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TAPIRA—The Taiwan Airborne Pollen Image Recording Application

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ABSTRACT: We describe the current version of "TAPIRA," the Taiwan Airborne Pollen Image Recording Application, developed at the Little Grass Laboratory of Biology, National Cheng-Kung University of Taiwan. The TAPIRA is a user-friendly application designed to recording and transferring the data of airborne pollen for aeropalynological investigation. Currently the programs are available for computers running the Macintosh operating system. Detailed information about the package is described and its future developments are also discussed.

KEY WORDS: Airborne pollen, Application program, Pollen image.

INTRODUCTION

A 3-years long-term airborne pollen survey project in Taiwan was well organized by T.-C. Huang (Huang *et al.*, 1997) and was executed at six stations around Taiwan since October 1992. The main problems that encountered by every station were the routine recording and the identification of large pollen samples. All the works are time-consuming, even more, experienced assistants or specialists are deficient and not easy to train in short time.

The keys, descriptions and photographs in Pollen Flora of Taiwan (Huang, 1972) are the main reference for identification and have been in use for a long time in Taiwan. A computer-based information system has been developed for identifyingTaiwan pollen (Hsieh, 1981; Hsieh and Huang, 1983) and the conventional methods have partially been improved. However, this text-based pollen identifying system written in BASIC language was not widely used.

Within recent years, a variety of image-capture device and some database management software, which enable us to use image data, have become available for personal computers. This technology will have an enormous impact on biological research and teaching. Although few related applications were available currently, the creation and use of image database will be rapidly expanded soon (Gomez-Pompa and Plummer, 1990; Kuoh, 1992).

The TAPIRA, Taiwan Airborne Pollen Image Recording Application, described here is the extension of the author's work on construction of grass image database (Kuoh, 1992).The aim is to provide a useful and user-friendly tool as an aid for executing the pollen project.

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MATERIALS AND METHODS

The program has been developed in FileMaker Pro and AppleScript for Macintosh operating system and presents a button-driven structure that aims to facilitate its use.

Hardware and software requirements

TAPIRA is running under Macintosh System 7.0 or more with at least 8 M RAM, and Claris FileMaker Pro™ 2.0 or above is required. The program "Scriptable Text Editor" is also needed to run AppleScript. This freeware could get from the FTP site "physgi.phy.ncku.edu.tw/pub/mac/Apple/util/ Scriptable_Text_Editor.sit.". TAPIRA application program contains four parts, TAPIRA_REC (Claris FileMaker Pro File), List_for_date /species/count (AppleScript program), List_for_time/species/count (Apple -Script program) and Readme (Text File) respectively. Data and images are recorded and accumulated as a database, TAPIRA_REC . The data in TAPIRA_REC can be transferred by two AppleScript programs (Fig. 1). The file size of TAPIRA_REC is limited to 30 MB.

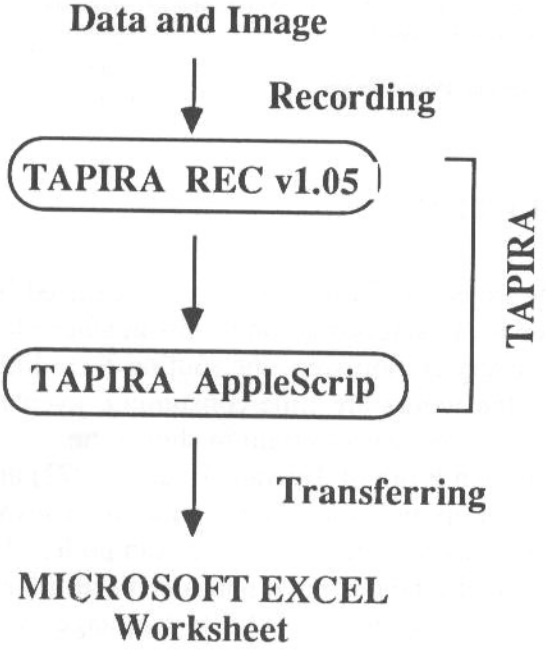

Fig. 1. The flowchart of TAPIRA. This diagram showing the main parts of TAPIRA and their function. The TAPIRA REC is a database for recording data and image while the TAPIRA_AppleScript contain two programs for transferring data.

Microscopy of pollen sample slides

Airborne pollen samples were collected with colophon tap by Burkard sampler each week, then the tap was equally divided into seven sections. Each section was mounted on the slide after staining with crystal violet (Tsou *et al.*, 1997).

Capturing of pollen images

The processes introduced by Kuoh (1992) are followed for capturing microscopic images with the software Adobe photoshop.

Building pollen database (TAPIRA_REC)

During the pollen microscopy, the following data fields were recorded in a sequence, including the starting (left side) and the ending (right side) points of each slide, the coordinates of each pollen on the slide, the collecting date and time, the pollen size, magnification, and the pollen image respectively. The "Note" field could record the other information when needed. The scientific names of the pollen source plant are also recorded after identification (Fig. 2).

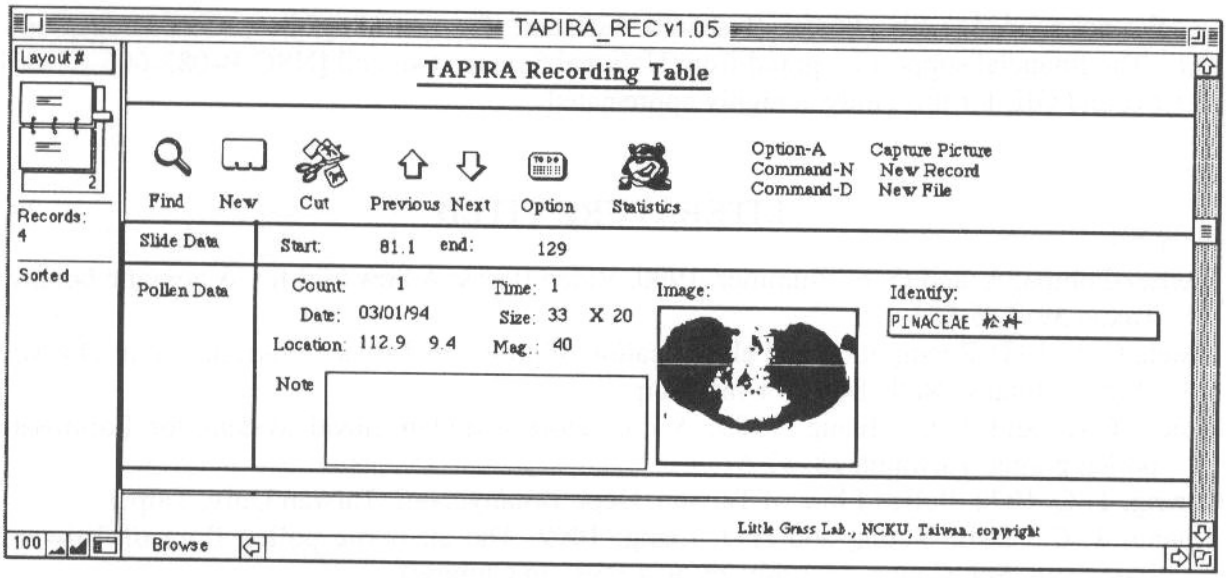

Fig. 2. The layout of one record of the database TAPIRA REC. There are four main parts of this layout. The upper left corner showing the amount of record and current record number in a booklet icon. The upper part is the command area with ten commands. The middle part is the Slide Data area for recording the starting and the ending position of the slide on the stage during microscopy. The lower part is the Pollen Data area including eleven fields for recording data of the collected pollen.

Transferring pollen data

The pollen data in the database of TAPIRA could be transferred to Microsoft Excel Worksheet by using the AppleScript programs, List_for_date/species/count or List_for_time /species/count. After transferring, the data could be used for analysis.

DISCUSSION

TAPIRA has been used for the last five years in our laboratory, assisting in the routine recording data of airborne pollen especially the pollen image that were collected at Tainan city in southern Taiwan area. TAPIRA has also been successfully used in teaching airborne pollen recognition. It is an application and database contains the most information that the aeropalynological investigation needs. Some icons of button were also added to facilitating its use such as navigating between each records, searching specific records, defining new coordinates, reporting statistic results and so on. The object-oriented nature of this application is a need for unexperienced users or non-research personnel. The major problem we met in this application is that TAPIRA_REC file size is limited to 32 MB. We tentatively solved this drawback by building several smaller size files and then recombined after transferring the data.

At this moment a Windows version is being developed and will be released in the near future. Copies of the application are available from the authors.

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TAPIRA—台灣空中花粉影像記錄應用軟體

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摘　　要

本文介紹最新版 TAPIRA—台灣空中花粉影像記錄應用軟體。TAPIRA發展於國立成功大學生物系小草研究室，主要用於記錄空中花粉調查的各項數據，特別是花粉影像。此外，各項數據也可轉換成各種檔型供進一步分析用。目前程式僅適用於麥金塔操作系統的電腦，其它相關資訊和將來之發展也於文中介紹和討論。

關鍵詞：空中花粉，應用軟體，花粉影像。

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