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AN EFFICIENT METHOD FOR THE CAPTURE AND TRANSMISSION OF SPECIMEN LABEL INFORMATION*

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Summary

Herbarium labels were photographed using single frames of 8 mm movie film. Up to 3200 labels can be captured on a 15 m roll of film. Total costs for capturing 60,000 labels was only $ 735 (1.2c/label) (US$). This should be an inexpensive method to transmit label data and decrease specimen borrowing for distribution mapping purposes.

Fundamental to almost all taxonomic research is information recorded on herbarium specimen labels. Label data provide the taxonomist with information on specimen identity, collection locality, date of collection, collector, and abundance. As a first step in most taxonomic researches many specimens of the taxa must be studied. This requires the investigator to either visit several of the herbaria with good collections of these taxa or borrow the specimens from them. In many modern systematic studies where new specimens are collected in the field for cytological, chemical, and morphological examination, the specimens borrowed are used chiefly to acquaint the investigator with the taxa for field identification, to estimate the amount of variation expected in the field, and to get locations of populations for subsequent collecting trips. In the former instance, a few carefully chosen specimens may be sufficient; in the latter, one likes to plot all known collection locations and then sample those which are of particular interest (i.e. central *versus* peripheral populations, those on sandy soils *versus* gypsum, etc.).

The lending/borrowing of some specimens to acquaint a researcher with taxa is difficult to avoid, but borrowing in order to obtain site information from the label places might be avoided by the transmission of the label data directly from the specimen to the user. The purpose of this paper is to describe an inexpensive method that we have recently used to transmit label data from the University of Colorado Museum Herbarium (COLO) to the Colorado State University Herbarium (CS).

The Rapid Access Plant Information Center (RAPIC) of Colorado is a computerized data bank of information on the vascular plants of Colorado, U.S.A. (see Adams, 1974; Adams, *et al.* 1975 for details). Each taxon in the system has a computer-stored distribution map. These distributional data are being collected from label information at Colorado State University, U.S. Forest Service Herbarium, U.S. Forest Service Pathology Herbarium, and the University of Colorado Museum Herbarium. Information taken from the label includes location of collection, elevation, and county. The location of the collection is then entered on a large base map of Colorado (1 map for each taxon). The dots on these maps are then coded onto a computer card *via* an x-y digitizer (see Adams, 1975 for details).

Although the University of Colorado is only 50 miles from Colorado State University, a problem arose as to how we could efficiently capture and transmit data from over 60,000 labels. Hand copying the information would take many

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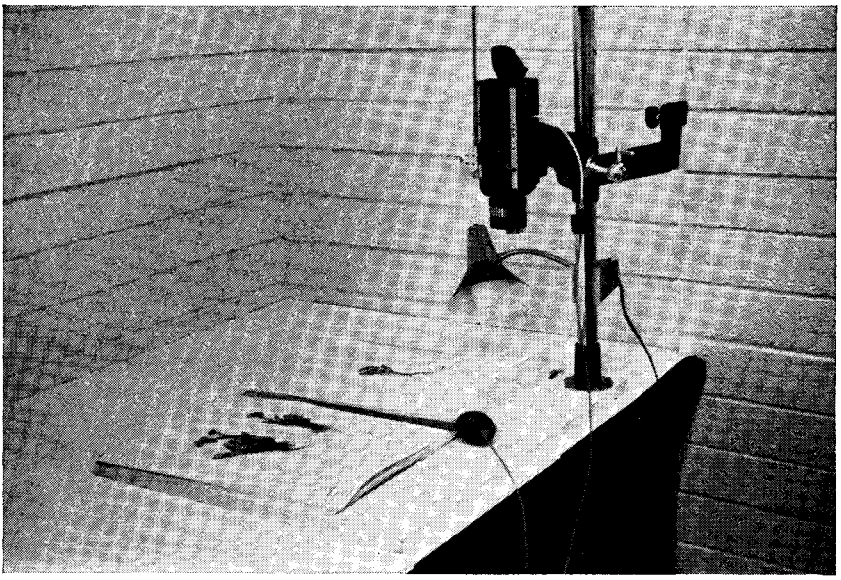

Fig. 1. The movie camera set up to photograph specimen labels. The air bulb on the table is usually placed on the floor and for use as a foot cable release to photograph single frames and at the same time to free both hands for specimen manipulation.

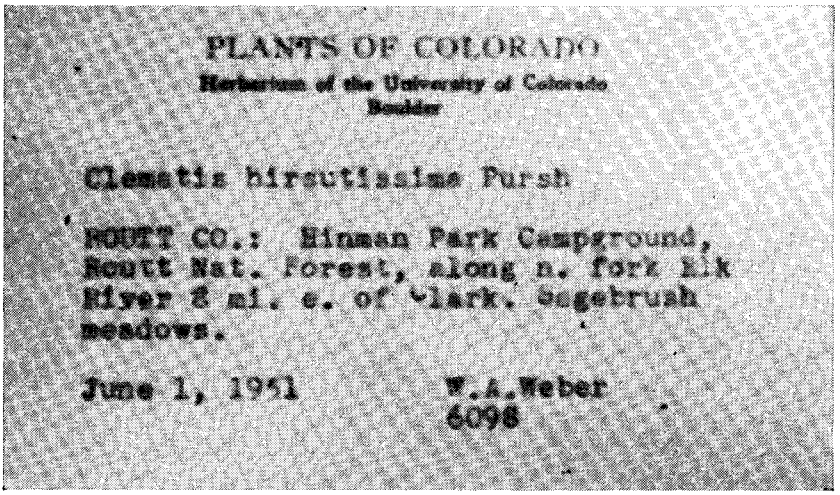

Fig. 2. A portion of 8 mm movie film with a label in the center. The fuzziness of the label is due to technical problems of obtaining a print from movie film. These frames can be shown on a microfilm or microfiche reader.

months and result in numerous errors.

Photographic duplication is an obvious solution but even using large quantities of 35 mm slide film, would cost about 10c/label (a total of $ 5,000, US$, just for film and processing). The solution was to use smaller film, 8 mm movie film or microfiche. We chose 8 mm ("Super Eight") movie film. A 15 m roll costs about $ 5.00 (US$) for film and processing and contains about 3200 single frames. Using the apparatus shown in Figure 1 we were able to shoot single frames by depressing the air bulb foot cable release. The lamp (Fig. 1) is a 75 watt bulb. Lighting was not critical since the Bolex "macro zoom" movie camera has automatic light meter and aperture setting. Kodachrome 40-A (ASA 25), color movie film was used because it was less expensive than black-and-white film. High speed Ektachrome (ASA 160) was tried but proved to be too grainy for good resolution.

A specimen is placed under the camera (Fig. 1), the label focused upon, and photographed. Due to the great depth of field (5 cm) with this camera, specimens can be placed in a stack (up to about 5 cm high) and photographed consecutively without adjustments to the camera. The film was sent to the Eastman Kodak Co. for processing *via* pre-paid mailers and returned within a week. Figure 2 shows a segment of one of the rolls of movie film, however, without showing any of the sprocket holes. The film was read on a microfilm reader but a microfiche reader could be used. The label is usually enlarged in the reader to about 20 cm and is clearer than shown in Figure 2. An ordinary 8 mm movie projector was used to screen the rolls upon receipt to determine the first and last frames and judge the quality of the film. For instance, we discovered that the technician filmed several rolls of film out of focus and these had to be re-photographed. This points out the need to check the camera each day for proper adjustment. There is ample room above the label to capture annotations if they are near the label (Figure 2). Annotation labels not affixed near the label could be photographed on an additional frame. The film costs are so low that another frame could be taken of the entire specimen but this would require refocusing the camera.

Cost analysis is shown in Table 1. All costs including film, processing, postage, and labor of filming came to 1.2c per label ($ 735, US, for 60,000 specimen). The Bolex macro-zoom 8 mm camera cost about $ 350.00 (US$) but we have recently seen several macro-zoom 8mm cameras which sell for $ 125-150 (US$) which would be satisfactory. The Bolex had several extras (electric powered zoom) which are not necessary. All that is needed is an 8 mm movie camera with a remote control single frame release, and the ability to focus down to about 20 centimeters.

This system is well within the capabilities of a herbarium and is simple to operate. The first and last dozen frames should be skipped to insure that none are lost in film development. Messages concerning the specimens can be inserted on cards and photographed. For instance, if the identity of several specimens is not certain, one might photograph a card that warns the user that the following 28 labels are of uncertain identification, etc.

This system will not abolish specimen lending but can greatly reduce the volume of materials exchanged. Since a major purpose of borrowing, in many systematic studies, is to determine possible field locations, these data could be obtained from photographic images of the labels. The film costs are so cheap (16c/specimen) that even if only a hundred specimens were to be loaned, it would be more economical to photograph them with this system. The borrower would probably be responsible for processing in any case. After distribution maps have been made, the researcher might then request to use a selected number of specimens in particular regions (margins, areas of sympatry, etc.). This would greatly cut down on specimen lending and damage.

Obviously this system would not suffice for a classical study which only involves the examination of herbaria vouchers. Misidentified specimens present a serious problem. Making twin sets of photos of the label and entire specimen might help resolve some of these problems.

The use of trade names in this paper is not an endorsement of these products.

References

ADAMS, R. P. 1974 – Computer Graphic Plotting and Mapping of Data in Systematics. Taxon 23 (1): 53-70.

ADAMS, R. P., D. H. WILKEN, W. M. KLEIN, G. BRYANT, and R. G. WALTER 1975 – RAPIC, The Missing Link? BioScience 25: 433-437.

TABLE I. Cost analysis of single frame photography of herbarium specimen labels (in US $).

	Cost per label
Film and processing:	
Kodachrome movie film (40-A) 50 ft., film, processing, and postage $ 5.00/roll (3200 frames)	$ 0.0016
Labor:	
290.5 hrs to photograph 60,000 labels = 206 labels/hr = 0.004842 hr/label (17.4 sec/label) @ $ 2.20/hr x .004842	0.01065
	$ 0.01225