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COMPILATION OF TAXONOMIC CATALOGUES BY COMPUTER

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ABSTRACT

The advantages of using a computer are examined for storing, updating, and cross indexing taxonomic collection data in working and published lists.

Records of collections of animals and plants for taxonomic purposes or for compilations of more general lists of fauna and flora are typically and unavoidably voluminous. Difficulty occurs in manually updating, cross indexing and listing data about each collection easily and quickly. However, the data are usually regular, in that information for every collection may be split into several logical and uniform divisions. For example, collection data consistently include taxonomic identification, location of the sample, date, collector, and sometimes a description of the sample and habitat. This regularity suits the data admirably to computer storage and manipulation. The advantage of using a computer is mainly in the speed with which it can extract, arrange and print information. The time saved is appreciable as the data base becomes larger. This paper discusses the use of the computer for maintaining and updating the various lists associated with a collection of aphids from British Columbia.

The aphidologists of our research group have accumulated a data base of more than 1500 collections during the past 20 years. Information is recorded on cards (Fig. 1) at the time a collection is made and these cards are indexed by plant host species. When an aphid is identified these data are also indexed alphabetically by aphid species. About 150 collections are added each year. The task of identifying aphids is made easier by using lists of previously collected aphids and host plants ordered in various ways (1, 2, 3), so that much time has been spent maintaining cross indices by hand.

Computer programming is a time consuming and often costly procedure. Most computing centers, however, maintain a library of those 'canned' programs most often needed by computer users. One such program called 'The UBC Report Generator' (RG), (4) was suited to our needs. The following is a brief description of how RG was used.

RG requires that all collections have the same divisions or fields of data, and that these fields be in a constant order. We ordered our data on three data cards per collection: by aphid genus, species and authority on the first; by host plant family, common name, genus, species and class code on the second; and by location of sample, month number, month, day, year, collector's name and lot number on the third. These fields are separated by commas. Since RG is extremely flexible this is only one of a number of ways in which the data can be organized. The data were then punched on computer cards (Fig. 2) and the card images were stored on magnetic tape for economical computer operations.

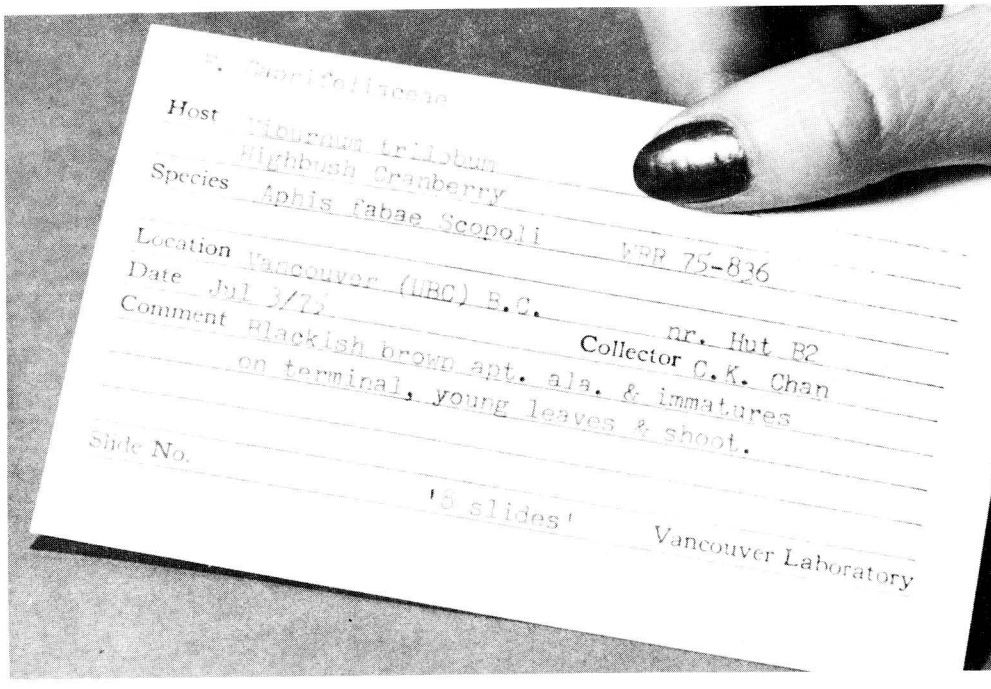

Fig. 1. A completed collection card.

In order to obtain lists, we 'ran' RG with the data, a description of how the data were set up and a series of commands describing what items to extract and how to order and print them (Fig. 3). Many other possibilities exist.

In many instances, field contents may be duplicated from collection to collection and when ordered, appear redundant (Fig. 3a). Although RG does not have the facility to reduce redundancy, it does allow the use of computer language subroutines which can be written to handle the problem. Subroutines were written in FORTRAN IV, to eliminate redundancy (Fig 4) and to provide appropriate punctuation.

The printing capability of the computer is far greater than that indicated by figures 3 and 4 because it has all the necessary typewriter characters and is much faster. Since publishable manuscripts were desirable in addition to working lists, a computer program was written to convert the normal upper case computer card characters to appropriate upper and lower case characters (Fig. 5).

Although RG is a complex program capable of many tasks it is remarkably easy to use, even for those not familiar with computers. Costs are minimal, but of course vary with the quantity and complexity of the lists. Preparation of a list of 1500 collections organized as illustrated (Fig. 3-5) cost between $5.00 and $15.00. The time required is as little as three minutes for the finished product. By far the most difficult and time consuming task is keypunching the original data, but this is done only once.

In conclusion, computer capabilities in taxonomy are limited only by need, time, money and imagination. We hope that greater use will be made of computers for facilitating the manipulation of animal and plant collection data. Their use for this purpose promotes better and more efficient use of the data and frees research and support staff for more interesting duties.

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We thank Dr. A. R. Forbes and Mr. Cho-Kai Chan who provided the data, the staff of the UBC Computing Centre, in particular Rita Cockle, who gave information and advice and Mr. S. W. MacDiarmid for the photography.

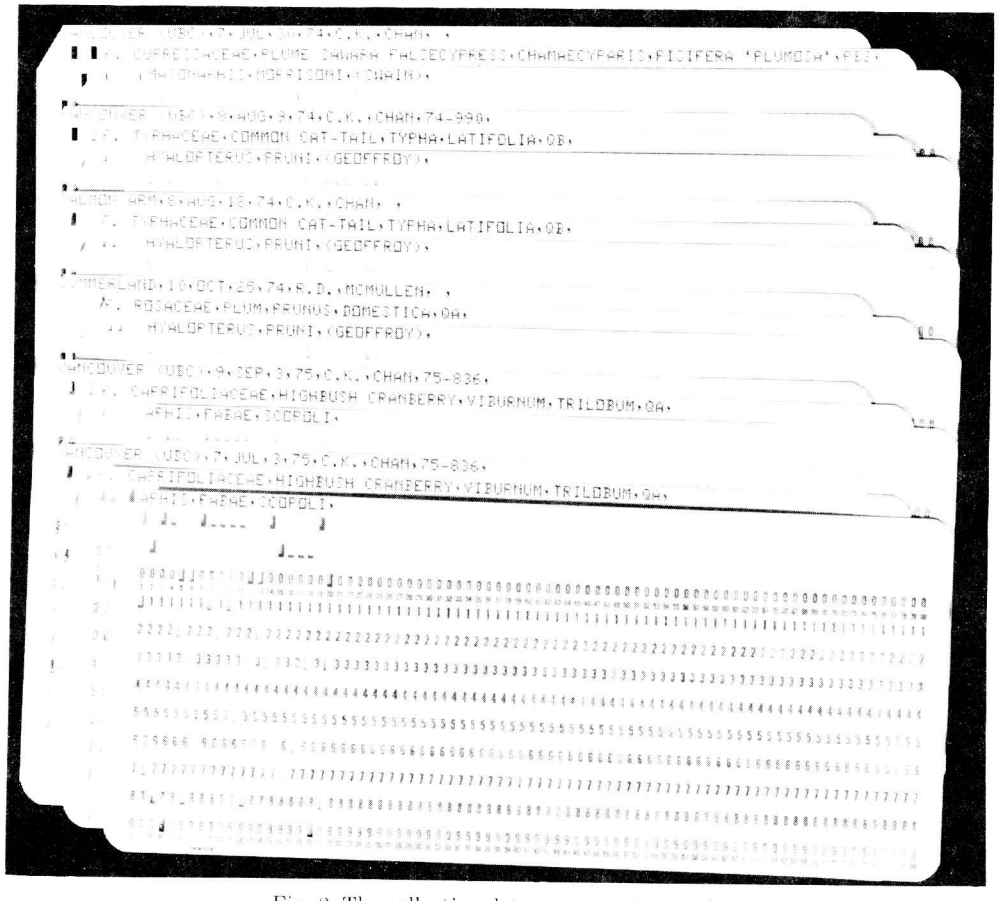

Fig. 2. The collection data on computer cards.

CL. PINOPSIDA (CONIFERS)
F. CUPRESSACEAE CHAMAECYPARIS PISIFERA 'PLUMOSA'
MASONAPHIS MORRISONI
CL. MAGNOLIOPSIDA (FLOWERING PLANTS - DICOTYLEDONS)
F. CAPRIFOLIACEAE VIBURNUM TRILOBUM
APHIS FABAE
CL. MAGNOLIOPSIDA (FLOWERING PLANTS - DICOTYLEDONS)
F. CAPRIFOLIACEAE VIBURNUM TRILOBUM
APHIS FABAE
CL. MAGNOLIOPSIDA (FLOWERING PLANTS - DICOTYLEDONS)
F. ROSACEAE PRUNUS DOMESTICA
HYALOPTERUS PRUNI
CL. LILIOPSIDA (FLOWERING PLANTS - MONOCOTYLEDONS)
F. TYPHACEAE TYPHA LATIFOLIA
HYALOPTERUS PRUNI
CL. LILIOPSIDA (FLOWERING PLANTS - MONOCOTYLEDONS)
F. TYPHACEAE TYPHA LATIFOLIA
HYALOPTERUS PRUNI

Fig. 3a. All collections of figure 2 extracted and ordered by plant class, family, genus, and species; aphid genus, and species.

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FABAE SCOPOLI APHIS
   VIBURNUM TRILOBUM VANCOUVER (UBC) JUL3/75
FABAE SCOPOLI APHIS
   VIBURNUM TRILOBUM VANCOUVER (UBC) SEP3/75
MORRISONI (SWAIN) MASONAPHIS
   CHAMAECYPARIS PISIFERA 'PLUMOSA' VANCOUVER (UBC) JUL30/74
PRUNI (GEOFFROY) HYALOPTERUS
   PRUNUS DOMESTICA SUMMERLAND OCT25/74
PRUNI (GEOFFROY) HYALOPTERUS
   TYPHA LATIFOLIA SALMON ARM AUG18/74
PRUNI (GEOFFROY) HYALOPTERUS
   TYPHA LATIFOLIA VANCOUVER (UBC) AUG9/74
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Fig. 3b. All collections of figure 2 extracted and ordered by aphid species, authority, and genus; plant genus, and species; location, month number, day, and year.

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APHIS FABAE SCOPOLI
   VIBURNUM TRILOBUM JUL3/75
HYALOPTERUS PRUNI (GEOFFROY)
   TYPHA LATIFOLIA AUG9/74
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Fig. 3c. All collections of figure 2 extracted where plant class code was 'QA' or 'QB', location contained 'Vancouver', and month number was less than 9.

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CL. PINOPSIDA (CONIFERS)
   F. CUPRESSACEAE
    CHAMAECYPARIS PISIFERA 'PLUMOSA'
      MASONAPHIS MORRISONI
CL. MAGNOLIOPSIDA (FLOWERING PLANTS - DICOTYLEDONS)
   F. CAPRIFOLIACEAE
    VIBURNUM TRILOBUM
      APHIS FABAE
   F. ROSACEAE
    PRUNUS DOMESTICA
      HYALOPTERUS PRUNI
CL. LILIOPSIDA (FLOWERING PLANTS - MONOCOTYLEDONS)
   F. TYPHACEAE
    TYPHA LATIFOLIA
      HYALOPTERUS PRUNI
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Fig. 4. Redundancy of figure 3a eliminated.

FABAE Scopoli, APHIS
Viburnum trilobum: Vancouver (UBC), Jul13/75, Sep3/75.

MORRISONI (Swain), MASONAPHIS
Chamaecyparis pisifera 'Plumosa': Vancouver (UBC), Jul30/74.

PRUNI (Geoffroy), HYALOPTERUS
Prunus domestica: Summerland, Oct25/74.
Typha latifolia: Salmon Arm, Aug18/74; Vancouver (UBC), Aug9/74.

Fig. 5. Figure 3b in publishable form.

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BOOK REVIEW

Mamaev, B. M. 1974. *Evolution of gall forming insects—gall midges* (English Edition). Translated by A. Crozy, edited by K. M. Harris. Published by The British Library, Lending Division, printed by W. S. Maney Ltd., Leeds, England, 317 pp. 79 figs. Size 6" x 8½" (15.5c x 22c). Paper cover. Price £ 8.50, + $15.00. (Translation of Russian Edition, published by "Nauka", Leningrad, 1968).

This book is a monograph of the family Cecidomyiidae that focuses on the origins, the lines and the patterns of evolution. It defines the family, the subfamilies, the tribes and subtribes in terms of the morphology, anatomy and ecology of all stages, but it contains no taxonomic keys. The author's primary purpose is to outline the evolutionary development of gall midges, and from this, to construct a logical classification. Thus, the classification adopted in the first chapter is, in effect, the practical outcome of the contents of the remaining seven chapters. The book is the culmination of 15 years work, beginning in 1951, on the native gall midge fauna of the European U.S.S.R., the Caucasus, Central Asia and the Far East. The collation of collections from different habitats (soil, litter, wood and living plant tissues) from these geographically distant and ecologically distinct areas (forests, steppes, deserts and mountains) provide the factual bases for the theoretical constructions developed.

Dr. Mamaev is well qualified to undertake such a project. He obtained his Ph.D under Prof. E. S. Smirnov, Head, Department of Entomology, Moscow State University, about 1951, and then went to work at the Institute of Evolutionary Morphology and Ecology of Animals, (Laboratory of Soil Zoology) Soviet Academy of Sciences in Moscow. Since then he has been a prolific researcher (author or co-author of 38 papers cited in the book), especially on Cecidomyiidae. All his work has been based on a multidisciplinary approach and most of his findings reflect a thoroughness and a soundness rarely encountered. His book is based largely on his own findings, coupled with first-hand information from colleagues with similar interests. Thus his book is built on a solid foundation of personal investigations and knowledge, and is much more than a synthesis of previously published data.

Part one, consisting of four chapters, deals primarily with the morphological aspects of the evolution of gall midges. Chapter one consists of diagnoses of the family, subfamilies, tribes and the subtribes; it also provides a modern classification of the family breaking it into two subfamilies: the Lestremiinae with three tribes, Lestremiini, Moehniini (since eliminated because the only known species belongs to the Sciaridae), and Micromyiini, and the Cecidomyiinae with six tribes, Heteropezini, Porricondylini, Oligotrophini, Lasiopterini, Ceci-