	0	0	0	0	0	0	0
O. minor	L	19	0	0	0	0	0	19	19
	L	2	2	0	0	0	4	8	
	M	13	24	0	22	29	30	118	
O. nova	N	6	5	2	8	5	11	37	163
O. unicarinata	-	0	0	0	0	0	0	0	0
Oppia sp., ? *nov*.	-	0	0	0	0	0	0	0	0
Quadroppia circumita	M	0	1	0	0	2	0	3	3
SUCTOBELBIDAE									
Suctobelba frothinghami	-	0	0	0	0	0	0	0	0
S. gigentea	-	0	0	0	0	0	0	0	0
	L	2	0	0	0	0	0	2	
	M	4	4	0	2	1	6	17	
S. hurshi	N	4	2	0	2	2	3	13	32
	L	13	0	0	0	0	0	13	
	M	2	0	0	0	1	1	4	
S. laxtoni	N	0	0	0	1	0	0	1	18

[1;2;3] See footnote p. 220

(table continued)

Table VII (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
S. longicuspis	L	1	0	0	0	0	0	1	1
Suctobelba sp.$_1$, ? *nov.*	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_2$, ? *nov.*	L	2	0	0	0	0	0	2	2
Suctobelba sp.$_3$, ? *nov.*	M	0	1	0	0	0	0	1	1
Suctobelba sp.$_4$, ? *nov.*	L	2	0	0	0	0	0	2	2
Suctobelba sp.$_5$, ? *nov.*	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_6$, ? *nov.*	L	1	0	0	0	0	0	1	1
Suctobelba sp.$_7$, ? *nov.*	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_8$, ? *nov.*	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_9$, ? *nov.*	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{10}$, ? *nov.*	L N	1 0	0 0	0 0	0 0	0 1	0 0	1 1	2
Suctobelba sp.$_{11}$, ? *nov.*	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{12}$, ? *nov.*	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{13}$, ? *nov.*	M N	0 0	0 0	0 0	1 3	0 0	1 0	2 3	5

[1;2;3] See footnote p. 220.

(table continued)

Table VII (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Suctobelba sp. 14, ? *nov*.	-	0	0	0	0	0	0	0	0
ACHIPTERIIDAE									
Achipteria coleoptera	-	0	0	0	0	0	0	0	0
ORIBATELLIDAE									
Oribatella reticulatoides . . .	-	0	0	0	0	0	0	0	0
CERATOZETIDAE									
	L	1	0	0	0	0	0	1	
Ceratozetes sp.	M	0	4	0	0	0	0	4	5
Fuscozetes bidentatus	-	0	0	0	0	0	0	0	0
CHAMBOBATIDAE									
Chambobates sp.	M	0	0	0	1	0	0	1	1
PARAKULMINIDAE									
? *Neoribates* sp.	N	0	0	0	1	0	0	1	1
Protokalumna depressum	-	0	0	0	0	0	0	0	0
GALUMNIDAE									
	L	0	0	2	0	0	1	3	
	M	1	0	0	0	0	8	9	
Pergalumna emarginatus	N	0	0	0	0	3	0	3	15
ORIBATULIDAE									
Oribatula minuta	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 220.

(table continued)

Table VII (continued). Site 1 (maple mull). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L	0	0	0	1	0	3	4	
<u>Scheloribates</u> <u>pallidulus</u>	M	0	0	0	0	0	4	4	8
HAPLOZETIDAE									
<u>Peloribates</u> <u>americanus</u>	-	0	0	0	0	0	0	0	0
	L	5	0	0	0	0	0	5	
	M	5	7	0	5	7	6	30	
<u>Protoribates</u> <u>capucinus</u>	N	4	5	3	5	9	2	28	63
<u>P</u>. <u>lophotrichus</u>	-	0	0	0	0	0	0	0	0
	L	6	2	0	1	0	5	14	
	M	14	18	0	1	2	4	39	
ORIBATEI undet.	N	0	17	0	0	0	2	19	72
ORIBATEI TOTAL		136	109	14	70	109	161		599
SARCOPTIFORMES TOTAL		143	124	16	71	114	170		638

1;2;3 See footnote page 220

Table VIII. Site 2 (beech mor). Numbers of Sarcoptiformes per sample (series A) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples: $L\text{-}F_1$, $F_2\text{-}H$, $A_2\text{-}B$. For explanation of these letters, see Appendix A, Table II.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ACARIDIAE									
ACARIDAE									
	F_2-H	0	0	0	0	0	1	1	
Rhizoglyphus sp.	A_2-B	0	0	0	0	0	1	1	2
	L-F_1	16	11	0	13	2	0	42	
	F_2-H	0	0	0	0	1	14	15	
Schwiebea cavernicola	A_2-B	1	0	0	0	0	1	2	59
Tyrophagus putrescentiae . . .	L-F_1	0	0	0	0	0	7	7	7
ANOETIDAE sp.	-	0	0	0	0	0	0	0	0
ACARIDAE undet.	L-F_1	0	5	1	0	0	1	7	7
ACARIDIAE TOTAL		17	16	1	13	3	25	75	75

[1]H = Horizon

[2]Tss = Sub-sample total

[3]Ts = Sample total

(table continued)

Table VIII (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (Series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ORIBATEI									
PALAEACARIDAE									
Palaeacarus hystricinus . . .	L-F_1	2	0	0	0	0	0	2	2
PARHYPOCHTHONIIDAE									
Gehypochthonius rhadamanthus .	A_2-B	2	2	0	0	0	0	4	4
Parhypochthonius aphidinus . .	-	0	0	0	0	0	0	0	0
HYPOCHTHONIIDAE									
Hypochthonius rufulus	L-F_1	0	0	1	0	6	6	13	13
ENIOCHTHONIIDAE									
	L-F_1	0	20	0	0	2	16	38	
	F_2-H	0	5	4	24	0	3	36	
Eniochthonius minutissimus . .	A_2-B	1	0	0	5	0	0	6	80
BRACHYCHTHONIIDAE									
Brachychthonius berlesei . . .	L-F_1	5	0	0	0	0	0	5	5
B. italicus	-	0	0	0	0	0	0	0	0
	L-F_1	68	2	86	0	14	9	179	
	F_2-H	30	4	3	3	15	8	63	
B. jugatus	A_2-B	8	5	0	35	0	0	48	290
B. rostratus	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 230

(table continued)

Table VIII (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
B. zelawaiensis	L-F_1	1	0	0	0	0	0	1	1
Brachychthonius sp., ? nov. .	-	0	0	0	0	0	0	0	0
	L-F_1	2	0	0	0	2	3	7	
	F_2-H	6	1	4	0	0	3	14	
Eobrachychthonius latior . . .	A_2-B	0	0	11	1	0	0	12	33
Linochthonius sp., ? alti-monticola	-	0	0	0	0	0	0	0	0
	L-F_1	33	0	4	0	0	1	38	
L. sp. ? latus	F_2-H	40	0	3	0	0	3	46	84
L. ocellatus	-	0	0	0	0	0	0	0	0
	L-F_1	1	0	0	0	0	0	1	
L. pilososetosus	F_2-H	0	0	1	0	0	0	1	2
	L-F_1	5	0	1	0	0	2	8	
	F_2-H	0	16	0	0	0	14	30	
L. scalaris	A_2-B	0	4	0	0	0	0	4	42
Linochthonius sp., ? nov. . . .	L-F_1	0	3	0	0	0	0	3	3
	F_2-H	1	0	0	0	0	0	1	
Synchthonius crenulatus . . .	A_2-B	1	0	0	0	0	0	1	2

[1;2;3] See footnote p. 230

(table continued)

Table VIII (continued). Site 2 (beech mor). Number of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
HETEROCHTHONIIDAE									
Heterochthonius sp., ? *nov.* . .	-	0	0	0	0	0	0	0	0
ATOPOCHTHONIIDAE									
	L-F_1	0	0	0	0	0	8	8	
Atopochthonius artiodactylus .	F_2-H	1	0	0	0	0	0	1	9
PTEROCHTHONIIDAE									
Pterochthonius angelus	L-F_1	3	1	0	0	0	7	11	11
PHTHIRACARIDAE									
Phthiracarus olivaceum	-	0	0	0	0	0	0	0	0
Ph. setosellum	-	0	0	0	0	0	0	0	0
Ph. sp., ? *sphaerulum*	L-F_1	1	1	0	0	0	1	3	3
Phthiracarus sp., ? *nov.*	L-F_1	0	1	0	0	0	0	1	1
	L-F_1	1	0	0	2	5	9	17	
Steganacarus diaphanum	F_2-H	0	0	1	0	1	1	3	20
EUPHTHIRACARIDAE									
	L-F_1	0	0	4	0	0	1	5	
Euphthiracarus flavus	F_2-H	0	3	0	0	0	0	3	8
	L-F_1	0	3	2	2	0	4	11	
	F_2-H	1	3	1	1	0	0	6	
Euphthiracarus sp.	A_2-B	1	0	0	0	0	1	2	19

1;2;3 See footnote p.230

(table continued)

Table VIII (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Rhysotritia *cf*. *ardua*	L-F_1	1	0	0	0	2	0	3	3
EPILOHMANNIIDAE									
Epilohmannia cylindrica . . .	L-F_1	0	0	0	0	1	0	1	1
EULOHMANNIIDAE									
Eulohmannia ribagai	-	0	0	0	0	0	0	0	0
NOTHRIDAE									
	L-F_1	1	1	3	0	10	0	15	
	F_2-H	8	0	0	1	0	0	9	
Northus gracilis	A_2-B	1	0	0	3	0	0	4	28
	L-F_1	1	1	0	0	20	2	24	
N. silvestris	F_2-H	0	0	0	0	2	0	2	26
TRHYPOCHTHONIIDAE									
	L-F_1	0	0	0	1	0	9	10	
Trhypochthonius tectorum . . .	F_2-H	0	0	0	0	0	2	2	12
MALACONOTHRIDAE									
Malaconothrus sp., ? *molli-septosus*	L-F_1	0	1	0	0	0	1	2	2
Malaconothrus $sp._1$	L-F_1	0	2	0	0	0	14	16	16
Malaconothrus $sp._2$	L-F_1	0	1	0	0	0	0	1	1
Trimalaconothrus sp.	L-F_1	0	1	0	0	2	0	3	3

[1;2;3] See footnote p. 230

(table continued)

Table VIII (continued). Site 2 (Beech mor). Numbers of Sarcoptiformes (Series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
NANHERMANNIIDAE									
	L-F_1	4	1	3	1	3	3	15	
Nanhermannia elegantula . . .	F_2-H	2	0	1	0	13	0	16	31
	L-F_1	1	0	2	0	2	4	9	
N. sp. ? *nana*	F_2-H	0	0	0	0	15	0	15	24
PLASMOBATIDAE									
Plasmobates sp.	-	0	0	0	0	0	0	0	0
GYMNODAMAEIDAE									
Gymnodamaeus sp., ? *nov*.	L-F_1	3	0	10	0	0	0	13	13
DAMAEIDAE									
Belba sp.$_1$	L-F_1	0	0	0	0	1	0	1	1
Belba sp.$_2$	-	0	0	0	0	0	0	0	0
CEPHEIDAE									
Cepheus corae	L-F_1	0	2	0	0	0	0	2	2
EREMOBELBIDAE									
Eremobelba flagellaris	L-F_1	1	0	2	1	4	0	8	8
LIACARIDAE									
Adorestes ovatus	L-F_1	0	0	0	0	7	0	7	7
Liacarus sp.$_1$	-	0	0	0	0	0	0	0	0
Liacarus sp.$_2$	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p.230

(table continued)

Table VIII (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ASTERGISTIDAE									
	L-F_1	5	3	0	1	17	0	26	
	F_2-H	0	0	1	1	1	0	3	
Cultroribula trifurca	A_2-B	0	0	0	2	0	0	2	31
CARABODIDAE									
Carabodes labyrinthicus . . .	-	0	0	0	0	0	0	0	0
Carabodes sp., ? *nov.*	-	0	0	0	0	0	0	0	0
TECTOCEPHEIDAE									
	L-F_1	250	36	68	25	51	23	453	
	F_2-H	13	4	19	7	24	0	67	
Tectocepheus velatus	A_2-B	0	0	1	0	0	1	2	522
OPPIIDAE									
Oppia maculata	-	0	0	0	0	0	0	0	0
	L-F_1	0	0	0	0	5	0	5	
O. manifera	F_2-H	1	0	0	0	0	0	1	6
	L-F_1	53	2	0	0	10	0	65	
	F_2-H	120	92	0	0	40	3	255	
O. minor	A_2-B	44	85	20	0	0	0	149	469
	L-F_1	54	48	154	27	140	150	573	
	F_2-H	76	80	56	4	120	50	386	
O. nova	A_2-B	18	35	28	16	4	6	107	1066

1;2;3 See footnote p.230

(table continued)

Table VIII (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
O. unicarinata	L-F_1	0	0	0	0	0	3	3	3
	L-F_1	30	0	0	0	0	0	30	
Oppia sp., ? nov.	A_2-B	0	0	4	0	0	0	4	34
Quadroppia circumita	L-F_1	0	2	0	0	0	1	3	3
SUCTOBELBIDAE									
	L-F_1	7	4	2	0	0	8	21	
	F_2-H	0	4	5	0	10	5	24	
Suctobelba frothinghami	A_2-B	0	0	1	0	0	0	1	46
S. gigentea	L-F_1	1	0	0	0	0	0	1	1
	L-F_1	13	2	14	0	20	1	50	
	F_2-H	22	20	8	0	0	2	52	
S. hurshi	A_2-B	6	0	0	0	0	0	6	108
	L-F_1	144	156	7	0	30	17	354	
	F_2-H	16	20	8	0	1	1	46	
S. laxtoni	A_2-B	6	5	0	0	0	0	11	411
	L-F_1	15	4	14	0	20	40	93	
	F_2-H	22	40	22	0	0	120	204	
S. longicuspis	A_2-B	0	10	0	0	0	1	11	308
Suctobelba sp.$_1$, ? nov.	F_2-H	0	0	0	0	0	2	2	2
	L-F_1	4	10	14	0	0	4	32	
	F_2-H	0	32	16	0	0	9	57	
Suctobelba sp.$_2$, ? nov.	A_2-B	0	15	12	0	0	1	28	117

1;2;3 See footnote p. 230

(table continued)

Table VIII (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	1	0	0	0	0	4	5	
Suctobelba sp.3, ? *nov.* . . .	F_2-H	0	0	0	0	0	3	3	8
	L-F_1	21	150	7	0	0	3	181	
Suctobelba sp. 4, ? *nov.* . . .	F_2-H	0	8	0	0	0	11	19	200
Suctobelba sp.5, ? *nov.* . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.6, ? *nov.* . . .	L-F_1	0	0	0	0	0	1	1	1
Suctobelba sp.7, ? *nov.* . . .	F_2-H	6	4	0	0	0	0	10	10
Suctobelba sp.8, ? *nov.* . . .	-	0	0	0	0	0	0	0	0
	L-F_1	0	2	0	0	0	0	2	
Suctobelba sp.9, ? *nov.* . . .	F_2-H	0	4	0	0	0	0	4	6
Suctobelba sp.10, ? *nov.* . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.11, ? *nov.* . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.12, ? *nov.* . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.13, ? *nov.* . . .	L-F_1	0	1	7	0	0	0	8	8
Suctobelba sp.14, ? *nov.* . . .	-	0	0	0	0	0	0	0	0
ACHIPTERIIDAE									
Achipteria coleoptera	-	0	0	0	0	0	0	0	0

1;2;3 See footnote p.230

(table continued)

Table VIII (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ORIBATELLIDAE									
Oribatella reticulatoides . .	$L\text{-}F_1$	1	0	0	0	1	0	2	2
CERATOZETIDAE									
	$L\text{-}F_1$	41	26	8	0	33	0	108	
	$F_2\text{-}H$	5	6	14	0	20	0	45	
Ceratozetes sp.	$A_2\text{-}B$	1	0	9	2	0	0	12	165
	$L\text{-}F_1$	0	0	0	0	10	0	10	
Fuscozetes bidentatus	$F_2\text{-}H$	0	0	0	0	4	0	4	14
CHAMBOBATIDAE									
Chambobates sp.	-	0	0	0	0	0	0	0	0
PARAKALUMNIDAE									
? *Neoribates*	-	0	0	0	0	0	0	0	0
Protokalumna depressum	-	0	0	0	0	0	0	0	0
GALUMNIDAE									
	$L\text{-}F_1$	3	2	0	2	10	6	23	
Pergalumna emarginatus	$A_2\text{-}B$	0	0	0	0	0	1	1	24
ORIBATULIDAE									
Oribatula minuta	-	0	0	0	0	0	0	0	0
	$L\text{-}F_1$	29	2	7	10	32	31	111	
Scheloribates pallidulus . . .	$F_2\text{-}H$	1	1	1	0	15	0	18	129

[1;2;3] See footnote p. 230

(table continued)

Table VIII (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
HAPLOZETIDAE									
Peloribates americanus	L-F_1	14	0	0	1	0	0	15	15
Protoribates capucinus	-	0	0	0	0	0	0	0	0
	L-F_1	18	11	15	14	10	20	88	
	F_2-H	2	2	13	0	0	3	20	
Protoribates lophotrichus . .	A_2-B	0	0	2	0	0	2	4	112
	L-F_1	51	29	36	2	41	25	184	
	F_2-H	18	25	28	0	39	12	122	
ORIBATEI undet.	A_2-B	11	21	0	17	1	0	50	356
ORIBATEI TOTAL		1380	1087	768	211	836	705		4987
SARCOPTIFORMES TOTAL		1397	1103	769	224	839	730		5062

[1;2;3] See footnote page 230.

Table IX. Site 2 (beech mor). Numbers of Sarcoptiformes per sample (series B) taken monthly from June to November, 1960. Each sample was sub-divided into 3 sub-samples: $L\text{-}F_1$, $F_2\text{-}H$, $A_2\text{-}B$. See Appendix A, Table II for details.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ACARIDIAE									
ACARIDAE									
Rhizoglyphus sp.	-	0	0	0	0	0	0	0	0
	$L\text{-}F_1$	2	5	1	9	0	39	56	
	$F_2\text{-}H$	2	11	0	0	0	1	14	
Schwiebea cavernicola	$A_2\text{-}B$	1	5	0	1	0	0	7	77
Tyrophagus putrescentiae . . .	-	0	0	0	0	0	0	0	0
ANOETIDAE sp.	-	0	0	0	0	0	0	0	0
ACARIDAE undet.	$L\text{-}F_1$	0	0	0	0	0	1	1	1
ACARIDIAE TOTAL		5	21	1	10	0	41	78	78

[1]H = Horizon

[2]Tss = Sub-sample total

[3]Ts = Sample total

(table continued)

Table IX (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ORIBATEI									
PALAEACARIDAE									
	F_2-H	1	0	0	1	0	0	2	
Palaeacarus hystricinus . . .	A_2-B	0	0	1	0	0	0	1	3
PARHYPOCHTHONIIDAE									
Gehypochthonius rhadamanthus .	A_2-B	1	0	0	0	1	0	2	2
Parhypochthonius aphidinus . .	-	0	0	0	0	0	0	0	0
HYPOCHTHONIIDAE									
Hypochthonius rufulus	L-F_1	2	2	0	1	1	1	7	7
ENIOCHTHONIIDAE									
	L-F_1	5	15	3	5	3	1	32	
Eniochthonius minutissimus . .	F_2-H	0	2	0	0	0	0	2	34
BRACHYCHTHONIIDAE									
	L-F_1	0	0	1	1	0	0	2	
	F_2-H	0	9	1	0	0	0	10	
Brachychthonius berlesei . . .	A_2-B	0	4	0	0	1	0	5	17
B. italicus	-	0	0	0	0	0	0	0	0
	L-F_1	5	0	8	34	0	1	48	
	F_2-H	12	14	1	1	0	1	29	
B. jugatus	A_2-B	6	0	1	0	0	1	8	85

[1;2;3]See footnote p.241

(table continued)

Table IX (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
B. rostratus	-	0	0	0	0	0	0	0	0
B. zelawaiensis	F_2-H	34	0	0	0	0	0	34	34
Brachychthonius sp., ? nov. . .	-	0	0	0	0	0	0	0	0
	L-F_1	1	0	0	0	0	6	7	
	F_2-H	39	9	0	8	25	2	83	
Eobrachychthonius latior . . .	A_2-B	2	0	0	7	0	0	9	99
Linochthonius sp., ? alti-monticola	-	0	0	0	0	0	0	0	0
	L-F_1	11	2	0	0	0	0	13	
	F_2-H	19	4	0	0	0	0	23	
L. sp. ? latus	A_2-B	3	0	2	0	0	0	5	41
L. ocellatus	L-F_1	1	0	0	0	0	0	1	1
	L-F_1	1	0	0	4	0	0	5	
L. pilososetosus	F_2-H	3	0	0	0	0	0	3	8
L. scalaris	F_2-H	0	39	0	0	0	0	39	39
Linochthonius sp., ? nov. . . .	L-F_1	3	0	0	3	0	0	6	6
	L-F_1	1	0	0	0	0	0	1	
Synchthonius crenulatus . . .	A_2-B	0	0	0	0	2	0	2	3

[1;2;3] See footnote p.241

(table continued)

Table IX (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
HETEROCHTHONIIDAE									
Heterochthonius sp., ? *nov.*	-	0	0	0	0	0	0	0	0
APOCHTHONIIDAE									
Atopochthonius artiodactylus	L-F_1	2	0	0	0	0	0	2	2
PTEROCHTHONIIDAE									
Pterochthonius angelus	L-F_1	2	0	1	22	0	0	25	25
PHTHIRACARIDAE									
Phthiracarus olivaceum	-	0	0	0	0	0	0	0	0
Ph. setosellum	L-F_1	0	0	0	2	0	0	2	2
Ph. sp., ? *sphaerulum*	L-F_1	0	0	1	0	0	0	1	1
Phthiracarus sp., ? *nov.*	-	0	0	0	0	0	0	0	0
	L-F_1	0	2	0	0	2	0	4	
	F_2-H	0	2	0	0	0	0	2	
Steganacarus diaphanum	A_2-B	1	0	0	0	0	0	1	7
EUPHTHIRACARIDAE									
Euphthiracarus flavus	L-F_1	0	1	2	2	0	0	5	5
	L-F_1	0	2	1	0	5	0	8	
Euphthiracarus sp.	F_2-H	6	4	2	0	0	0	12	20
Rhysotritia cf. *ardua*	L-F_1	1	1	2	1	0	1	6	6

[1;2;3] See footnote p.241

(table continued)

Table IX (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
EPILOHMANNIIDAE									
Epilohmannia cylindrica . . .	-	0	0	0	0	0	0	0	0
EULOHMANNIIDAE									
Eulohmannia ribagai	-	0	0	0	0	0	0	0	0
NOTHRIDAE									
	L-F_1	1	0	2	2	0	1	6	
	F_2-H	2	0	0	4	0	0	6	
N. gracilis	A_2-B	3	0	0	1	0	0	4	16
	L-F_1	1	1	0	0	3	0	5	
N. silvestris	F_2-H	0	0	0	0	0	1	1	6
TRHYPOCHTHONIIDAE									
	L-F_1	1	0	0	0	0	2	3	
Trhypochthonius tectorum . . .	A_2-B	0	0	0	0	0	2	2	5
MALACONOTHRIDAE									
Malaconothrus sp., ? *molliseptosus*	L-F_1	10	0	0	0	0	0	10	10
	L-F_1	2	0	0	1	0	12	15	
Malaconothrus sp.1	F_2-H	3	0	1	0	1	0	5	20
Malaconothrus sp.2	-	0	0	0	0	0	0	0	0
	L-F_1	0	0	1	1	0	0	2	
Trimalaconothrus sp.	F_2-H	1	0	0	0	0	0	1	3

[1;2;3] See footnote p.241

(table continued)

Table IX (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
NANHERMANNIIDAE									
	$L-F_1$	3	10	2	1	1	0	17	
Nanhermannia elegantula . . .	F_2-H	8	0	0	0	0	0	8	25
	$L-F_1$	2	0	5	4	3	1	15	
	F_2-H	0	0	0	1	1	0	2	
N. sp. ? *nana*	A_2-B	0	0	0	0	1	0	1	18
PLASMOBATIDAE									
Plasmobates sp.	F_2-H	0	0	0	0	1	0	1	1
GYMNODAMAEIDAE									
Gymnodomaeus sp. ? *nov.*	$L-F_1$	4	0	0	0	0	0	4	4
DAMAEIDAE									
Belba sp.$_1$	-	0	0	0	0	0	0	0	0
Belba sp.$_2$	-	0	0	0	0	0	0	0	0
CEPHEIDAE									
Cepheus corae	-	0	0	0	0	0	0	0	0
EREMOBELBIDAE									
Eremobelba flagellaris	$L-F_1$	1	0	4	0	2	1	8	8
LIACARIDAE									
Adorestes ovatus	-	0	0	0	0	0	0	0	0
Liacarus sp.$_1$	-	0	0	0	0	0	0	0	0
Liacarus sp.$_2$	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 241

(table continued)

Table IX (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ASTERGISTIDAE									
	L-F1	1	0	0	0	0	1	2	
Cultroribula trifurca	F2-H	0	1	0	0	0	0	1	3
CARABODIDAE									
Carabodes labyrinthicus . . .	-	0	0	0	0	0	0	0	0
Carabodes sp., ? *nov*.	L-F1	0	0	0	1	0	0	1	1
TECTOCEPHEIDAE									
	L-F1	194	45	30	128	41	77	515	
	F2-H	15	27	4	108	6	1	161	
Tectocepheus velatus	A2-B	1	0	1	7	0	0	9	685
OPPIIDAE									
Oppia maculata	L-F1	0	0	0	25	0	0	25	25
	L-F1	0	5	12	15	1	1	34	
	F2-H	0	39	1	0	0	0	40	
O. manifera	A2-B	0	0	0	1	0	0	1	75
	L-F1	4	0	0	0	0	0	4	
	F2-H	42	91	1	0	0	7	141	
O. minor	A2-B	30	1	17	4	30	7	89	234
	L-F1	108	105	40	100	121	147	621	
	F2-H	60	104	0	8	125	26	323	
O. nova	A2-B	20	4	8	11	60	0	103	1047
O. unicarinata	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 241

(table continued)

Table IX (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Oppia sp., ? *nov.*	-	0	0	0	0	0	0	0	0
Quadroppia circumita	L-F_1	4	0	0	1	0	0	5	5
SUCTOBELBIDAE									
	L-F_1	8	16	1	0	4	7	36	
	F_2-H	0	26	0	0	2	45	73	
Suctobelba frothinghami . . .	A_2-B	3	0	2	0	0	2	7	116
S. gigentea	L-F_1	0	0	0	0	1	0	1	1
	L-F_1	9	5	0	0	0	7	21	
	F_2-H	3	0	1	0	0	18	22	
S. hurshi	A_2-B	0	0	2	1	0	0	3	46
	L-F_1	76	0	12	2	40	21	151	
	F_2-H	21	0	0	0	0	9	30	
S. laxtoni	A_2-B	8	0	0	1	0	0	9	190
	L-F_1	16	0	0	0	14	0	30	
	F_2-H	12	13	1	3	0	121	150	
S. longicuspis	A_2-B	4	0	2	2	0	0	8	188
Suctobelba $sp._1$, ? *nov.*	-	0	0	0	0	0	0	0	0
	L-F_1	52	16	12	0	2	0	82	
	F_2-H	42	26	1	1	0	81	151	
Suctobelba $sp._2$, ? *nov.* . . .	A_2-B	4	1	0	3	0	0	8	241
Suctobelba $sp._3$, ? *nov.* . . .	F_2-H	0	0	0	0	0	27	27	27

[1;2;3] See footnote p. 241

(table continued)

Table IX (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	52	0	0	0	14	0	66	
	F_2-H	15	0	0	0	0	0	15	
Suctobelba sp.4, ? nov. . . .	A_2-B	3	0	0	0	0	0	3	84
Suctobelba sp.5, ? nov. . . .	F_2-H	30	0	0	0	0	58	88	88
Suctobelba sp.6, ? nov. . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.7, ? nov. . . .	L-F_1	0	16	0	0	0	0	16	16
Suctobelba sp.8, ? nov. . . .	F_2-H	12	0	0	0	0	0	12	12
Suctobelba sp.9, ? nov. . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.10, ? nov. . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.11, ? nov. . . .	L-F_1	0	0	0	0	0	1	1	1
Suctobelba sp.12, ? nov. . . .	-	0	0	0	0	0	0	0	0
	L-F_1	4	0	0	0	0	1	5	
	F_2-H	6	0	0	0	0	0	6	
Suctobelba sp.13, ? nov. . . .	A_2-B	0	0	0	1	0	0	1	12
	L-F_1	0	10	0	0	0	0	10	
Suctobelba sp.14, ? nov. . . .	F_2-H	0	52	0	0	0	0	52	62
ACHIPTERIIDAE									
Achipteria coleoptera	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 241

(table continued)

Table IX (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ORIBATELLIDAE									
Oribatella reticulatoides . .	$L\text{-}F_1$	0	0	0	0	3	1	4	4
CERATOZETIDAE									
	$L\text{-}F_1$	38	5	12	4	24	5	88	
	$F_2\text{-}H$	17	15	11	3	1	6	53	
Ceratozetes sp.	$A_2\text{-}B$	2	1	4	4	0	7	18	159
Fuscozetes bidentatus	-	0	0	0	0	0	0	0	0
CHAMBOBATIDAE									
Chambobates sp.	$L\text{-}F_1$	2	0	0	1	1	0	4	4
PARAKALUMNIDAE									
? *Neoribates*	-	0	0	0	0	0	0	0	0
Protokalumna depressum	-	0	0	0	0	0	0	0	0
GALUMNIDAE									
Pergalumna emarginatus	$L\text{-}F_1$	5	5	8	7	11	3	39	39
ORIBATULIDAE									
Oribatula minuta	-	0	0	0	0	0	0	0	0
	$L\text{-}F_1$	5	1	8	26	5	3	48	
	$F_2\text{-}H$	1	0	1	6	0	0	8	
Scheloribates pallidulus . . .	$A_2\text{-}B$	0	0	0	7	0	0	7	63
HAPLOZETIDAE									
Peloribates americanus	$L\text{-}F_1$	4	0	3	4	0	0	11	11

[1;2;3] See footnote p. 241

(table continued)

Table IX (continued). Site 2 (beech mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Protoribates capucinus	-	0	0	0	0	0	0	0	0
	$L-F_1$	13	31	2	11	12	17	86	
	F_2-H	2	5	0	1	4	0	12	
Protoribates lophotrichus . .	A_2-B	1	0	0	0	3	0	4	102
	$L-F_1$	38	14	9	18	14	8	101	
	F_2-H	18	12	2	10	1	2	45	
ORIBATEI undet.	A_2-B	2	3	0	1	2	0	8	154
ORIBATEI TOTAL		1211	818	250	633	595	751		4258
SARCOPTIFORMES TOTAL		1216	839	251	643	595	792		4336

[1;2;3] See footnote p. 241.

Table X. Site 3 (hemlock mor). Numbers of Sarcoptiformes per sample (series A) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples: $L\text{-}F_1$, $F_2\text{-}H$, $A_2\text{-}B$. For explanation of these letters, see Appendix A, Table II.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
<u>ACARIDIAE</u>									
ACARIDAE									
Rhizoglyphus sp.	-	0	0	0	0	0	0	0	0
Schwiebea cavernicola	$L\text{-}F_1$	0	1	0	0	0	1	2	2
Tyrophagus putrescentiae . . .	-	0	0	0	0	0	0	0	0
ANOETIDAE sp.	$L\text{-}F_1$	0	0	0	0	0	1	1	1
ACARIDAE undet.	$A_2\text{-}B$	1	0	0	1	0	0	2	2
ACARIDIAE TOTAL		1	1	0	1	0	2	5	5

[1]H = Horizon

[2]Tss = Sub-sample total

[3]Ts = Sample total

(table continued)

Table X (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ORIBATEI									
PALAEACARIDAE									
	L-F_1	2	0	0	0	1	0	3	
	F_2-H	2	0	2	1	0	0	5	
Palaeacarus hystricinus . . .	A_2-B	1	0	3	0	0	0	4	12
PARHYPOCHTHONIIDAE									
	L-F_1	0	0	0	0	0	5	5	
	F_2-H	5	20	0	2	1	3	31	
Gehypochthonius rhadamanthus .	A_2-B	1	4	0	0	9	1	15	51
	L-F_1	46	0	3	0	1	0	50	
	F_2-H	84	0	0	0	11	1	96	
Parhypochthonius aphidinus . .	A_2-B	35	0	0	0	15	0	50	196
HYPOCHTHONIIDAE									
Hypochthonius rufulus	L-F_1	15	0	0	0	0	0	15	15
ENIOCHTHONIIDAE									
	L-F_1	50	3	1	11	2	23	90	
	F_2-H	1	4	0	2	2	5	14	
Eniochthonius minutissimus . .	A_2-B	1	0	0	0	0	1	2	106
BRACHYCHTHONIIDAE									
Brachychthonius berlesei . . .	L-F_1	0	2	0	0	0	0	2	2
B. italicus	L-F_1	15	0	0	0	0	0	15	15

[1;2;3] See footnote p. 252

(table continued)

Table X (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	99	1	0	0	7	5	112	
	F_2-H	130	8	0	0	4	10	152	
B. jugatus	A_2-B	77	0	0	1	2	0	80	344
B. rostratus	L-F_1	15	0	0	0	0	0	15	15
	L-F_1	30	5	0	0	0	0	35	
B. zelawaiensis	F_2-H	6	0	0	0	0	0	6	41
Brachychthonius sp., ? *nov*. .	L-F_1	0	0	0	0	0	4	4	4
Eobrachychthonius latior . . .	-	0	0	0	0	0	0	0	0
Linochthonius sp., ? *alti-monticola*	L-F_1	1	0	0	0	0	0	1	1
L. sp. ? *latus*	L-F_1	109	2	0	0	0	2	113	113
L. ocellatus	-	0	0	0	0	0	0	0	0
L. pilososetosus	L-F_1	15	0	0	0	0	0	15	15
	L-F_1	1	75	0	0	0	17	93	
L. *scalaris*	F_2-H	6	0	0	0	0	4	10	103
	L-F_1	0	0	0	0	0	1	1	
Linochthonius sp., ? *nov*. . . .	A_2-B	0	0	0	0	0	1	1	2

[1;2;3] See footnote page 252.

(table continued)

Table X (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	126	0	0	0	0	0	126	
	F_2-H	33	0	0	0	0	0	33	
Synchthonius crenulatus . . .	A_2-B	36	0	0	0	0	0	36	195
HETEROCHTHONIIDAE									
	L-F_1	20	0	0	0	0	0	20	
	F_2-H	19	0	0	1	0	0	20	
Heterochthonius sp., ? *nov.* .	A_2-B	2	0	0	0	0	0	2	42
ATOPOCHTHONIIDAE									
Atopochthonius artiodactylus .	A_2-B	1	0	0	0	0	0	1	1
PTEROCHTHONIIDAE									
Pterochthonius angelus	L-F_1	1	0	0	0	0	0	1	1
PHTHIRACARIDAE									
Phthiracarus olivaceum	-	0	0	0	0	0	0	0	0
Ph. setosellum	-	0	0	0	0	0	0	0	0
Ph. sp., ? *sphaerulum*	-	0	0	0	0	0	0	0	0
Phthiracarus sp., ? *nov.* . . .	-	0	0	0	0	0	0	0	0
	L-F_1	21	10	10	6	11	10	68	
	F_2-H	0	0	2	0	0	0	2	
Steganaracus diaphanum	A_2-B	0	0	0	0	0	1	1	71

1;2;3 See footnote p. 252

(table continued)

Table X (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
EUPHTHIRACARIDAE									
Euphthiracarus flavus	-	0	0	0	0	0	0	0	0
	L-F1	2	0	0	0	0	1	3	
	F2-H	0	3	0	0	0	0	3	
Euphthiracarus sp.	A2-B	0	1	0	0	0	0	1	7
Rhysotritia cf. ardua	L-F1	1	0	0	0	0	0	1	1
EPILOHMANNIIDAE									
Epilohmannia cylindrica . . .	-	0	0	0	0	0	0	0	0
EULOHMANNIIDAE									
Eulohmannia ribagai	-	0	0	0	0	0	0	0	0
NOTHRIDAE									
Northus gracilis	-	0	0	0	0	0	0	0	0
	L-F1	11	0	0	0	0	0	11	
	F2-H	9	0	0	0	0	1	10	
N. silvestris	A2-B	5	0	0	0	0	0	5	26
TRHYPOCHTHONIIDAE									
	L-F1	14	0	0	0	0	9	23	
Trhypochthonius tectorum . . .	F2-H	0	0	0	0	0	2	2	25
MALACONOTHRIDAE									
Malaconothrus sp., ? *molli-septosus*	L-F1	3	0	0	0	0	0	3	3

[1;2;3] See footnote p. 252

(table continued)

Table X (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Malaconothrus sp.$_1$	L-F$_1$	0	0	0	0	1	0	1	1
Malaconothrus sp.$_2$	-	0	0	0	0	0	0	0	0
Trimalaconothrus sp.	-	0	0	0	0	0	0	0	0
NANHERMANNIIDAE									
Nanhermannia elegantula . . .	A$_2$-B	0	0	1	0	0	0	1	1
N. sp., ? *nana*	-	0	0	0	0	0	0	0	0
PLASMOBATIDAE									
Plasmobates sp.	-	0	0	0	0	0	0	0	0
GYMNODAMAEIDAE									
Gymnodamaeus sp., ? *nov.*	L-F$_1$	1	0	0	0	0	0	1	1
DAMAEIDAE									
Belba sp.$_1$	-	0	0	0	0	0	0	0	0
Belba sp.$_2$	L-F$_1$	0	0	0	0	0	1	1	1
CEPHEIDAE									
	L-F$_1$	1	3	1	0	0	0	5	
Cepheus corae	A$_2$-B	0	1	0	0	0	0	1	6
EREMOBELBIDAE									
Eremobelba flagellaris	-	0	0	0	0	0	0	0	0

1;2;3 See footnote p. 252

(table continued)

Table X (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
LIACARIDAE									
Adorestes ovatus	L-F_1	0	0	7	6	5	3	21	21
Liacarus sp.$_1$	-	0	0	0	0	0	0	0	0
Liacarus sp.$_2$	-	0	0	0	0	0	0	0	0
ASTERGISTIDAE									
Cultroribula trifurca	-	0	0	0	0	0	0	0	0
CARABODIDAE									
Carabodes labyrinthicus . . .	-	0	0	0	0	0	0	0	0
Carabodes sp., ? *nov*.	A_2-B	0	1	0	0	0	0	1	1
TECTOCEPHEIDAE									
	L-F_1	55	61	70	47	76	38	347	
	F_2-H	21	0	2	0	21	4	48	
Tectocepheus velatus	A_2-B	20	0	0	0	1	1	22	417
OPPIIDAE									
Oppia maculata	-	0	0	0	0	0	0	0	0
O. manifera	L-F_1	1	0	0	0	0	0	1	1
	L-F_1	0	75	0	0	0	9	84	
	F_2-H	21	225	0	0	70	95	411	
O. minor	A_2-B	15	168	0	0	0	7	190	685

1;2;3 See footnote p. 252

(table continued)

Table X (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	48	83	1	1	3	150	286	
	F_2-H	63	173	0	4	17	30	287	
O. nova	A_2-B	6	84	0	1	16	0	107	680
	L-F_1	0	108	0	0	0	30	138	
O. unicarinata	A_2-B	0	9	0	0	0	0	9	147
Oppia sp., ? *nov*.	L-F_1	0	3	0	0	0	0	3	3
Quadroppia circumita	L-F_1	20	0	0	0	0	0	20	20
SUCTOBELBIDAE									
	L-F_1	26	0	1	0	0	4	31	
	F_2-H	2	1	0	1	0	0	4	
Suctobelba frothinghami	A_2-B	0	0	1	0	0	0	1	36
S. gigantea	-	0	0	0	0	0	0	0	0
	L-F_1	112	3	0	0	0	0	115	
	F_2-H	3	0	0	1	0	0	4	
S. hurshi	A_2-B	3	0	2	0	0	1	6	125
	L-F_1	180	30	0	8	0	6	224	
	F_2-H	236	45	0	1	0	0	282	
S. laxtoni	A_2-B	12	0	0	0	0	0	12	518
	L-F_1	20	0	0	0	0	1	21	
	F_2-H	45	18	0	0	0	1	64	
S. longicuspis	A_2-B	0	0	0	0	0	1	1	86

[1;2;3] See footnote p. 252

(table continued)

Table X (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Suctobelba sp.$_{1}$, ? *nov.* . . .	F_2-H	0	0	0	0	0	5	5	5
	L-F_1	110	0	0	0	0	3	113	
	F_2-H	1	0	0	0	0	0	1	
Suctobelba sp.$_{2}$, ? *nov.* . . .	A2-B	6	0	0	0	0	0	6	120
Suctobelba sp.$_{3}$, ? *nov.* . . .	L-F_1	0	75	0	0	0	0	75	75
	L-F_1	10	0	0	0	0	1	11	
Suctobelba sp.$_{4}$, ? *nov.* . . .	F_2-H	4	0	0	0	0	0	4	15
Suctobelba sp.$_{5}$, ? *nov.* . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{6}$, ? *nov.* . . .	-	0	0	0	0	0	0	0	0
	L-F_1	0	0	0	1	0	0	1	
Suctobelba sp.$_{7}$, ? *nov.* . . .	F_2-H	3	0	0	0	0	0	3	4
Suctobelba sp.$_{8}$, ? *nov.* . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{9}$, ? *nov.* . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{10}$, ? *nov.* . . .	F_2-H	10	0	0	0	0	0	10	10
Suctobelba sp.$_{11}$, ? *nov.* . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.$_{12}$, ? *nov.* . . .	L-F_1	0	2	0	0	0	0	2	2

[1;2;3] See footnote p. 252

(table continued)

Table X (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Suctobelba sp.13, ? nov.	$L-F_1$	1	0	0	0	0	0	1	
	A_2-B	0	6	0	0	0	0	6	7
Suctobelba sp.14, ? nov.	-	0	0	0	0	0	0	0	0
ACHIPTERIIDAE									
Achipteria coleoptera	-	0	0	0	0	0	0	0	0
ORIBATELLIDAE									
Oribatella reticulatoides . . .	-	0	0	0	0	0	0	0	0
CERATOZETIDAE									
	$L-F_1$	1	5	0	0	18	29	53	
	F_2-H	2	3	0	7	4	36	52	
Ceratozetes sp.	A_2-B	2	2	0	0	0	1	5	110
	$L-F_1$	0	0	0	2	4	7	13	
Fuscozetes bidentatus	F_2-H	0	0	0	0	0	1	1	14
CHAMBOBATIDAE									
Chambobates sp.	-	0	0	0	0	0	0	0	0
PARAKALUMNIDAE									
? Neoribates sp.	-	0	0	0	0	0	0	0	0
Protokalumna depressum	$L-F_1$	0	0	0	0	0	1	1	1
GALUMNIDAE									
	$L-F_1$	9	0	0	0	1	0	10	
Pergalumna emarginatus	F_2-H	0	0	0	0	1	0	1	11

[1;2;3] See footnote p. 252

(table continued)

Table X (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ORIBATULIDAE									
	L-F_1	4	10	3	2	2	6	27	
Oribatula minuta	F_2-H	0	0	1	0	0	0	1	28
	L-F_1	12	9	3	5	8	13	50	
	F_2-H	0	0	0	0	0	2	2	
Scheloribates pallidulus . . .	A_2-B	0	3	0	0	0	0	3	55
HAPLOZETIDAE									
Peloribates americanus	L-F_1	7	1	0	0	0	1	9	9
Protoribates capucinus	-	0	0	0	0	0	0	0	0
	L-F_1	0	0	0	0	3	1	4	
P. lophotrichus	F_2-H	0	0	2	8	0	1	11	15
	L-F_1	15	247	5	47	11	65	390	
	F_2-H	4	2	6	5	8	47	72	
ORIBATEI undet.	A_2-B	4	10	0	0	0	2	16	478
ORIBATEI TOTAL		2167	1604	127	171	336	711		5116
SARCOPTIFORMES TOTAL		2168	1605	127	172	336	713		5121

[1;2;3] See footnote page 252.

Table XI. Site 3 (hemlock mor). Numbers of Sarcoptiformes per sample (series B), taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples: L-F_1, F_2-H, A_2-B. For explanation of these letters see Appendix A, Table II.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ACARIDIAE									
ACARIDAE									
Rhizoglyphus sp.	-	0	0	0	0	0	0	0	0
	L-F_1	3	0	0	0	0	1	4	
Schwiebea cavernicola	A_2-B	0	0	1	0	0	0	1	5
Tyrophagus putrescentiae . . .	-	0	0	0	0	0	0	0	0
ANOETIDAE sp.	-	0	0	0	0	0	0	0	0
ACARIDAE undet.	-	0	0	0	0	0	0	0	0
ACARIDIAE TOTAL		3	0	1	0	0	1	5	5

[1]H = Horizon

[2]Tss = Sub-sample total

[3]Ts = Sample total

(table continued)

Table XI (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
<u>ORIBATEI</u>									
PALAEACARIDAE									
	L-F1	0	0	0	0	0	5	5	
	F2-H	1	0	0	0	0	1	2	
<u>Palaeacarus hystricinus</u> . . .	A2-B	2	0	0	0	0	0	2	9
PARHYPOCHTHONIIDAE									
	L-F1	0	1	0	0	3	2	6	
<u>Gehypochthonius rhadamanthus</u> .	F2-H	0	6	0	0	5	2	13	19
	L-F1	0	2	0	0	0	0	2	
<u>Parhypochthonius aphidinus</u> . .	F2-H	1	4	0	0	0	1	6	8
HYPOCHTHONIIDAE									
<u>Hypochthonius rufulus</u>	-	0	0	0	0	0	0	0	0
ENIOCHTHONIIDAE									
	L-F1	0	9	1	8	2	97	117	
	F2-H	0	1	0	0	0	2	3	
<u>Eniochthonius minutimissus</u> . .	A2-B	0	0	1	0	0	1	2	122
BRACHYCHTHONIIDAE									
	L-F1	0	5	0	0	0	0	5	
<u>Brachychthonius berlesei</u> . . .	F2-H	3	0	0	0	0	0	3	8
<u>B. italicus</u>	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 263

(table continued)

Table XI (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	6	9	0	0	0	0	15	
	F_2-H	7	13	0	0	0	0	20	
B. jugatus	A_2-B	9	0	0	0	0	0	9	44
B. rostratus	L-F_1	4	0	0	0	0	0	4	4
B. zelawaiensis	-	0	0	0	0	0	0	0	0
Brachychthonius sp., ? nov. .	-	0	0	0	0	0	0	0	0
Eobrachychthonius latior . . .	-	0	0	0	0	0	0	0	0
Linochthonius sp., ? alti-monticola	-	0	0	0	0	0	0	0	0
	L-F_1	1	2	1	0	0	0	4	
L. sp. ? latus	F_2-H	0	0	6	0	0	1	7	11
L. ocellatus	-	0	0	0	0	0	0	0	0
L. pilososetosus	F_2-H	0	1	0	0	0	0	1	1
	L-F_1	0	7	0	0	2	34	43	
L. scalaris	F_2-H	0	2	0	0	0	0	2	45
Linochthonius sp., ? nov. . .	-	0	0	0	0	0	0	0	0
	L-F_1	17	30	0	0	0	0	47	
	F_2-H	18	0	0	0	0	0	18	
Synchthonius crenulatus . . .	A_2-B	1	-	-	-	-	-	1	66

[1;2;3] See footnote p. 263

(table continued)

Table XI (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
HETEROCHTHONIIDAE									
	L-F1	1	0	0	0	0	0	1	
	F2-H	1	0	0	0	0	0	1	
Heterochthonius sp., ? nov. .	A2-B	0	0	1	0	0	0	1	3
ATOPOCHTHONIIDAE									
Atopochthonius artidactylus .	L-F1	1	0	0	0	0	0	1	1
PTEROCHTHONIIDAE									
Pterochthonius angelus	L-F1	1	0	0	0	0	0	1	1
PHTHIRACARIDAE									
Phthiracarus olivaceum	-	0	0	0	0	0	0	0	0
Ph. setosellum	-	0	0	0	0	0	0	0	0
Ph. sp., ? spherulum	L-F1	0	5	0	0	1	0	6	6
Phthiracarus sp., ? nov. . . .	-	0	0	0	0	0	0	0	0
	L-F1	30	12	4	12	10	31	99	
Steganacarus diaphanum	F2-H	0	0	0	0	3	0	3	102
EUPHTHIRACARIDAE									
Euphthiracarus flavus	A2-B	0	0	1	0	0	0	1	1
	L-F1	3	1	3	0	0	0	7	
	F2-H	0	2	0	0	0	0	2	
Euphthiracarus sp.	A2-B	0	0	0	0	0	7	7	16

1;2;3 See footnote p. 263

(table continued)

Table XI (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
<u>Rhysotritia</u> <u>cf</u>. <u>ardua</u>	L-F_1	0	0	0	1	1	0	2	2
EPILOHMANNIIDAE									
<u>Epilohmannia</u> <u>cylindrica</u> . . .	-	0	0	0	0	0	0	0	0
EULOHMANNIIDAE									
<u>Eulohmannia</u> <u>ribagai</u>	-	0	0	0	0	0	0	0	0
NOTHRIDAE									
<u>Northus</u> <u>gracilis</u>	-	0	0	0	0	0	0	0	0
	L-F_1	2	0	0	1	0	2	5	
	F_2-H	2	0	0	0	4	1	7	
<u>Northus</u> <u>silvestris</u>	A_2-B	1	0	0	0	0	1	2	14
TRHYPOCHTHONIIDAE									
<u>Trhypochthonius</u> <u>tectorum</u> . . .	L-F_1	0	16	0	1	3	18	38	38
MALACONOTHRIDAE									
	L-F_1	13	0	1	0	0	0	14	
<u>Malaconothrus</u> sp., ? <u>molli-septosus</u>	A_2-B	1	0	0	0	0	0	1	15
<u>Malaconothrus</u> sp.$_1$	L-F_1	0	1	0	0	0	0	1	1
<u>Malaconothrus</u> sp.$_2$	-	0	0	0	0	0	0	0	0
<u>Trimalaconothrus</u> sp.	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 263

(table continued)

Table XI (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
NANHERMANIIDAE									
Nanhermannia elegantula . . .	L-F_1	1	0	0	0	0	0	1	1
N. sp., ? *nana*	L-F_1	0	0	0	0	0	1	1	1
PLASMOBATIDAE									
Plasmobates sp.	-	0	0	0	0	0	0	0	0
GYMNODAMAEIDAE									
Gymnodomaeus sp. ? *nov.* . . .	-	0	0	0	0	0	0	0	0
DAMAEIDAE									
Belba sp.$_1$	-	0	0	0	0	0	0	0	0
Belba sp.$_2$	-	0	0	0	0	0	0	0	0
CEPHEIDAE									
Cepheus corae	L-F_1	0	4	0	1	0	3	8	8
EREMOBELBIDAE									
Eremobelba flagellaris	-	0	0	0	0	0	0	0	0
LIACARIDAE									
	L-F_1	1	2	0	1	11	4	19	
Adorestes ovatus	F_2-H	0	0	0	0	1	0	1	20
Liacarus sp.$_1$	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 263

(table continued)

Table XI (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Liacarus sp.2	-	0	0	0	0	0	0	0	0
ASTERGISTIDAE									
Cultroribula trifurca	-	0	0	0	0	0	0	0	0
CARABODIDAE									
Carabodes labyrinthicus . . .	L-F_1	0	0	0	1	0	0	1	1
Carabodes sp., ? *nov*.	L-F_1	1	0	0	0	0	0	1	1
TECTOCEPHEIDAE									
	L-F_1	91	153	14	55	39	9	361	
	F_2-H	3	0	8	1	1	1	14	
Tectocepheus velatus	A_2-B	2	0	0	0	1	0	3	378
OPPIIDAE									
Oppia maculata	-	0	0	0	0	0	0	0	0
O. manifera	-	0	0	0	0	0	0	0	0
	L-F_1	2	18	0	1	0	15	36	
	F_2-H	0	720	0	0	2	39	761	
O. minor	A_2-B	0	224	0	1	4	66	295	1092
	L-F_1	12	2	0	4	24	60	102	
	F_2-H	220	17	0	2	9	159	407	
O. nova	A_2-B	45	5	1	0	0	0	51	560
O. unicarinata	-	0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 263

(table continued)

Table XI (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Oppia sp.,?*nov*.	-	0	0	0	0	0	0	0	0
Quadroppia circumita	L-F_1	3	0	0	0	0	0	3	3
SUCTOBELBIDAE									
	L-F_1	6	0	0	0	0	15	21	
Suctobelba frothinghami . . .	F_2-H	2	40	0	0	0	2	44	65
S. gigentea	-	0	0	0	0	0	0	0	0
	L-F_1	22	0	0	1	0	0	23	
	F_2-H	7	0	0	6	0	0	13	
S. hurshi	A_2-B	3	0	0	0	0	0	3	39
	L-F_1	8	18	0	0	0	3	29	
	F_2-H	21	0	0	0	0	3	24	
S. laxtoni	A_2-B	11	0	2	0	0	1	14	67
	L-F_1	7	0	0	0	0	0	7	
	F_2-H	1	0	0	0	0	1	2	
S. longicuspis	A_2-B	1	0	4	0	1	0	6	15
Suctobelba sp.$_1$, ? *nov*. . . .	-	0	0	0	0	0	0	0	0
	L-F_1	2	6	0	0	1	14	23	
	F_2-H	2	0	0	0	0	0	2	
Suctobelba sp.$_2$, ? *nov*. . . .	A_2-B	2	0	0	0	0	0	2	27
Suctobelba sp.$_3$, ? *nov*. . . .	-	0	0	0	0	0	0	0	

[1;2;3] See footnote p. 263

(table continued)

Table XI (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Suctobelba sp.4, ? nov. . . .	F_2-H	10	0	2	0	0	1	13	
	A_2-B	1	0	0	0	0	0	1	14
Suctobelba sp.5, ? nov. . . .	F_2-H	0	0	0	0	0	2	2	2
Suctobelba sp.6, ? nov. . . .	L-F_1	0	6	0	0	0	0	6	6
Suctobelba sp.7, ? nov. . . .	F_2-H	1	0	0	0	0	0	1	
	A_2-B	1	0	0	0	0	0	1	2
Suctobelba sp.8, ? nov. . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.9, ? nov. . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.10, ? nov. . . .	F_2-H	0	0	0	1	0	0	1	1
Suctobelba sp.11, ? nov. . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.12, ? nov. . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.13, ? nov. . . .	-	0	0	0	0	0	0	0	0
Suctobelba sp.14, ? nov. . . .	-	0	0	0	0	0	0	0	0
ACHIPTERIIDAE									
Achipteria coleoptera	A_2-B	1	0	0	0	0	0	1	1
ORIBATELLIDAE									
Oribatella reticulatoides . .	-	0	0	0	0	0	0	0	0

1;2;3 See footnote p. 263

(table continued)

Table XI (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
CERATOZETIDAE									
	$L-F_1$	2	7	0	1	11	13	34	
	F_2-H	2	3	0	0	4	6	15	
Ceratozetes sp.	A_2-B	1	0	0	0	0	1	2	51
Fuscozetes bidentatus	$L-F_1$	0	3	0	0	13	3	19	19
CHAMBOBATIDAE									
Chambobates sp.	$L-F_1$	0	0	0	1	0	0	1	1
PARAKALUMNIDAE									
? Neoribates sp.	-	0	0	0	0	0	0	0	0
Protokalumna depressum	-	0	0	0	0	0	0	0	0
GALUMNIDAE									
	$L-F_1$	1	0	0	0	0	0	1	
Pergalumna emarginatus	F_2-H	0	1	0	0	0	0	1	2
ORIBATULIDAE									
Oribatula minuta	$L-F_1$	2	10	5	1	4	8	30	30
Scheloribates pallidulus . . .	$L-F_1$	13	7	8	20	7	9	64	64
HAPLOZETIDAE									
Peloribates americanus	$L-F_1$	3	1	0	0	1	0	5	5
Protoribates capucinus	F -H	1	0	0	0	0	0	1	1

[1;2;3] See footnote p. 263

(table continued)

Table XI (continued). Site 3 (hemlock mor). Numbers of Sarcoptiformes (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	27	0	2	4	3	7	43	
	F_2-H	1	0	8	1	0	1	11	
<u>P</u>. <u>lophotrichus</u>	A_2-B	0	0	2	0	0	0	2	56
	L-F_1	16	10	10	16	12	24	88	
	F_2-H	0	8	0	1	3	0	12	
ORIBATEI undet.	A_2-B	1	2	2	0	0	2	7	107
ORIBATEI TOTAL		686	1396	87	143	186	679		3177
SARCOPTIFORMES TOTAL		689	1396	88	143	186	680		3182

[1;2;3] See footnote p. 263

Table XII. Site 1 (maple mull). Numbers of Collembola per sample (series A) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples: L, M, N. See Appendix A, Table VI for details.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
PODURIDAE									
Anurida caeca		0	0	0	0	0	0	0	0
Anurida sp.,? granaria		0	0	0	0	0	0	0	0
Anurida sp. nr. pygmaea		0	0	0	0	0	0	0	0
Friesea sublimis		0	0	0	0	0	0	0	0
Hypogastrura sp.,? armata		0	0	0	0	0	0	0	0
Hypogastrura sp., manubrialis-group		0	0	0	0	0	0	0	0
Hypogastrura sp.$_3$		0	0	0	0	0	0	0	0
Neanura sp.,? muscorum	M	0	1	0	0	0	0	1	1
Odontella sp.$_1$		0	0	0	0	0	0	0	0
Odontella sp.$_2$		0	0	0	0	0	0	0	0

[1]H = Horizon
[2]Tss = Sub-sample total
[3]Ts = Sample total

(table continued)

Table XII (continued). Site 1 (maple mull). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Pseudachorutes sp., ? *aurefasciatus*		0	0	0	0	0	0	0	0
Pseudachorutes sp., ? *dilatatus* .		0	0	0	0	0	0	0	0
Pseudachorutes sp., ? *simplex* . .	M	0	1	0	0	0	0	1	1
Pseudachorutes sp.[4]		0	0	0	0	0	0	0	0
Willemia anophthalma	M	0	1	0	1	0	0	2	
	N	0	0	0	0	1	0	1	3
PODURIDAE TOTAL		0	3	0	1	1	0		5
ONYCHIURIDAE									
Onychiurus absoloni		0	0	0	0	0	0	0	0
Onychiurus sp., ? *armatus*	N	0	0	0	0	1	0	1	1
Onychiurus sp., *fimetarius*-group		0	0	0	0	0	0	0	0
Onychiurus subtenuis	M	0	0	0	0	1	0	1	
	N	1	0	0	0	1	0	2	3
Tullbergia clavata	M	7	3	0	7	13	11	41	
	N	1	1	0	1	1	1	5	46
Tullbergia collis	M	1	0	0	0	0	0	1	
	N	1	1	0	0	0	0	2	3

1;2;3 See footnote p. 274

(table continued)

Table XII (continued). Site 1 (maple mull). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	M	5	3	2	1	5	0	16	
Tullbergia granulata	N	0	0	1	0	1	0	2	18
Tullbergia sp., *granulata*-group .		0	0	0	0	0	0	0	0
	M	0	0	0	0	0	1	1	
Tullbergia krausbaueri	N	0	1	0	0	0	0	1	2
ONYCHIURIDAE undet.	M	0	0	0	2	0	0	2	2
ONYCHIURIDAE TOTAL		16	9	3	11	23	13		75
ISOTOMIDAE									
	M	1	0	0	0	0	0	1	
Folsomia sp. nr. *duodecimsetosa* .	N	0	0	0	0	5	0	5	6
Folsomia sensibilis		0	0	0	0	0	0	0	0
Folsomides sp. nr. *inequalis* . .		0	0	0	0	0	0	0	0
Isotoma andrei	N	0	0	0	0	1	0	1	1
Isotoma grandiceps	M	0	1	0	0	0	0	1	1
Isotoma notabilis	(L	1	1	0	0	0	0	2	
	(M	6	19	1	7	2	4	39	
	(N	0	4	2	0	0	0	6	47

[1;2;3] See footnote p. 274

(table continued)

Table XII (continued). Site 1 (maple mull). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	M	1	0	0	0	0	0	1	
<u>Isotoma</u> <u>olivacea</u>	N	0	1	0	0	0	0	1	2
<u>Isotoma</u> <u>violacea</u>		0	0	0	0	0	0	0	0
<u>Isotoma</u> sp.6	M	0	0	0	0	1	0	1	1
	M	1	1	1	8	0	6	17	
<u>Isotomiella</u> <u>minor</u>	N	0	0	1	0	14	2	17	34
<u>Isotomodes</u> <u>trisetosus</u>		0	0	0	0	0	0	0	0
<u>Micrisotoma</u> <u>achromata</u>		0	0	0	0	0	0	0	0
<u>Proisotoma</u> sp. nr. <u>borealis</u> . . .		0	0	0	0	0	0	0	0
<u>Proisotoma</u> <u>minima</u>	M	1	0	1	0	1	0	3	3
<u>Proisotoma</u> sp.3		0	0	0	0	0	0	0	0
<u>Proisotoma</u> sp.4		0	0	0	0	0	0	0	0
	L	0	5	0	0	0	0	5	
ISOTOMIDAE undet.	M	2	2	0	0	0	0	4	9
ISOTOMIDAE TOTAL		13	34	6	15	24	12		104

[1;2;3] See footnote p. 274

(table continued)

Table XII (continued). Site 1 (maple mull). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ENTOMOBRYIDAE									
Entomobrya clitellaria	N	0	0	0	0	1	0	1	1
Entomobrya sp.$_2$	N	0	0	0	0	1	0	1	1
Entomobrya sp.$_3$		0	0	0	0	0	0	0	0
Entomobrya sp.$_4$		0	0	0	0	0	0	0	0
	L	1	0	0	0	0	0	1	
	M	10	7	0	2	0	5	24	
Pseudosinella alba	N	1	3	3	0	0	2	9	34
	L	0	1	0	0	0	0	1	
	M	2	0	0	0	0	0	2	
Pseudosinella petterseni	N	0	0	1	0	0	0	1	4
	L	0	0	0	0	0	1	1	
Tomocerus flavescens	M	2	0	0	0	0	0	2	3
	L	3	0	0	0	0	0	3	
	M	0	1	1	0	0	0	2	
Willowsia nigromaculata	N	3	1	1	0	0	0	5	10
ENTOMOBRYIDAE TOTAL		22	13	6	2	2	8		53

[1;2;3] See footnote p. 274

(table continued)

Table XII (continued). Site 1 (maple mull). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
SMYNTHURIDAE									
Arrhopalites sp.1	M-	2	1	0	0	0	0	3	3
Arrhopalites sp.2		0	0	0	0	0	0	0	0
Bourletiella sp.		0	0	0	0	0	0	0	0
Dicyrtoma sp.,? unicolor		0	0	0	0	0	0	0	0
Neelus incertus	M	3	0	0	0	0	0	3	3
	M	1	0	10	1	0	0	12	
Neelus minimus	N	1	0	0	0	0	2	3	15
Neelus sp.3	M	2	0	0	0	0	0	2	2
Sminthurides sp.,? occultus . . .		0	0	0	0	0	0	0	0
	M	0	0	0	0	1	0	1	
Sminthurinus aureus	N	0	0	0	0	1	0	1	2
	L	0	0	0	0	0	6	6	
	M	0	0	0	0	0	1	1	
Sminthurinus elegans	N	0	0	0	0	0	2	2	9
SMYNTHURIDAE TOTAL		9	1	10	1	2	11		34
COLLEMBOLA TOTAL		60	60	25	30	52	44		271

[1;2;3] See footnote p. 274.

Table XIII. Site 1 (maple mull). Numbers of Collembola per sample (series B) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples: L, M, N. Details are in Appendix A, Table VI.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
PODURIDAE									
Anurida caeca		0	0	0	0	0	0	0	0
Anurida sp.,? *granaria*		0	0	0	0	0	0	0	0
Anurida sp. nr. *pygmaea*	L	4	0	0	0	0	0	4	4
Friesea sublimis		0	0	0	0	0	0	0	0
Hypogastrura sp.,? *armata*		0	0	0	0	0	0	0	0
Hypogastrura sp., *manubrialis*-group		0	0	0	0	0	0	0	0
Hypogastrura sp.$_3$		0	0	0	0	0	0	0	0
Neanura sp.,? *muscorum*		0	0	0	0	0	0	0	0
Odontella sp.$_1$		0	0	0	0	0	0	0	0
Odontella sp.$_2$		0	0	0	0	0	0	0	0

[1]H = Horizon
[2]Tss = Sub-sample total
[3]Ts = Sample total

(table continued)

Table XIII (continued). Site 1 (maple mull). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Pseudachorutes sp., ? *aurefasciatus*	M	1	0	0	0	0	0	1	1
Pseudachorutes *dilatatus*		0	0	0	0	0	0	0	0
Pseudachorutes *simplex*		0	0	0	0	0	0	0	0
Pseudachorutes sp.[4]		0	0	0	0	0	0	0	0
	M	0	0	0	1	0	0	1	
Willemia *anophthalma*	N	1	0	0	0	0	0	1	2
PODURIDAE TOTAL		6	0	0	1	0	0	7	7
ONYCHIURIDAE									
Onychiurus *absoloni*		0	0	0	0	0	0	0	0
Onychiurus sp., ? *armatus*		0	0	0	0	0	0	0	0
Onychiurus sp. *fimetarius* group .	M	0	0	1	0	0	1	2	2
	M	2	4	1	0	0	0	7	
Onychiurus *subtenuis*	N	0	1	0	0	0	0	1	8
	L	0	0	0	0	0	2	2	
Tullbergia *clavata*	M	0	0	1	0	2	7	10	12
Tullbergia *collis*		0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 280

(table continued)

Table XIII (continued). Site 1 (maple mull). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L	0	1	0	0	0	0	1	
	M	7	0	1	0	0	0	8	
Tullbergia granulata	N	0	1	2	0	7	0	10	19
Tullbergia sp., granulata-group .		0	0	0	0	0	0	0	0
	M	1	0	0	0	0	0	1	
Tullbergia Krausbaueri	N	0	0	0	0	1	2	3	4
	M	0	1	0	0	0	0	1	
ONYCHIURIDAE undet.	N	0	3	0	0	0	0	3	4
ONYCHIURIDAE TOTAL		10	11	6	0	10	12		49
ISOTOMIDAE									
	L	5	0	0	0	0	0	5	
	M	0	0	0	0	0	1	1	
Folsomia sp.nr. duodecimsetosa .	N	0	0	0	0	0	1	1	7
Folsomia sensibilis		0	0	0	0	0	0	0	0
Folsomides sp. nr. inequalis . .		0	0	0	0	0	0	0	0
Isotoma andrei	L	1	0	0	0	0	0	1	1
Isotoma grandiceps		0	0	0	0	0	0	0	0

1;2;3 See footnote p. 280

(table continued)

Table XIII (continued). Site 1 (maple mull). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L	6	23	0	1	0	7	37	
	M	13	23	2	4	1	12	55	
<u>Isotoma</u> <u>notabilis</u>	N	0	3	0	0	0	0	3	95
	L	1	0	0	0	0	0	1	
<u>Isotoma</u> <u>olivacea</u>	M	1	0	0	0	0	0	1	2
<u>Isotoma</u> <u>violacea</u>		0	0	0	0	0	0	0	0
<u>Isotoma</u> sp.6	L	0	0	0	0	1	0	1	1
	L	9	0	0	0	0	0	9	
	M	2	0	2	0	1	7	12	
<u>Isotomiella</u> <u>minor</u>	N	0	0	1	0	3	2	6	27
<u>Isotomodes</u> <u>trisetosus</u>	M	0	0	0	0	0	1	1	1
<u>Micrisotoma</u> <u>achromata</u>	M	0	0	0	5	0	0	5	5
<u>Proisotoma</u> sp. nr. <u>borealis</u>		0	0	0	0	0	0	0	0
<u>Proisotoma</u> <u>minima</u>		0	0	0	0	0	0	0	0
<u>Proisotoma</u> sp.3		0	0	0	0	0	0	0	0
<u>Proisotoma</u> sp.4	M	3	0	0	0	0	0	3	3
ISOTOMIDAE TOTAL		41	49	5	10	6	31		142

[1;2;3] See footnote p. 280

(table continued)

Table XIII (continued). Site 1 (maple mull). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ENTOMOBRYIDAE									
	L	0	0	0	1	0	2	3	
Entomobrya clitellaria	M	0	0	0	1	1	5	7	10
Entomobrya sp.$_2$		0	0	0	0	0	0	0	0
Entomobrya sp.$_3$		0	0	0	0	0	0	0	0
Entomobrya sp.$_4$		0	0	0	0	0	0	0	0
	L	2	4	0	0	0	0	6	
	M	9	6	0	2	2	6	25	
Pseudosinella alba	N	2	3	1	1	0	5	12	43
Pseudosinella petterseni	M	0	1	1	0	1	0	3	3
Tomocerus flavescens	L	1	3	0	0	0	1	5	5
	L	5	1	0	0	0	0	6	
	M	0	0	0	1	0	0	1	
Willowsia nigromaculata	N	0	0	1	0	0	0	1	8
ENTOMOBRYIDAE TOTAL		19	18	3	6	4	19		69
SMYNTHURIDAE									
	L	1	1	0	0	0	0	2	
	M	1	1	0	0	0	0	2	
Arrhopalites sp.$_1$	N	0	1	0	0	0	0	1	5

1;2;3 See footnote p. 280

(table continued)

Table XIII (continued). Site 1 (maple mull). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Arrhopalites sp.$_2$		0	0	0	0	0	0	0	0
Bourletiella sp.		0	0	0	0	0	0	0	0
	L	0	0	0	0	0	1	1	
Dicyrtoma sp.,? *unicolor*	N	0	1	0	0	0	0	1	2
Neelus incertus	M	1	0	0	0	0	0	1	1
	L	2	15	0	0	0	0	17	
	M	4	3	1	3	0	4	15	
Neelus minimus	N	0	7	0	0	1	0	8	40
Neelus sp.$_3$	L	1	0	0	0	0	0	1	1
Sminthurides sp.,? *occultus* . . .		0	0	0	0	0	0	0	0
Sminthurinus aureus		0	0	0	0	0	0	0	0
Sminthurinus elegans		0	0	0	0	0	0	0	0
SMINTHURIDAE TOTAL		10	29	1	3	1	5		49
COLLEMBOLA TOTAL		86	107	15	20	21	67		316

[1;2;3] See footnote p. 280

Table XIV. Site 2 (beech mor). Numbers of Collembola per sample (series A) taken monthly from June to November, 1960. Each sample was sub-divided into 3 sub-samples: L-F_1, F_2-H, A_2-B. For details see Appendix A, Table VIII.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
PODURIDAE									
Anurida caeca		0	0	0	0	0	0	0	0
Anurida sp.,? *granaria*	L-F_1	1	0	0	0	0	0	1	1
	L-F_1	7	0	0	0	0	1	8	
Anurida sp. nr *pygmaea*	F_2-H	2	0	0	0	0	0	2	10
Friesea sublimis	L-F_1	1	0	0	5	0	0	6	6
	L-F_1	6	0	0	19	0	0	25	
	F_2-H	0	0	0	7	0	0	7	
Hypogastrura sp.,? *armata* . . .	A_2-B	0	0	0	4	0	0	4	36
Hypogastrura sp., *manubrialis*-grp.		0	0	0	0	0	0	0	0
Hypogastrura sp.$_3$	L-F_1	0	0	0	3	0	0	3	3
Neanura sp.,? *muscorum*		0	0	0	0	0	0	0	0
Odontella sp.$_1$	L-F_1	0	0	0	2	0	0	2	2

[1]H = Horizon

[2]Tss = Sub-sample total

[3]Ts = Sample total

(table continued)

Table XIV (continued). Site 2 (beech mor). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Odontella sp. 2		0	0	0	0	0	0	0	0
Pseudachorutes sp.,? *aurefasciatus*	L-F_1	1	0	0	0	0	0	1	1
Pseudachorutes sp.,? *dilatatus*	L-F_1	1	0	0	0	0	0	1	1
Pseudachorutes sp.,? *simplex* .	L-F_1	0	0	0	1	0	0	1	1
Pseudachorutes sp. 4	L-F_1	1	0	0	0	0	0	1	1
Willemia anophthalma	L-F_1	19	6	0	3	1	0	29	29
PODURIDAE undet.	L-F_1	1	0	0	0	4	0	5	5
PODURIDAE TOTAL		40	6	0	44	5	1		96
ONYCHIURIDAE									
Onychiurus absoloni	L-F_1	1	1	1	2	0	1	6	6
Onychiurus sp.,? *armatus* . . .	L-F_1	0	0	0	2	0	1	3	3
Onychiurus sp., *fimetarius*-group	L-F_1	4	0	1	6	0	7	18	
	F_2-H	0	0	0	1	0	1	2	20
Onychiurus subtenuis	L-F_1	1	4	0	3	1	0	9	
	F_2-H	0	0	0	1	0	0	1	10

[1;2;3] See footnote p. 286

(table continued)

Table XIV (continued). Site 2 (beech mor). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	0	0	0	0	0	1	1	
<u>Tullbergia</u> <u>clavata</u>	F_2-H	0	0	0	0	1	0	1	2
<u>Tullbergia</u> <u>collis</u>		0	0	0	0	0	0	0	0
<u>Tullbergia</u> <u>granulata</u>		0	0	0	0	0	0	0	0
	F_2-H	0	1	0	0	0	0	1	
<u>Tullbergia</u> sp.,<u>granulata</u>-group	A_2-B	0	2	0	0	0	0	2	3
<u>Tullbergia</u> <u>Krausbaueri</u>	L-F_1	1	0	0	0	0	0	1	1
	L-F_1	0	0	1	1	0	1	3	
ONYCHIURIDAE undet.	F_2-H	0	0	0	0	1	0	1	4
ONYCHIURIDAE TOTAL		7	8	3	16	3	12		49
ISOTOMIDAE									
	L-F_1	38	6	9	8	5	6	72	
<u>Folsomia</u> sp.nr. <u>duodecimsetosa</u>	F_2-H	0	1	0	3	1	0	5	77
<u>Folsomia</u> <u>sensibilis</u>	A_2-B	1	0	0	0	0	0	1	1
<u>Folsomides</u> sp. nr. <u>inequalis</u> .	L-F_1	0	1	0	0	0	0	1	1
<u>Isotoma</u> <u>andrei</u>	L-F_1	0	0	0	0	2	5	7	7
<u>Isotoma</u> <u>grandiceps</u>		0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 286

(table continued)

Table XIV (continued). Site 2 (beech mor). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Isotoma notabilis	L-F_1	0	7	0	0	0	0	7	7
Isotoma olivacea		0	0	0	0	0	0	0	0
Isotoma violacea		0	0	0	0	0	0	0	0
Isotoma sp.6		0	0	0	0	0	0	0	0
	L-F_1	61	22	23	0	4	1	111	
	F_2-H	17	0	1	0	6	1	25	
Isotomiella minor	A_2-B	0	0	0	0	1	0	1	137
Isotomodes trisetosus		0	0	0	0	0	0	0	0
	L-F_1	0	1	0	0	1	5	7	
	F_2-H	2	1	0	1	0	1	5	
Micrisotoma achromata	A_2-B	2	2	1	0	0	0	5	17
Proisotoma sp. nr. *borealis* . .		0	0	0	0	0	0	0	0
Proisotoma minima		0	0	0	0	0	0	0	0
Proisotoma sp.3		0	0	0	0	0	0	0	0
Proisotoma sp.4		0	0	0	0	0	0	0	0
	L-F_1	0	1	0	0	0	0	1	
ISOTOMIDAE undet.	F_2-H	0	0	0	1	0	0	1	2
ISOTOMIDAE TOTAL		121	42	34	13	20	19		249

[1;2;3] See footnote p. 286

(table continued)

Table XIV (continued). Site 2 (beech mor). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ENTOMOBRYIDAE									
Entomobrya clitellaria	L-F1	1	0	2	5	0	0	8	8
Entomobrya sp.2		0	0	0	0	0	0	0	0
Entomobrya sp.3	L-F1	2	0	0	0	0	0	2	2
	L-F1	0	1	0	0	0	0	1	
Entomobrya sp.4	A2-B	0	1	0	0	0	0	1	2
Pseudosinella alba		0	0	0	0	0	0	0	0
Pseudosinella petterseni . . .		0	0	0	0	0	0	0	0
Tomocerus flavescens		0	0	0	0	0	0	0	0
	L-F1	4	0	1	0	0	0	5	
	F2-H	1	0	1	0	0	0	2	
Willowsia nigromaculata	A2-B	3	0	2	1	0	0	6	13
ENTOMOBRYIDAE TOTAL		11	2	6	6	0	0		25
SMYNTHURIDAE									
Arrhopalites sp.1	L-F1	2	0	0	2	0	0	4	4
Arrhopalites sp.2	L-F1	0	0	0	1	0	0	1	1

[1;2;3] Footnote page 286

(table continued)

Table XIV (continued). Site 2 (beech mor). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	0	1	0	0	0	0	1	
Bourletiella sp.	F_2-H	0	0	1	0	0	0	1	2
Dicyrtoma sp.,? *unicolor* . . .		0	0	0	0	0	0	0	0
Neelus incertus	L-F_1	0	1	0	0	0	0	1	1
	L-F_1	1	3	2	0	1	3	10	
	F_2-H	0	0	0	0	0	3	3	
Neelus minimus	A_2-B	0	0	0	0	0	1	1	14
Neelus sp.[3]		0	0	0	0	0	0	0	0
Sminthurides sp.,? *occultus* . .		0	0	0	0	0	0	0	0
Sminthurinus aureus		0	0	0	0	0	0	0	0
Sminthurinus elegans		0	0	0	0	0	0	0	0
SMYNTHURIDAE TOTAL		3	5	3	3	1	7		22
COLLEMBOLA TOTAL		182	63	46	82	29	39		441

[1;2;3] See footnote p. 286

Table XV. Site 2 (beech mor). Numbers of Collembola per sample (series B) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples: L-F_1, F_2-H, A_2-B. Details are in Appendix A, Table VIII.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
PODURIDAE									
	L-F_1	1	0	2	0	2	0	5	
Anurida caeca	A_2-B	0	2	1	0	0	0	3	8
Anurida sp.,? *granaria*	F_2-H	0	1	1	0	0	0	2	2
	L-F_1	5	0	0	2	0	0	7	
Anurida sp.nr. *pygmaea*	F_2-H	21	1	0	0	0	0	22	29
Friesea sublimis	L-F_1	0	0	0	18	0	0	18	18
Hypogastrura sp.,? *armata* . . .	L-F_1	17	0	7	24	0	0	48	48
Hypogastrura sp., *manubrialis*-group	F_2-H	0	0	0	0	0	1	1	1
Hypogastrura sp.$_3$		0	0	0	0	0	0	0	0
Neanura sp.,? *muscorum*		0	0	0	0	0	0	0	0
Odontella sp.$_1$		0	0	0	0	0	0	0	0

[1]Horizon = H

[2]Tss = Sub-sample total

[3]Ts = Sample total

(table continued)

Table XV (continued). Site 2 (beech mor). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Odontella sp.$_2$	F_1-H	0	0	3	0	0	0	3	3
Pseudachorutes sp.,? *aurefasciatus*		0	0	0	0	0	0	0	0
Pseudachorutes sp.,? *dilatatus*		0	0	0	0	0	0	0	0
Pseudachorutes sp.,? *simplex* .		0	0	0	0	0	0	0	0
Pseudachorutes sp.$_4$		0	0	0	0	0	0	0	0
	L-F_1	28	0	0	0	2	3	33	
	F_2-H	0	0	0	0	1	0	1	
Willemia anophthalma	A_2-B	1	0	0	0	0	0	1	35
PODURIDAE TOTAL		73	4	14	44	5	4		144
ONYCHIURIDAE									
Onychiurus absoloni	L-F_1	5	0	6	0	0	0	11	11
	L-F_1	3	0	4	11	0	0	18	
Onychiurus sp.,? *armatus* . . .	F_2-H	0	0	0	1	0	0	1	19
	L-F_1	6	0	5	14	0	1	26	
	F_2-H	1	0	0	0	0	0	1	
Onychiurus sp.,*fimetarius*-group	A_2-B	0	1	0	0	0	0	1	28

[1;2;3] See footnote p. 292

Table XV (continued). Site 2 (beech mor). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	$L\text{-}F_1$	1	0	8	0	0	0	9	
Onychiurus subtenuis	$F_2\text{-}H$	1	0	1	0	0	0	2	11
Tullbergia clavata		0	0	0	0	0	0	0	0
Tullbergia collis		0	0	0	0	0	0	0	0
	$L\text{-}F_1$	0	0	0	1	0	0	1	
	$F_2\text{-}H$	0	1	0	0	1	0	2	
Tullbergia granulata	$A_2\text{-}B$	0	0	0	1	1	0	2	5
	$L\text{-}F_1$	1	0	0	0	0	0	1	
Tullbergia sp., *granulata*-group	$F_2\text{-}H$	1	1	0	0	0	0	2	3
	$L\text{-}F_1$	3	0	0	0	3	0	6	
Tullbergia krausbaueri	$F_2\text{-}H$	0	1	0	1	0	2	4	10
ONYCHIURIDAE undet.	$L\text{-}F_1$	0	0	0	0	3	0	3	3
ONYCHIURIDAE TOTAL		22	4	24	29	8	3		90
ISOTOMIDAE									
	$L\text{-}F_1$	19	1	9	29	8	7	73	
Folsomia sp.nr. *duodecimsetosa*	$F_2\text{-}H$	9	2	0	6	0	0	17	90
Folsomia sensibilis		0	0	0	0	0	0	0	0
Folsomides sp.nr. *inequalis* . .		0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 292

(table continued)

Table XV (continued). Site 2 (beech mor). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	9	0	0	0	2	2	13	
Isotoma andrei	F_2-H	0	0	2	0	0	0	2	15
Isotoma grandiceps		0	0	0	0	0	0	0	0
Isotoma notabilis	A_2-B	0	1	0	0	0	0	1	1
Isotoma olivacea		0	0	0	0	0	0	0	0
Isotoma violacea		0	0	0	0	0	0	0	0
Isotoma sp. 6		0	0	0	0	0	0	0	0
	L-F_1	49	2	40	6	10	3	110	
	F_2-H	48	15	8	1	0	2	74	
Isotomiella minor	A_2-B	0	0	0	2	0	3	5	189
Isotomodes trisetosus		0	0	0	0	0	0	0	0
	F_2-H	0	3	0	1	0	1	5	
Micrisotoma achromata	A_2-B	0	0	2	0	0	0	2	7
Proisotoma sp. nr. *borealis* . .		0	0	0	0	0	0	0	0
Proisotoma minima		0	0	0	0	0	0	0	0
Proisotoma sp. 3		0	0	0	0	0	0	0	0
Proisotoma sp. 4		0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 292

(table continued)

Table XV (continued). Site (beech mor). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	1	0	0	0	5	0	6	
ISOTOMIDAE undet.	F_2-H	0	0	1	0	0	0	1	7
ISOTOMIDAE TOTAL		135	24	62	45	25	18		309
ENTOMOBRYIDAE									
	L-F_1	0	0	0	0	4	0	4	
Entomobrya clitellaria	A_2-B	0	0	0	0	0	1	1	5
Entomobrya sp.$_2$		0	0	0	0	0	0	0	0
Entomobrya sp.$_3$		0	0	0	0	0	0	0	0
Entomobrya sp.$_4$		0	0	0	0	0	0	0	0
Pseudosinella alba		0	0	0	0	0	0	0	0
Pseudosinella petterseni . . .		0	0	0	0	0	0	0	0
Tomocerus flavescens		0	0	0	0	0	0	0	0
	L-F_1	3	0	2	0	0	0	5	
	F_2-H	1	1	0	0	0	0	2	
Willowsia nigromaculata	A_2-B	1	0	0	0	0	0	1	8
ENTOMOBRYIDAE TOTAL		5	1	2	0	4	1		13

1;2;3 See footnote p. 292

(table continued)

Table XV (continued). Site 2 (beech mor). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
SMYNTHURIDAE									
Arrhopalites sp.$_1$	L-F$_1$	2	1	1	0	0	0	4	
	A$_2$-B	0	1	0	0	0	0	1	5
Arrhopalites sp.$_2$		0	0	0	0	0	0	0	0
Bourletiella sp.		0	0	0	0	0	0	0	0
Dicyrtoma sp.,? *unicolor* . . .		0	0	0	0	0	0	0	0
Neelus incertus		0	0	0	0	0	0	0	0
Neelus minimus	L-F$_1$	0	11	5	1	0	0	17	
	F$_2$-H	0	0	1	0	0	0	1	18
Neelus sp.$_3$		0	0	0	0	0	0	0	0
Sminthurides sp.,? *occultus* . .		0	0	0	0	0	0	0	0
Sminthurinus aureus		0	0	0	0	0	0	0	0
Sminthurinus elegans		0	0	0	0	0	0	0	0
SMYNTHURIDAE undet.	L-F$_1$	0	0	0	0	1	0	1	1
SMYNTHURIDAE TOTAL		2	13	7	1	1	0		24
COLLEMBOLA TOTAL		237	46	109	119	43	26		580

[1;2;3] See footnote p. 292

Table XVI. Site 3 (hemlock mor). Numbers of Collembola per sample (series A) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples: $L\text{-}F_1$, $F_2\text{-}H$, $A_2\text{-}B$. Details are in Appendix A, Table VIII.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
PODURIDAE									
Anurida caeca		0	0	0	0	0	0	0	0
Anurida sp.,? *granaria*	F_2-H	0	0	0	0	0	1	1	1
	L-F_1	0	1	0	0	0	0	1	
	F_2-H	4	1	0	0	1	5	11	
Anurida sp. nr. *pygmaea*	A_2-B	0	1	0	0	0	0	1	13
Friesea sublimis		0	0	0	0	0	0	0	0
Hypogastrura sp.,? *armata* . . .		0	0	0	0	0	0	0	0
Hypogastrura sp., *manubrialis*-grp.		0	0	0	0	0	0	0	0
Hypogastrura $sp._3$		0	0	0	0	0	0	0	0
Neanura sp.,? *muscorum*		0	0	0	0	0	0	0	0
Odontella $sp._1$		0	0	0	0	0	0	0	0

[1]H = Horizon

[2]Tss = Sub-sample total

[3]Ts = Sample total

(table continued)

Table XVI (continued). Site 3 (hemlock mor). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
<u>Odontella</u> sp.2		0	0	0	0	0	0	0	0
<u>Pseudachorutes</u> sp. ? <u>aurefasciatus</u>		0	0	0	0	0	0	0	0
<u>Pseudachorutes</u> sp. ? <u>dilatatus</u>		0	0	0	0	0	0	0	0
<u>Pseudachorutes</u> sp. ? <u>simplex</u> .		0	0	0	0	0	0	0	0
<u>Pseudachorutes</u> sp.4		0	0	0	0	0	0	0	0
<u>Willemia</u> <u>anophtholma</u>		0	0	0	0	0	0	0	0
PODURIDAE TOTAL		4	3	0	0	1	6		14
ONYCHIURIDAE									
<u>Onychiurus</u> <u>absoloni</u>	L-F_1	0	0	2	2	0	0	4	
	F_2-H	0	0	1	0	0	0	1	5
<u>Onychiurus</u> sp. ? <u>armatus</u> . . .	L-F_1	0	10	0	3	1	0	14	
	F_2-H	0	0	0	0	1	0	1	15
<u>Onychiurus</u> sp. <u>fimetarius</u> group	L-F_1	0	1	0	2	0	0	3	
	F_2-H	2	0	0	0	0	0	2	5
<u>Onychiurus</u> <u>subtenuis</u>	L-F_1	0	3	0	4	0	0	7	7
<u>Tullbergia</u> <u>clavata</u>		0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 298

(table continued)

Table XVI (continued). Site 3 (hemlock mor). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Tullbergia collis		0	0	0	0	0	0	0	0
	F_2-H	0	0	1	0	0	0	1	
Tullbergia granulata	A_2-B	1	0	2	0	0	0	3	4
Tullbergia sp., *granulata*-group		0	0	0	0	0	0	0	0
	L-F_1	1	0	3	1	0	0	5	
	F_2-H	0	0	1	0	0	0	1	
Tullbergia krausbaueri	A_2-B	3	0	1	0	0	0	4	10
ONYCHIURIDAE undet.	F_2-H	1	0	0	0	0	0	1	1
ONYCHIURIDAE TOTAL		8	14	11	12	2	0		47
ISOTOMIDAE									
	L-F_1	9	37	0	3	2	0	51	
	F_2-H	5	7	0	4	2	13	31	
Folsomia sp.nr. *duodecimsetosa*	A_2-B	1	1	0	0	0	1	3	85
	F_2-H	46	0	0	0	0	0	46	
Folsomia sensibilis	A_2-B	33	0	0	0	0	0	33	79
Folsomides sp. nr. *inequalis* . .		0	0	0	0	0	0	0	0
Isotoma andrei		0	0	0	0	0	0	0	0
Isotoma grandiceps	L-F_1	8	0	0	0	1	0	9	9

[1;2;3] See footnote p. 298

(table continued)

Table XVI (continued). Site 3 (Hemlock mor). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Isotoma notabilis		0	0	0	0	0	0	0	0
Isotoma olivacea	F_2-H	0	0	0	1	0	0	1	1
Isotoma violacea	F_2-H	1	0	0	0	0	0	1	1
	L-F_1	6	2	0	0	1	0	9	
Isotoma sp.6	F_2-H	7	0	0	0	0	0	7	16
	L-F_1	36	0	0	0	2	0	38	
	F_2-H	55	1	0	0	14	0	70	
Isotomiella minor	A_2-B	20	0	1	0	4	0	25	133
	L-F_1	8	0	0	0	0	0	8	
	F_2-H	4	0	0	1	0	0	5	
Isotomodes trisetosus	A_2-B	9	0	0	11	0	0	20	33
	L-F_1	1	0	0	0	0	0	1	
	F_2-H	13	1	0	0	3	1	18	
Micrisotoma achromata	A_2-B	14	0	0	1	0	0	15	34
Proisotoma sp. nr. *borealis* . .	L-F_1	0	0	0	0	1	0	1	1
Proisotoma minima		0	0	0	0	0	0	0	0
	L-F_1	0	0	0	0	0	1	1	
Proisotoma sp.3	F_2-H	0	0	0	0	0	1	1	2
Proisotoma sp.4		0	0	0	0	0	0	0	0

[1;2;3] See footnote p.298

(table continued)

Table XVI (continued). Site 3 (hemlock mor). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ISOTOMIDAE TOTAL		276	49	1	21	30	17		394
ENTOMOBRYIDAE									
Entomobrya clitellaria		0	0	0	0	0	0	0	0
Entomobrya sp.$_2$		0	0	0	0	0	0	0	0
Entomobrya sp.$_3$	L-F$_1$	0	0	0	1	0	0	1	1
Entomobrya sp.$_4$		0	0	0	0	0	0	0	0
Pseudosinella alba		0	0	0	0	0	0	0	0
Pseudosinella petterseni . . .		0	0	0	0	0	0	0	0
Tomocerus flavescens		0	0	0	0	0	0	0	0
	L-F$_1$	0	1	0	0	0	0	1	
	F$_2$-H	2	0	0	0	0	0	2	
Willowsia nigromaculata	A$_2$-B	2	0	0	0	0	0	2	5
ENTOMOBRYIDAE TOTAL		4	1	0	1	0	0		6
SMYNTHURIDAE									
Arrhopalites sp.$_1$	F$_2$-H	1	0	0	0	0	0	1	1

[1;2;3] See footnote p. 298

(table continued)

Table XVI (continued). Site 3 (hemlock mor). Numbers of Collembola (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Arrhopalites sp.$_2$	A_2-B	3	0	0	0	0	0	3	3
Bourletiella sp.		0	0	0	0	0	0	0	0
Dicyrtoma sp.,? *unicolor* . . .		0	0	0	0	0	0	0	0
Neelus incertus	L-F_1	1	0	0	0	0	0	1	1
	L-F_1	8	0	1	0	0	0	9	
	F_2-H	7	0	0	0	0	0	7	
Neelus minimus	A_2-B	2	0	0	0	0	0	2	18
Neelus sp.$_3$		0	0	0	0	0	0	0	0
Sminthurides sp.,? *occultus* . .	L-F_1	0	0	1	0	0	0	1	1
Sminthurinus aureus	L-F_1	0	0	4	0	0	0	4	4
Sminthurinus elegans		0	0	0	0	0	0	0	0
SMYNTHURIDAE TOTAL		22	0	6	0	0	0		28
COLLEMBOLA undet. . . . . , ...	L-F_1	0	0	0	0	0	45[a]	0	45[a]
COLLEMBOLA TOTAL		314	67	18	34	33	68		534

[1;2;3] See footnote p. 298

[a] Accidently destroyed

Table XVII. Site 3 (hemlock mor). Numbers of Collembola per sample (series B) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples: L-F_1, F_2-H, A_2-B. Details are in Appendix A, Table VIII.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
PODURIDAE									
Anurida caeca	A_2-B	0	1	3	0	0	0	4	4
Anurida sp.,? granaria		0	0	0	0	0	0	0	0
	L-F_1	1	0	0	0	0	3	4	
	F_2-H	0	1	0	0	0	0	1	
Anurida sp. nr. pygmaea	A_2-B	0	0	0	0	1	0	1	6
Friesea sublimis	L-F_1	0	0	0	0	1	6	7	7
	L-F_1	0	0	1	2	0	11	14	
	F_2-H	1	0	0	0	0	10	11	
Hypogastrura sp.,? armata	A_2-B	1	0	0	0	0	1	2	27
Hypogastrura sp., manubrialis-grp.		0	0	0	0	0	0	0	0
Hypogastrura sp.3		0	0	0	0	0	0	0	0
Neanura sp.,? muscorum		0	0	0	0	0	0	0	0
Odontella sp.1		0	0	0	0	0	0	0	0

[1]H = Horizon
[2]Tss = Sub-sample total
[3]Ts = Sample total

(table continued)

Table XVII (continued). Site 3 (hemlock mor). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Odontella sp.$_2$		0	0	0	0	0	0	0	0
Pseudachorutes sp. _aurefasciatus_		0	0	0	0	0	0	0	0
Pseudachorutes sp.,? _dilatatus_		0	0	0	0	0	0	0	0
Pseudachorutes sp.,? _simplex_ .		0	0	0	0	0	0	0	0
Pseudachorutes sp.$_4$		0	0	0	0	0	0	0	0
	F_2-H	1	0	0	0	0	0	1	
Willemia anophthalma	A_2-B	0	0	1	0	0	0	1	2
PODURIDAE TOTAL		4	2	5	2	2	31		46
ONYCHIURIDAE									
Onychiurus absoloni	L-F_1	3	1	1	0	1	0	6	6
	L-F_1	0	1	0	2	16	57	76	
Onychiurus sp.,? _armatus_ . . .	A_2-B	0	0	0	0	1	0	1	77
	L-F_1	1	0	2	1	0	0	4	
	F_2-H	1	0	0	0	0	0	1	
Onychiurus sp., _fimetarius_-group	A_2-B	0	0	1	0	0	0	1	6
Onychiurus subtenuis	L-F_1	0	3	1	0	0	0	4	4

[1;2;3] See footnote p. 304

(table continued)

Table XVII (continued). Site 3 (hemlock mor). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Tullbergia clavata		0	0	0	0	0	0	0	0
Tullbergia collis		0	0	0	0	0	0	0	0
	F2-H	1	0	1	0	0	0	2	
Tullbergia granulata	A2-B	0	0	1	0	0	0	1	3
Tullbergia sp., *granulata*-group		0	0	0	0	0	0	0	0
	L-F1	2	0	0	0	0	0	2	
Tullbergia krausbaueri	F2-H	0	0	0	1	0	0	1	3
ONYCHIURIDAE TOTAL		8	5	7	4	18	57		99
ISOTOMIDAE									
	L-F1	5	9	2	2	11	99	128	
	F2-H	3	16	1	1	0	56	77	
Folsomia sp. nr. *duodecimsetosa*	A2-B	1	3	0	0	5	2	11	216
	L-F1	1	0	0	1	1	1	4	
	F2-H	14	0	0	1	0	0	15	
Folsomia sensibilis	A2-B	3	2	0	0	0	0	5	24
Folsomides sp. nr. *inequalis* .		0	0	0	0	0	0	0	0
Isotoma andrei		0	0	0	0	0	0	0	0

1;2;3 See footnote p. 304

(table continued)

Table XVII (continued). Site 3 (hemlock mor). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	2	0	2	1	0	2	7	
Isotoma grandiceps	F_2-H	0	0	0	0	0	1	1	8
	L-F_1	0	1	0	0	1	9	11	
Isotoma notabilis	F_2-H	0	0	0	0	0	2	2	13
	F_2-H	1	0	0	0	0	0	1	
Isotoma olivacea	A_2-B	1	0	0	0	0	0	1	2
Isotoma violacea		0	0	0	0	0	0	0	0
	L-F_1	0	0	0	0	0	8	8	
Isotoma sp.$_6$	F_2-H	1	0	0	0	0	2	3	11
	L-F_1	27	1	1	1	0	0	30	
	F_2-H	9	1	5	0	0	0	15	
Isotomiella minor	A_2-B	2	0	4	0	0	0	6	51
	L-F_1	2	0	0	0	0	0	2	
	F_2-H	5	0	5	1	0	0	11	
Isotomodes trisetosus	A_2-B	2	1	0	0	1	0	4	17
	L-F_1	4	0	0	1	0	9	14	
	F_2-H	5	0	0	5	0	2	12	
Micrisotoma achromata	A_2-B	1	0	0	0	0	1	2	28
	L-F_1	0	0	0	0	0	74	74	
Proisotoma sp. nr. borealis . .	F_2-H	0	0	0	0	0	9	9	83

[1;2;3] See footnote p. 304

(table continued)

Table XVII (continued). Site 3 (hemlock mor). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Proisotoma minima		0	0	0	0	0	0	0	0
Proisotoma sp.$_3$		0	0	0	0	0	0	0	0
Proisotoma sp.$_4$		0	0	0	0	0	0	0	0
ISOTOMIDAE undet.	A_2-B	1	0	0	0	0	0	1	1
ISOTOMIDAE TOTAL		90	34	20	14	19	277		454
ENTOMOBRYIDAE									
Entomobrya clitellaria		0	0	0	0	0	0	0	0
Entomobrya sp.$_2$		0	0	0	0	0	0	0	0
Entomobrya sp.$_3$	L-F_1	0	1	0	1	1	0	3	3
Entomobrya sp.$_4$	A_2-B	0	1	0	0	0	0	1	1
Pseudosinella alba		0	0	0	0	0	0	0	0
Pseudosinella petterseni . . .		0	0	0	0	0	0	0	0
Tomocerus flavescens		0	0	0	0	0	0	0	0
Willowsia nigromaculata . . .	F_2-H A_2-B	2 3	0 0	0 0	0 0	0 0	0 0	2 3	5

[1;2;3] See footnote p. 304

(table continued)

Table XVII (continued). Site 3 (hemlock mor). Numbers of Collembola (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
ENTOMOBRYIDAE TOTAL		5	2	0	1	1	0		9
SMYNTHURIDAE									
<u>Arrhopalites</u> sp.$_1$		0	0	0	0	0	0	0	0
<u>Arrhopalites</u> sp.$_2$		0	0	0	0	0	0	0	0
<u>Bourletiella</u> sp.		0	0	0	0	0	0	0	0
<u>Dicyrtoma</u> sp. ? <u>unicolor</u> . . .		0	0	0	0	0	0	0	0
<u>Neelus</u> <u>incertus</u>	$L-F_1$	2	0	0	0	0	0	2	2
	$L-F_1$	16	0	3	1	0	0	20	
<u>Neelus</u> <u>minimus</u>	F_2-H	4	1	0	0	0	0	5	25
<u>Neelus</u> sp.$_3$		0	0	0	0	0	0	0	0
<u>Sminthurides</u> sp. ? <u>occultus</u> . .		0	0	0	0	0	0	0	0
<u>Sminthurinus</u> <u>aureus</u>		0	0	0	0	0	0	0	0
<u>Sminthurinus</u> <u>elegans</u>		0	0	0	0	0	0	0	0
SMYNTHURIDAE TOTAL		22	1	3	1	0	0		27
COLLEMBOLA TOTAL		129	44	35	22	40	365		635

[1;2;3] See footnote p. 304

Table XVIII. Site 1 (maple mull). Numbers of animals other than Acarina and Collembola (series A) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples, L, M, N. For details see Appendix A, Table VI.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Gastropoda		0	0	0	0	0	0	0	0
	M	0	1	2	0	0	0	3	
Lumbricidae	N	0	1	1	0	0	0	2	5
	M	0	0	0	2	1	1	4	
Pseudoscorpionida	N	0	0	1	1	0	0	2	6
Araneida	N	0	0	0	0	1	0	1	1
	L	0	0	1	0	0	0	1	
	M	0	0	0	1	1	0	2	
Chilopoda	N	0	0	0	1	0	0	1	4
	M	0	4	0	0	3	1	8	
Diplopoda	N	0	2	9	4	0	0	15	23
	M	11	21	1	0	0	0	33	
Pauropoda	N	10	0	2	0	2	0	14	47
Symphyla	M	0	0	1	0	0	1	2	2

[1]H = Horizon

[2]Tss = Sub-sample total

[3]Ts = Sample total

(table continued)

Table XVIII (continued). Site 1 (maple mull). Numbers of other animals (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L	0	0	0	0	1	0	1	
	M	10	2	8	5	1	1	27	
Protura	N	7	11	2	3	0	2	25	53
	L	0	0	1	0	0	0	1	
	M	0	6	5	1	1	0	13	
Diplura	N	0	0	6	1	0	0	7	21
Psocoptera		0	0	0	0	0	0	0	0
	L	1	0	0	0	0	0	1	
	M	2	0	4	0	2	1	9	
Thysanoptera	N	2	2	1	2	2	0	9	19
Hemiptera	M	0	0	0	0	0	2	2	2
	M	0	0	7	0	0	0	7	
Homoptera	N	0	0	2	0	0	0	2	9
Lepidoptera	L	0	4	0	0	0	0	0	4
Coleoptera	L	0	1	0	0	0	0	1	1
Hymenoptera	M	0	1	0	0	0	0	1	1
	L	0	37	0	0	0	0	37	
	M	2	27	1	0	0	0	30	
Diptera	N	0	11	3	1	0	0	15	82

1;2;3 See footnote p. 310

(table continued)

Table XVIII (continued). Site 1 (maple mull). Numbers of other animals (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	M	1	0	2	4	0	1	8	
Insect larva	N	0	1	0	1	0	2	4	12
Insect pupae		0	0	0	0	0	0	0	0

1;2;3 See footnote p. 310

Table XIX. Site 1 (maple mull). Numbers of animals other than Acarina and Collembola (series B) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples, L, M, N. For details see Appendix A, Table VI.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Gastropoda	L	0	1	0	0	0	0	1	1
Lumbricidae	N	1	0	0	0	1	0	2	2
	L	0	1	0	0	0	0	1	
	M	0	0	0	0	1	1	2	
Pseudoscorpionida	N	0	0	0	1	0	2	3	6
	M	0	3	0	0	0	1	4	
Araneida	N	0	2	0	0	0	0	2	6
	M	0	0	0	2	0	0	2	
Chilopoda	N	0	4	0	0	1	0	5	7
	M	1	2	0	0	0	0	3	
Diplopoda	N	0	0	0	0	0	2	2	5
	L	0	1	0	0	0	0	1	
	M	3	0	8	1	0	1	13	
Pauropoda	N	12	3	0	2	0	2	19	33
Symphyla	N	0	1	0	0	0	0	1	1

[1]H = Horizon
[2]Tss = Sub-sample total
[3]Ts = Sample total

(table continued)

Table XIX (continued). Site 1 (maple mull). Numbers of other animals (Series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L	0	4	0	0	0	0	4	
	M	0	2	0	3	0	0	5	
Protura	N	4	25	3	0	0	5	37	46
	M	0	4	0	3	0	1	8	
Diplura	N	0	0	1	0	0	0	1	9
Psocoptera		0	0	0	0	0	0	0	0
	M	0	0	2	0	0	3	5	
Thysanoptera	N	0	4	2	1	2	0	9	14
	M	0	12	0	0	0	0	12	
Hemiptera	N	0	7	0	0	0	0	7	19
Homoptera		0	0	0	0	0	0	0	0
	L	1	0	0	0	0	0	1	
	M	1	0	0	0	0	1	2	
Coleoptera	N	0	0	0	0	1	0	1	4
Hymenoptera	N	0	0	0	0	1	0	1	1
	L	0	10	3	1	0	0	14	
	M	0	9	3	1	0	0	13	
Diptera	N	1	0	4	0	1	0	6	33
	L	0	1	0	0	0	0	1	
	M	2	1	4	0	0	0	7	
Insect larvae	N	0	0	7	0	0	0	7	15
Insect pupae		0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 313

Table XX. Site 2 (beech mor). Numbers of animals other than Acarina and Collembola (series A) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples, L-F_1, F_2-H, A_2-B. For details see Appendix A, Table VIII.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Gastropoda		0	0	0	0	0	0	0	0
Lumbricidae	F_2-H	0	0	0	0	0	1	1	1
	L-F_1	2	0	0	0	1	1	4	
Pseudoscorpionida	F_2-H	0	0	0	0	6	2	8	12
	L-F_1	1	0	0	5	1	5	12	
	F_2-H	0	0	1	0	0	3	4	
Araneida	A_2-B	0	0	0	1	0	0	1	17
Chilopoda	A_2-B	0	1	0	0	0	0	1	1
	L-F_1	0	0	1	1	0	0	2	
Diplopoda	F_2-H	0	0	0	1	0	0	1	3
Pauropoda	L-F_1	0	0	0	0	1	0	1	1
	L-F_1	1	0	0	0	0	1	2	
Symphyla	F_2-H	0	2	0	0	0	0	2	4
Protura		0	0	0	0	0	0	0	0

[1]H = Horizon

[2]Tss = Sub-sample total

[3]Ts = Sample total

(table continued)

Table XX (continued). Site 2 (beech mor). Numbers of other animals (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	0	0	1	0	0	0	1	
Diplura	F_2-H	0	0	1	0	0	0	1	2
Psocoptera		0	0	0	0	0	0	0	0
Thysanoptera		0	0	0	0	0	0	0	0
Hemiptera		0	3	0	0	0	0	3	3
Homoptera		0	0	0	0	0	0	0	0
Coleoptera		0	0	0	0	0	0	0	0
Hymenoptera	L-F_1	0	0	1	0	0	0	1	1
	L-F_1	1	11	2	1	0	0	15	
	F_2-H	1	12	0	3	0	0	16	
Diptera	A_2-B	0	15	0	0	0	0	15	46
	L-F_1	0	4	0	0	3	6	13	
	F_2-H	0	1	1	0	3	4	9	
Insect larvae	A_2-B	0	0	0	1	2	1	4	26
Insect pupae		0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 315

Table XXI. Site 2 (beech mor). Numbers of animals other than Acarina and Collembola (series B) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples, L-F_1, F_2-H, A_2-B. For details see Appendix A, Table VIII.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Gastropoda		0	0	0	0	0	0	0	0
Lumbricidae		0	0	0	0	0	0	0	0
Pseudoscorpionida	L-F_1	0	0	2	0	0	0	2	2
	L-F_1	2	1	0	0	0	1	4	
	F_2-H	0	1	0	0	2	0	3	
Araneida	A_2-B	0	0	0	1	0	1	2	9
Chilopoda		0	0	0	0	0	0	0	0
	L-F_1	7	0	1	0	0	0	8	
Diplopoda	A_2-B	1	0	0	0	0	0	1	9
Pauropoda		0	0	0	0	0	0	0	0
	L-F_1	4	0	0	0	0	0	4	
	F_2-H	0	1	0	0	0	0	1	
Symphyla	A_2-B	1	0	2	0	1	0	4	9
Protura		0	0	0	0	0	0	0	0

[1]H = Horizon
[2]Tss = Sub-sample total
[3]Ts = Sample total

(table continued)

Table XXI (continued). Site 2 (beech mor). Numbers of other animals (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Diplura		0	0	0	0	0	0	0	0
Psocoptera	$L-F_1$	2	0	0	0	0	0	2	2
Thysanoptera		0	0	0	0	0	0	0	0
Hemiptera		0	0	0	0	0	0	0	0
Homoptera		0	0	0	0	0	0	0	0
Coleoptera	$L-F_1$	1	0	0	0	1	2	4	4
Hymenoptera		0	0	0	0	0	0	0	0
	$L-F_1$	0	20	0	5	0	0	25	
	F_2-H	1	5	3	0	0	0	9	
Diptera	A_2-B	0	5	1	1	1	0	8	42
	$L-F_1$	4	0	2	0	0	3	9	
Insect larvae	F_2-H	0	4	0	3	5	0	13	22
Insect pupae		0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 317

Table XXII. Site 3 (hemlock mor). Numbers of animals other than Acarina and Collembola (series A) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples, $L-F_1$, F_2-H, A_2-B. For details see Appendix A, Table VIII.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Gastropoda		0	0	0	0	0	0	0	0
Lumbricidae		0	0	0	0	0	0	0	0
	$L-F_1$	1	0	3	1	0	1	6	
Pseudoscorpionida	F_2-H	0	0	0	0	5	0	5	11
Araneida		0	0	0	0	0	0	0	0
Chilopoda		0	0	0	0	0	0	0	0
Diplopoda		0	0	0	0	0	0	0	0
Pauropoda	$L-F_1$	1	0	0	0	0	0	1	1
Symphyla		0	0	0	0	0	0	0	0
Protura		0	0	0	0	0	0	0	0
Diplura		0	0	0	0	0	0	0	0
Psocoptera	A_2-B	2	0	0	0	0	0	2	2

[1]H = Horizon

[2]Tss = Sub-sample total

[3]Ts = Sample total

(table continued)

Table XXII (continued). Site 3 (hemlock mor). Numbers of other animals (series A).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	3	0	0	0	0	1	4	
	F_2-H	3	2	0	0	1	1	7	
Thysanoptera	A_2-B	0	0	0	0	0	2	2	13
Hemiptera		0	0	0	0	0	0	0	0
Homoptera		0	0	0	0	0	0	0	0
Coleoptera	L-F_1	2	1	0	0	0	0	3	3
Hymenoptera		0	0	0	0	0	0	0	0
	L-F_1	3	0	0	0	0	0	3	
	F_2-H	1	3	1	0	0	0	5	
Diptera	A_2-B	0	2	0	0	0	0	2	10
	L-F_1	0	0	1	1	1	0	3	
	F_2-H	1	0	2	0	1	1	5	
Insect larvae	A_2-B	2	1	1	0	0	1	5	13
Insect pupae		1	0	0	0	0	0	1	1

[1;2;3] See footnote p. 319

Table XXIII. Site 3 (hemlock mor). Numbers of animals other than Acarina and Collembola (series B) taken monthly from June to November, 1960. Each sample was divided into 3 sub-samples, L-F_1, F_2-H, A_2-B. For details see Appendix A, Table II.

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
Gastropoda	L-F_1	0	1	0	0	0	0	1	1
Lumbricidae	F_2-H	1	0	0	0	0	0	1	1
Pseudoscorpionida		0	0	0	0	0	0	0	0
Araneida	F_2-H	1	0	0	0	0	0	1	1
Chilopoda	L-F_1	0	1	0	0	0	0	1	1
Diplopoda	F_2-H	1	0	0	0	0	0	1	1
Pauropoda		0	0	0	0	0	0	0	0
Symphyla	A_2-B	0	1	0	0	0	0	1	1
	L-F_1	0	0	0	1	0	2	3	
Protura	F_2-H	0	0	0	1	0	2	3	6
Diplura		0	0	0	0	0	0	0	0
Psocoptera		0	0	0	0	0	0	0	0

[1]H = Horizon
[2]Tss = Sub-sample total
[3]Ts = Sample total

(table continued)

Table XXIII (continued). Site 3 (hemlock mor). Numbers of other animals (series B).

	H[1]	June	July	Aug.	Sept.	Oct.	Nov.	Tss[2]	Ts[3]
	L-F_1	1	2	0	0	0	0	3	
Thysanoptera	F_2-H	5	0	0	0	0	1	6	9
Hemiptera		0	0	0	0	0	0	0	0
Homoptera		0	0	0	0	0	0	0	0
Coleoptera		0	0	0	0	0	0	0	0
Hymenoptera	L-F_1	0	0	0	0	1	0	1	1
	L-F_1	2	4	0	1	0	0	7	
	F_2-H	1	3	0	0	0	0	4	
Diptera	A_2-B	1	2	0	2	0	0	5	16
	L-F_1	0	0	0	1	3	0	4	
Insect larvae	F_2-H	1	0	1	1	1	1	5	9
Insect pupae		0	0	0	0	0	0	0	0

[1;2;3] See footnote p. 321

Table XXIV. Total numbers and frequency percentage (FP) of each species of Sarcoptiformes in the three sites.

	Site 1		Site 2		Site 3		Total	FP
	A	B	A	B	A	B		
ACARIDIAE								
Rhizoglyphus sp.			2				2	3
Schwiebea cavernicola	10	29	59	77	2	5	182	60
Tyrophagus putrescentiae	3	8	7				18	14
Anoetidae sp.	2				1		3	8
Acaridae undetermined		2	7	1	2		12	19
ACARIDIAE TOTAL	15	39	75	78	5	5	217	-
ORIBATEI								
Palaeacarus hystricinus			2	3	12	9	26	30
Gehypochthonius rhadamanthus			4	2	51	19	76	33
Parhypochthonius aphidinus	9	16			196	8	229	36
Hypochthonius rufulus	39	37	13	7	15		111	56
Eniochthonius minutissimus	1	9	80	34	106	122	352	75

(table continued)

Table XXIV (continued).

	Site 1		Site 2		Site 3		Total	FP
	A	B	A	B	A	B		
Brachychthonius berlesei			5	17	2	8	32	22
B. italicus					15		15	3
B. jugatus		2	290	85	344	44	765	53
B. rostratus					15	4	19	6
B. zelawaiensis			1	34	41		76	11
Brachychthonius sp., ? *nov*.					4		4	3
Eobrachychthonius latior		8	33	99			140	33
Linochthonius sp., ? *altimonticola* .					1		1	3
L. sp., ? *latus*			84	41	113	11	249	36
L. ocellatus				1			1	3
L. pilososetosus	1		2	8	15	1	27	19
L. scalaris	19	3	42	39	103	45	251	36
Linochthonius sp., ? *nov*.			3	6	2		11	11
Synchthonius crenulatus			2	3	195	66	266	17

(table continued)

Table XXIV (continued).

	Site 1		Site 2		Site 3		Total	FP
	A	B	A	B	A	B		
Heterochthonius sp., ? nov.					42	3	45	11
Atopochthonius artiodactylus . . .	5		9	2	1	1	18	14
Pterochthonius angelus			11	25	1	1	38	22
Phthiracarus olivaceum		9					9	11
Ph. setosellum	3			2			5	8
Ph. sp., ? sphaerulum	4	2	3	1		6	16	30
Phthiracarus sp., ? nov.		1	1				2	6
Steganacarus diaphanum	20	20	20	7	71	102	240	86
Euphthiracarus flavus			8	5		1	14	19
Euphthiracarus sp.			19	20	7	16	62	45
Rhysotritia cf. ardua		2	3	6	1	2	14	33
Epilohmannia cylindrica			1				1	3
Eulohmannia ribagai	5	4					9	22
Northus gracilis	32	34	28	16			110	57

(table continued)

Table XXIV (continued).

	Site 1		Site 2		Site 3		Total	FP
	A	B	A	B	A	B		
N. silvestris	19	4	26	6	26	14	95	46
Trhypochthonius tectorum			12	5	25	38	80	30
Malaconothrus sp., ? *molliseptosus*			2	10	3	15	30	17
Malaconothrus sp.$_1$			16	20	1	1	38	25
Malaconothrus sp.$_2$			1				1	3
Trimalaconothrus sp.			3	3			6	14
Nanhermannia elegantula		1	31	25	1	1	59	39
N. sp., ? *nana*			24	18		1	43	30
? *Plasmobates* sp.				1			1	3
Gymnadamaeus sp., ? *nov*.			13	4	1		18	11
Belba sp.$_1$			1				1	3
Belba sp.$_2$					1		1	3
Cepheus corae			2		6	8	16	19
Eremobelba flagellaris		9	8	8			25	30

(table continued)

Table XXIV (continued).

	Site 1		Site 2		Site 3		Total	FP
	A	B	A	B	A	B		
Adorestes ovatus			7		21	20	48	30
Liacarus sp.1	1	2					3	8
Liacarus sp.2	1						1	3
Cultroribula trifurca	4	4	31	3			42	39
Carabodes labyrinthicus						1	1	3
Carabodes sp. ? *nov*.					1	1	2	6
Tectocepheus velatus	41	17	522	685	417	378	2060	97
Oppia maculata		1		25			26	6
O. manifera			6	75	1		82	22
O. minor		19	469	234	685	1092	2499	57
O. nova	97	163	1066	1047	680	560	3613	100
O. unicarinata			3		147		150	8
Oppia sp., ? *nov*.			34		3		37	8
Quadroppia circumita	1	3	3	5	20	3	35	25

(table continued)

Table XXIV (continued).

	Site 1		Site 2		Site 3		Total	FP
	A	B	A	B	A	B		
<u>Suctobelba</u> <u>frothinghami</u>			46	116	36	65	263	50
<u>S</u>. <u>gigentea</u>			1	1			2	6
<u>S</u>. <u>hurshi</u>	17	32	108	46	125	39	367	67
<u>S</u>. <u>laxtoni</u>	1	18	411	190	518	67	1205	60
<u>S</u>. <u>longicuspis</u>	1	1	308	188	86	15	599	53
<u>Suctobelba</u> sp.$_1$, ? <u>nov</u>.			2		5		7	6
<u>Suctobelba</u> sp.$_2$, ? <u>nov</u>.		2	117	241	120	27	507	46
<u>Suctobelba</u> sp.$_3$, ? <u>nov</u>.	7	1	8	27	75		118	17
<u>Suctobelba</u> sp.$_4$, ? <u>nov</u>.		2	200	84	15	14	315	33
<u>Suctobelba</u> sp.$_5$, ? <u>nov</u>.				88		2	90	8
<u>Suctobelba</u> sp.$_6$, ? <u>nov</u>.		1	1			6	8	8
<u>Suctobelba</u> sp.$_7$, ? <u>nov</u>.			10	16	4	2	32	17
<u>Suctobelba</u> sp.$_8$, ? <u>nov</u>.				12			12	3
<u>Suctobelba</u> sp.$_9$, ? <u>nov</u>.			6				6	3

(table continued)

Table XXIV (continued).

	Site 1		Site 2		Site 3		Total	FP
	A	B	A	B	A	B		
Suctobelba sp.$_{10}$, ? *nov.*		2			10	1	13	11
Suctobelba sp.$_{11}$, ? *nov.*				1			1	3
Suctobelba sp.$_{12}$, ? *nov.*					2		2	3
Suctobelba sp.$_{13}$, ? *nov.*		5	8	12	7		32	25
Suctobelba sp.$_{14}$, ? *nov.*				62			62	3
Achipteria coleoptera						1	1	3
Oribatella reticulatoides			2	4			6	11
Ceratozetes sp.	3	5	165	159	110	51	493	67
Fuscozetes bidentatus			14		14	19	47	19
Chambobates sp.	2	1		4		1	8	19
? *Neoribates* sp.		1					1	3
Protokalumna depressum					1		1	3
Pergalumna emarginatus	5	15	24	39	11	2	96	61
Oribatula minuta					28	30	58	33

(table continued)

Table XXIV (continued).

	Site 1		Site 2		Site 3		Total	FP
	A	B	A	B	A	B		
Scheloribates pallidulus	14	8	129	63	55	64	333	78
Peloribates americanus			15	11	9	5	40	31
Protoribates capucinus	50	63				1	114	36
P. lophotrichus	6		112	102	15	56	291	61
Oribatei undetermined	32	72	356	154	478	107	1199	81
ORIBATEI TOTAL	440	599	4987	4258	5116	3177	18577	
SARCOPTIFORMES TOTAL	455	638	5062	4336	5121	3182	18794	

Table XXV. Total numbers and frequency percentage (FP) of each species of Collembola in the three sites.

	Site 1		Site 2		Site 3		Total	FP
	A	B	A	B	A	B		
PODURIDAE								
Anurida caeca	0	0	0	8	0	4	12	5
Anurida sp.,? *granaria*	0	0	1	2	1	0	4	4
Anurida sp. nr. *pygmaea*	0	4	10	29	13	6	62	13
Friesea sublimis	0	0	6	18	0	7	31	5
Hypogastrura sp.,? *armata*	0	0	36	48	0	27	111	9
Hypogastrura sp., *manubrialis*-group	0	0	0	1	0	0	1	1
Hypogastrura sp.$_3$	0	0	3	0	0	0	3	2
Neanura sp.,? *muscorum*	1	0	0	0	0	0	1	1
Odontella sp.$_1$	0	0	2	0	0	0	2	1
Odontella sp.$_2$	0	0	0	3	0	0	3	1
Pseudachorutes sp.,? *aurefasciatus*	0	1	1	0	0	0	2	2
Pseudachorutes sp.,? *dilatatus*	0	0	1	0	0	0	1	1
Pseudachorutes sp.,? *simplex*	1	0	1	0	0	0	2	2

(table continued)

Table XXV (continued).

	Site 1 A	Site 1 B	Site 2 A	Site 2 B	Site 3 A	Site 3 B	Total	FP
Pseudachorutes sp.[4]	0	0	1	0	0	0	1	1
Willemia anophthalma	3	2	29	35	0	2	71	14
ONYCHIURIDAE								
Onychiurus absoloni	0	0	6	11	5	6	28	15
Onychiurus sp.,? *armatus*	1	0	3	19	15	77	115	13
Onychiurus sp., *fimetarius*-group	0	2	20	28	5	6	61	16
Onychiurus subtenuis	3	8	10	11	7	4	43	15
Tullbergia clavata	46	12	2	0	0	0	60	10
Tullbergia collis	3	0	0	0	0	0	3	2
Tullbergia granulata	18	19	0	5	4	3	49	16
Tullbergia sp., *granulata*-group	0	0	3	3	0	0	6	3
Tullbergia krausbaueri	2	4	1	10	10	3	30	13

(table continued)

Table XXV (continued).

	Site 1		Site 2		Site 3		Total	FP
	A	B	A	B	A	B		
ISOTOMIDAE								
Folsomia sp. nr. duodecimsetosa	6	7	77	90	85	216	481	27
Folsomia sensibilis	0	0	1	0	79	24	104	5
Folsomides sp. nr. inequalis	0	0	1	0	0	0	1	1
Isotoma andrei	1	1	7	15	0	0	24	8
Isotoma grandiceps	1	0	0	0	9	8	18	7
Isotoma notabilis	47	95	7	1	0	13	163	16
Isotoma olivacea	2	2	0	0	1	2	7	4
Isotoma violacea	0	0	0	0	1	0	1	1
Isotoma sp.6	1	1	0	0	16	11	29	5
Isotomiella minor	34	27	137	189	133	51	571	31
Isotomodes trisetosus	0	1	0	0	33	17	51	8
Micrisotoma achromata	0	5	17	7	34	28	91	18
Proisotoma sp. nr. borealis	0	0	0	0	1	83	84	2

(table continued)

Table XXV (continued).

	Site 1		Site 2		Site 3		Total	FP
	A	B	A	B	A	B		
Proisotoma minima	3	0	0	0	0	0	3	3
Proisotoma sp.3	0	0	0	0	2	0	2	1
Proisotoma sp.4	0	3	0	0	0	0	3	1
ENTOMOBRYIDAE								
Entomobrya clitellaria	1	10	8	5	0	0	24	9
Entomobrya sp.2	1	0	0	0	0	0	1	1
Entomobrya sp.3	0	0	2	0	1	3	6	5
Entomobrya sp.4	0	0	2	0	0	1	3	2
Pseudosinella alba	34	43	0	0	0	0	77	11
Pseudosinella petterseni	4	3	0	0	0	0	7	6
Tomocerus flavescens	3	5	0	0	0	0	8	3
Willowsia nigromaculata	10	8	13	8	5	5	49	16

(table continued)

Table XXV (continued).

	Site 1		Site 2		Site 3		Total	FP
	A	B	A	B	A	B		
SMYNTHURIDAE								
Arrhopalites sp.$_1$	3	5	4	5	1	0	18	10
Arrhopalites sp.$_2$	0	0	1	0	3	0	4	2
Bourletiella sp.	0	0	2	0	0	0	2	1
Dicyrtoma sp.,? *unicolor*	0	2	0	0	0	0	2	1
Neelus incertus	3	1	1	0	1	2	8	5
Neelus minimus	15	40	14	18	18	25	130	20
Neelus sp.$_3$	2	1	0	0	0	0	3	2
Sminthurides sp.,? *occultus*	0	0	0	0	1	0	1	1
Sminthurinus aureus	2	0	0	0	4	0	6	2
Sminthurinus elegans	9	0	0	0	0	0	9	1
Collembola undetermined	11	4	11	11	1	46[a]	84	
TOTAL COLLEMBOLA	271	316	441	580	489	680	2777	

[a]45 of these were accidentally destroyed.

Table XXVI. Overall quantitative distribution of the Oribatei in the sub-samples of the three sites, showing totals, averages and percentages. For explanation of letters see Appendix A, Table II.

	Site 1						Site 2						Site 3					
	L		M		N		L-F_1		F_2-H		A_2-B		L-F_1		F_2-H		A_2-B	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
June	16	71	60	50	19	15	889	693	391	424	100	94	1230	299	710	304	227	83
July	2	5	26	71	7	33	531	310	374	494	182	14	813	347	502	818	289	231
Aug.	0	3	21	5	16	6	471	182	209	28	88	40	105	49	15	24	7	14
Sept.	0	2	95	48	11	20	89	427	41	155	81	51	136	130	33	12	2	1
Oct.	0	0	25	75	11	34	505	328	326	167	5	100	154	148	139	32	43	6
Nov.	1	20	116	116	14	25	431	327	255	405	19	19	446	377	248	223	17	79
Total	19	101	343	365	78	133	2916	2267	1596	1673	475	318	2884	1350	1617	1413	585	414
Ave.	10		59		18		432		273		66		353		255		82	
%	11		68		21		56		35		9		51		37		12	

Table XXVII. Overall quantitative distribution of the Collembola in the sub-sample of the three sites, showing totals, averages and percentages. For explanation of letters see Appendix A, Table II.

	Site 1						Site 2						Site 3					
	L		M		N		L-F_1		F_2-H		A_2-B		L-F_1		F_2-H		A_2-B	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
June	5	38	47	45	8	3	154	153	22	82	6	2	78	66	148	48	88	15
July	6	48	42	40	12	19	55	15	4	26	4	5	55	17	10	19	2	8
Aug.	0	0	16	10	9	5	40	89	3	17	3	3	11	13	3	12	4	10
Sept.	0	2	29	17	1	1	63	106	14	10	5	3	16	13	6	9	12	0
Oct.	0	1	25	8	27	12	19	40	9	2	1	1	8	32	21	0	4	8
Nov.	7	13	28	44	9	10	32	16	6	6	1	4	46	279	21	82	1	4
Total	18	102	187	164	68	50	363	417	58	143	20	18	214	420	209	170	111	45
Ave.	10		29		9		65		19		3		38		32		13	
%	20		60		20		75		22		3		45		39		16	

Table XXVIII. Data for the analysis of variance of the Oribatei. Figures from Appendix A, Table XXVI ($\sqrt{\frac{1}{2} + x}$ transformation).

	Site 1						Site 2						Site 3						Total
	L		M		N		L-F_1		F_2-H		A_2-B		L-F_1		F_2-H		A_2-B		
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
June	4	8	8	7	4	4	30	26	20	21	10	10	35	17	27	17	15	9	272
July	1	2	5	8	3	6	23	18	19	22	13	4	29	19	22	29	17	15	255
Aug.	1	2	5	2	4	2	22	13	14	5	9	6	10	7	4	5	3	4	118
Sept.	1	1	10	7	3	4	9	21	6	12	9	7	12	11	6	3	1	1	124
Oct.	1	1	5	9	3	6	22	18	18	13	2	10	12	12	12	6	7	2	159
Nov.	1	4	11	11	4	5	21	18	16	20	4	4	21	19	16	15	4	9	203
Total	9	18	44	44	21	27	127	114	93	93	47	41	119	85	87	75	47	40	
Total (A+B)	27		88		48		241		186		88		204		162		87		
Site Total	163						515						453						1131

Table XXIX. Data for the analysis of variance of the Collembola. Figures from Appendix A, Table XXVII ($\sqrt{\frac{1}{2} + x}$ transformation).

	Site 1						Site 2						Site 3						Total
	L		M		N		L-F_1		F_2-H		A_2-B		L-F_1		F_2-H		A_2-B		
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
June	2.3	6.2	6.9	6.7	3.0	1.7	12.4	12.4	4.7	9.1	2.5	1.5	8.8	8.2	12.2	6.9	9.4	3.9	118.8
July	2.5	7.0	6.6	6.4	3.5	4.4	7.4	3.9	2.0	5.1	2.1	2.3	7.4	4.1	3.2	4.4	1.6	2.9	76.8
Aug.	0.7	0.7	4.1	3.2	3.1	2.2	6.3	9.5	1.7	4.2	1.7	1.9	3.4	3.6	1.7	3.5	2.1	3.1	56.7
Sept.	0.7	1.5	5.4	4.3	1.2	1.2	7.9	10.3	3.8	3.2	2.3	1.9	4.1	3.6	2.5	3.1	3.5	0.7	61.2
Oct.	0.7	1.2	5.0	3.0	5.2	3.5	4.4	6.4	3.1	1.6	1.2	1.2	2.9	5.7	4.6	0.7	2.1	2.9	55.4
Nov.	2.7	3.7	5.3	6.7	3.1	3.2	5.7	4.1	2.5	2.5	1.2	2.0	6.8	16.7	4.6	9.1	1.2	2.1	83.2
Sub-sample Total	9.6	20.3	33.3	30.3	19.1	16.2	44.1	46.6	17.8	25.7	11.0	10.8	33.4	41.9	28.8	27.7	19.9	15.6	452.1
Total (A + B)	29.9		63.6		35.3		90.7		43.5		21.8		75.3		56.5		35.5		
Site Total	128.8						156.0						167.3						

Table XXX. Number of species of Oribatei in the three sites and numbers common to pairs of sites.

Site	Maple Mull		Beech Mor		Hemlock Mor		Total no.of species
	1A	1B	2A	2B	3A	3B	
1A		23	21	23	19	20	28
1B			29	29	24	25	38
2A				52	48	42	64
2B					41	40	61
3A						44	60
3B							53

Table XXXI. Numbers of species of Collembola in the three sites and numbers common to pairs of sites.

Site	Maple Mull		Beech Mor		Hemlock Mor		Total no. of species
	1A	1B	2A	2B	3A	3B	
1A		20	15	13	14	14	29
1B			17	15	15	16	27
2A				20	17	19	34
2B					14	17	24
3A						20	27
3B							26

Table XXXII. Value of I(index of similarity)x 10^4 for data of Oribatei. For explanation of calculations see text.

Site	Maple Mull		Beech Mor		Hemlock Mor	
	1A	1B	2A	2B	3A	3B
1A		754	254	336	225	297
1B			304	329	217	285
2A				795	556	449
2B					348	420
3A						634
3B						

(table continued)

Table XXXII (continued).

Reduced Table A

	1A	1B	2A 2B	3A	3B
1A	--	**754**	295	225	297
1B			317	217	285
2A 2B				452	435
3A					634
3B					---

Reduced Table B

	1A 1B	2A 2B	3A	3B
1A 1B	---	306	221	291
2A 2B			452	435
3A				**634**
3B				---

Reduced Table C

	1A 1B	2A 2B	3A 3B
1A 1B	---	306	256
2A 2B			**443**
3A 3B			---

Reduced Table D

	1A 1B	2A 2B, 3A 3B
1A 1B	---	**281**

Table XXXIII. Value of **I**(index of similarity) x 10^4 for data of Collembola. For explanation of calculations see text.

Site	Maple Mull		Beech Mor		Hemlock Mor	
	1A	1B	2A	2B	3A	3B
1A	--	897	292	370	358	379
1B			426	565	463	576
2A				847	426	605
2B					481	854
3A						1163
3B						---

(continued)

Table XXXIII (continued).

Reduced Table A

	1A	3A 3B	1B	2A	2B
1A	--	369	897	292	370
3A 3B			520	516	668
1B				426	565
2A					847
2B					---

Reduced Table B

	1A 1B	3A 3B	2A	2B
1A 1B	---	444	335	468
3A 3B			516	668
2A				847
2B				---

Reduced Table C

	1A 1B	3A 3B	2A 2B
1A 1B	---	444	413
3A 3B			731
2A 2B			---

Reduced Table D

	1A 1B	2A 2B, 3A 3B
1A 1B	---	428

APPENDIX B

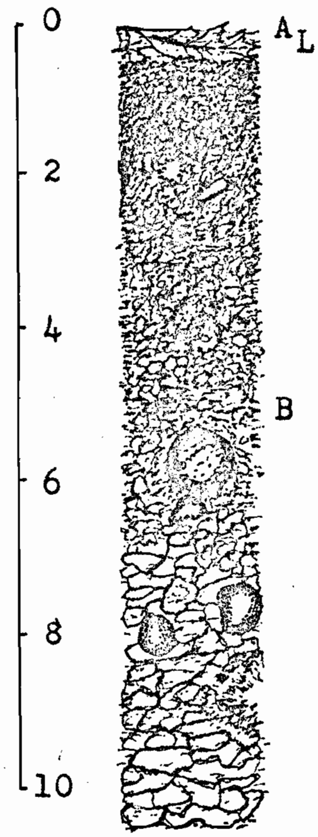
FIGURES

Figure 1. The Maple mull, Site 1, 11th May, 1961, showing the abundant ground vegetation, especially <u>Trillium grandiflorum</u>. The samples were taken within the area bounded by the white stakes.

Figure 2. The Beech mor, site 2. Taken same time of year as Figure 1. The ground vegetation has not yet developed. The young trees in the foreground are all beech.

Figure 3. The Hemlock mor, Site 3. White stakes indicate sample area. Like Site 2, ground vegetation is sparse. Also taken 11th May, 1961.

Depth (cm)	Horizon	pH	Texture	Colour



pH	Texture	Colour
6.9	Granular clay Firm Moderately plastic	Very Dark brown
6.6	Granular clay Firm Plastic	Dark brown

Figure 4. Profile of maple mull (Site 1) showing some of the soil characteristics.

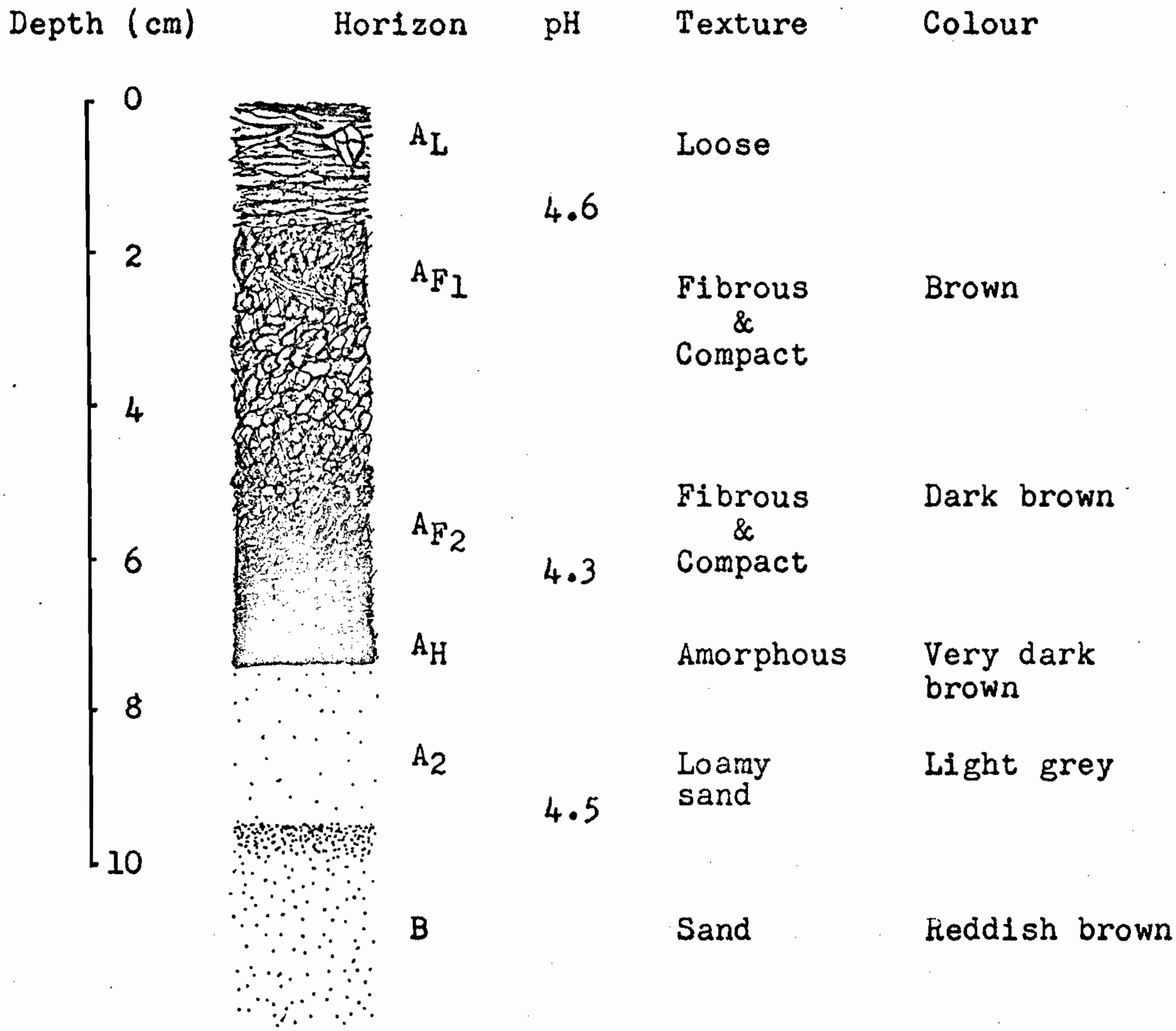
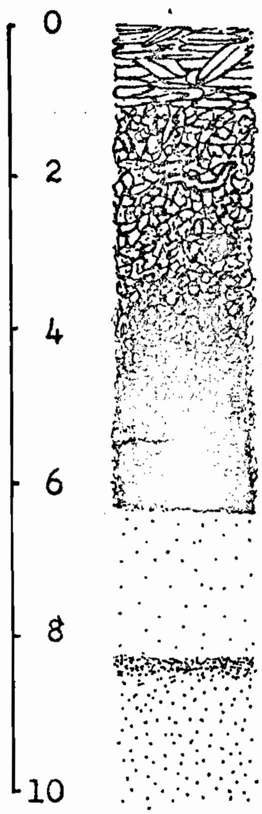


Figure 5. Profile of beech mor (Site 2) showing some of the soil characteristics.



Depth (cm)	Horizon	pH	Texture	Colour
	A_L		Compact	
	A_{F1}	4.5	Fibrous & Compact	Brown
	A_{F2}	4.5	Fibrous & Compact	Dark brown
	A_H		Amorphous	Very dark brown
	A_2	4.8	Loamy sand	Light grey
	B		Sand	Reddish brown

Figure 6. Profile of the hemlock mor (Site 3) showing some of the soil characteristics.

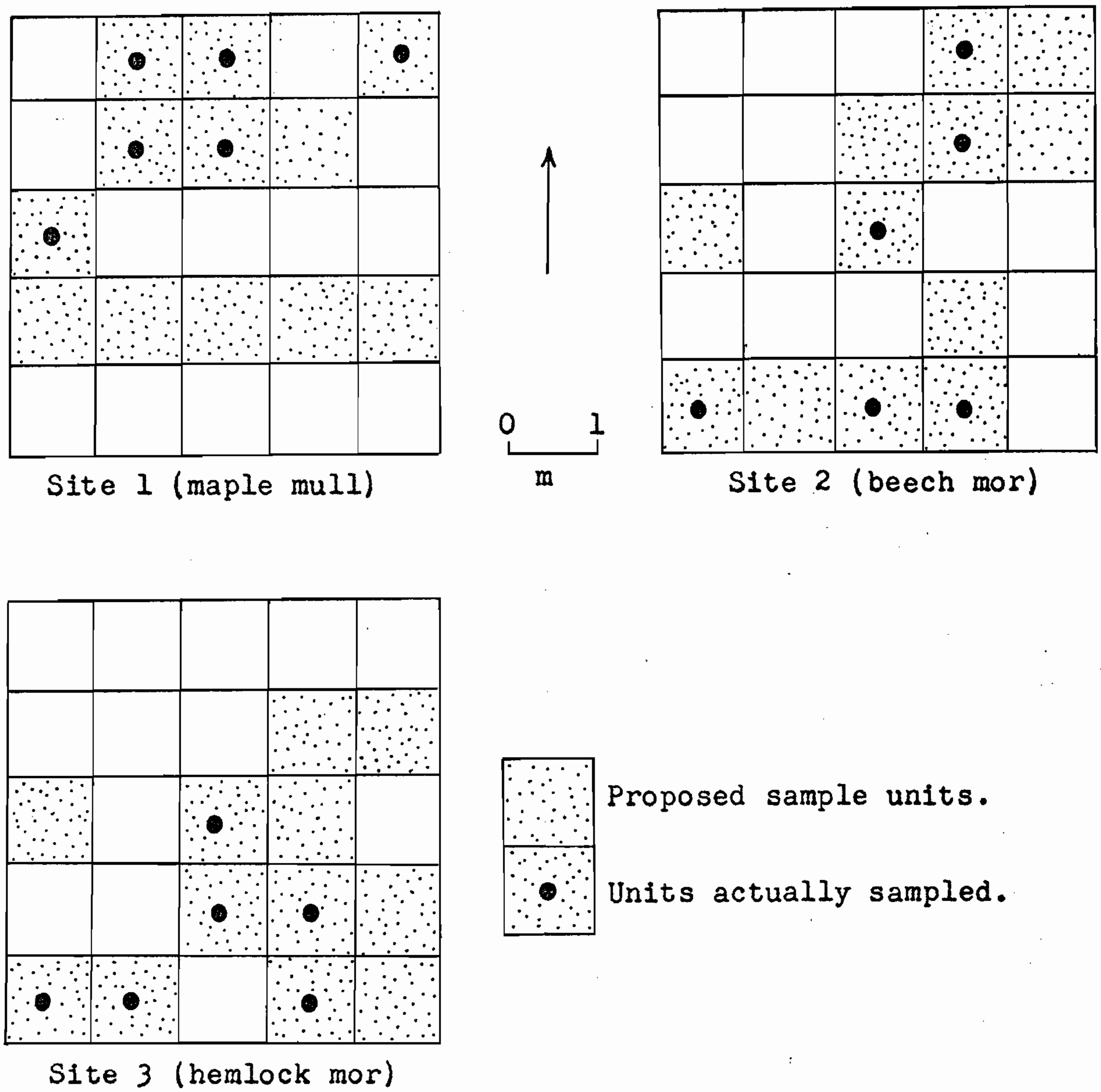


Figure 7. Field plan of Sites 1, 2 and 3, showing proposed sample units and those which were actually sampled.

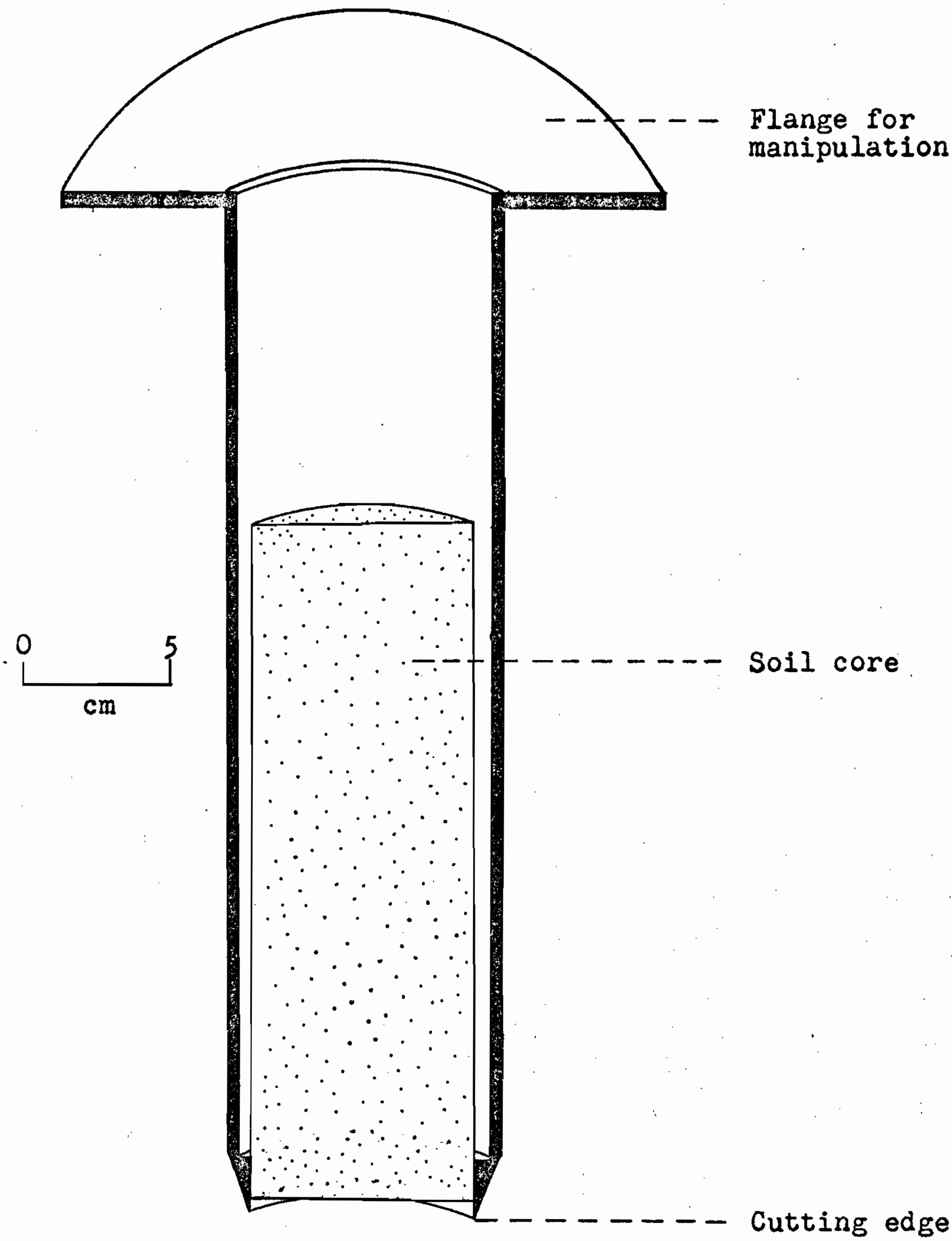


Figure 8. A sagittal section of the sampler, showing the clearance of the soil core within the tube. This a larger modification of a sampler designed by Haarløv and Weis-Fogh (1953).