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A Photographic Atlas of Nglanggeran Plant Herbarium as a Plant Taxonomy Learning Source

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Abstract: Mount Nglanggeran is remnants of an ancient volcano located in Baturagung area, Gunung Kidul, Yogyakarta. The landscape and rocky subsoil of Mount Nglanggeran make its plant diversity has been conserved. There is a high diversity of plants that inhabit the area, containing many rare and endemic plants. We developed an interactive photographic atlas of Nglanggeran plant herbarium as a teaching aid. Samples were collected from some parts of Mount Nglanggeran, identified, dried, and processed further to herbaria. The herbaria were photographed. The photographs were processed using software, arranged and formatted into interactive atlas. The result of the research was an interactive atlas of Nglanggeran plant herbarium. The atlas is a useful teaching aid in subject of taxonomy, plant diversity and general biology.

Keywords*:* Photographic atlas, Nglanggeran, plant diversity, herbarium, teaching aid.

Introduction

Mount Nglanggeran is remnants of a tertiary volcano (Oligo-Miosen, approximately 70 million years ago) located in Gunung Kidul, Yogyakarta (Adhie, 2009). The landscape and rocky subsoil of Mount Nglanggeran make its plant diversity has been conserved. There is a high diversity of plants that inhabit the area, containing many rare and endemic plants. One of our authors has extensively studied the plant diversity on that area (Widodo et al., 2014; Widodo & Luthfi, 2016a; Widodo & Luthfi, 2016b; Widodo & Luthfi, 2017a; Widodo & Luthfi, 2017b; Widodo & Luthfi, 2017c).

Herbarium is a collection of preserved plant specimens and associated data used for scientific study. As a preserved specimen of an identified taxon deposited in a permanent and accessible storage facility, the herbarium specimens (vouchers) serve as the supporting material for published studies of the taxon and ensures that the science is repeatable. Vouchers are crucial in authenticating the taxonomy of an organism, as a tool for identifying localities of the taxon, and for additional taxonomic, genetic, ecological, and/or environmental research. Simply said, herbarium specimen is important in identification to confirm authenticity of a given plant species. The material in the herbarium remains as permanent record of flora of those regions even the natural topography and the vegetation have changed or extinct. In these the herbarium provide evidence of what once existed.

Even though herbarium has many purposes for scientific study, assessing it is sometimes difficult. People have to travel to the location of the institution keeping it and spend sufficient time to find the specimen. This is frequently not practical for the students working at a place far away from a herbarium institution.

We have many herbaria collection of Nglanggeran plant from several years of exploration and expedition in Mount Nglanggeran. Processing herbarium collection into printed or electronic material would benefit student of plant taxonomy. Photographic Atlas could make herbarium specimen more accessible, reaching wider audience. The aim of the research was to

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develop a photographic atlas of Nglanggeran plant herbarium that can be used as a learning source in plant identification and taxonomic study.

Materials and Methods

The materials used in this study were as follows: plant specimens from Mount Ngglangeran, paper, plastic bag, label paper, pencil, making kit, electric oven, personal computer, software for image processing and making atlas, photographic lighting set and DLSR camera.

Sample collection

We were doing field trip to Mount Nglanggeran to collect selected sample plants and brought them to laboratory for further step.

Herbarium making procedure

Sorting the plants

The collected plants from Mount Nglanggeran were brought to laboratorium to be sorted and selected for herbarium. We selected the proper intact plants, removed the unnecessary parts, and prepared for making herbarium.

Pressing and drying of specimens

Specimens were pressed as soon as possible after field collection, to avoid wilting and excessive wrinkling. Specimens were kept in sealed plastic bags for few days if it was not possible to press all of them immediately. Specimens were pressed flat and dried between sheets of absorbent paper (we used newspaper). The plants should be carefully laid out between the sheets as their form at this stage would determine their final appearance. The flowers should be spread out with the petals carefully arranged, leaves should be straightened, and unnecessary shoots of excessively twiggy shrubs may be removed. Leaves must be placed so that both the upper and lower surfaces are visible on the specimen.

Specimens were pressed with moderate pressure in an arrangement that would permit a free circulation of air. This was achieved by strapping the pile together in a press, that is, between frames made from sheets of a lattice of wood strips.

The pressed plants then thoroughly dried prior to mounting, using an electrical oven that holds the presses and provides heat between 40°C and 60°C. A low humidity and good airflow around the presses would insure perfect and thorough drying of specimens. As the plants dry, it may be necessary to further tighten the straps on the lattice to minimize shrinkage and wrinkling.

Mounting, labelling, and identifying the specimens

After pressing and drying process, the specimens were mounted and labelled. Only one specimen number should be put on one sheet of paper. The label was glued at the lower right-and corner. The specimens were identified by one of our authors, Dr Widodo. The specimens were kept in Laboratory of Faculty of Tarbiyah and Education, UIN Sunan Kalijaga Yogyakarta.

Photographing and image processing

The herbarium specimens were photographed using DLSR camera. Each specimen was pictured several times to get the best result. The images were selected and processed further using Photoshop software.

Atlas making procedure

The selected and optimized photograph, one photograph per species, were grouped under the same family, and arranged one page per specimen. The species name was put into upper part of each page. All the pages were arranged, edited and got layout using software CorelDraw to make the atlas readable, artistic and friendly user.

The files were converted to the final result as PDF file. We designed front and back cover, added up content, introduction, glossary, and reference. Then we made hyperlink (*a hyperlink, or simply a link, is a reference to data that the user can follow by clicking or tapping*) with software Nitro Pro 9 (figure 1).

Figure 1. proses atau flow chart pembuatan hyperlink.

Result and Discussion

We have developed a Photographic Atlas of Nglanggeran Plant Herbarium sourced from our collection of Mount Nglanggeran plants, which can be used to assist learning on plant taxonomy (figure 2). The atlas comprised of 30 specimen of plant species herbaria. Each specimen bears labels with adequate data on habitat, common name, native uses, ecological notes like frequency and abundance of species, associated plants and habit (figure 3).

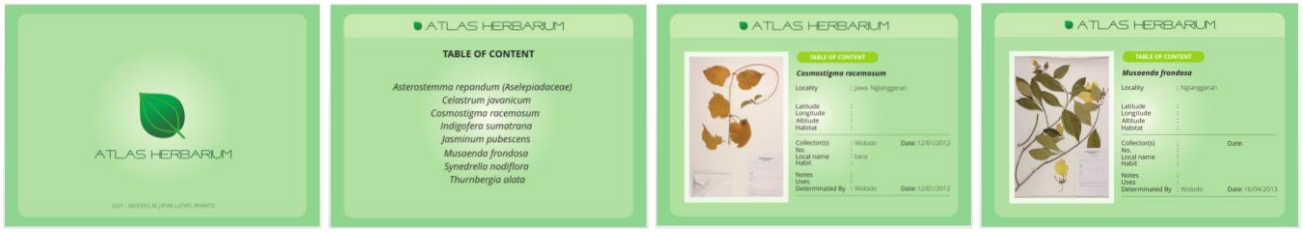

Figure 2. Cover and Sample pages of Atlas Herbarium.

Yalmancı and Girgin (2017) studied the impact of using herbarium material on student's academic success in learning plant diversity. They mentioned that student would have advantage by utilizing herbarium in term of the student could be informed about plant identity, their existence, and distinguish plant diversity and observe plant samples when it was not possible to reach out the plant itself in their habitat. Herbarium material provided students with recognizing plants, knowing their existence, distinguishing plant diversity and gaining classification skills.

Herbaria are remarkable and irreplaceable sources of information about plants and the place they inhabit. They provide the comparative material that is important for studies in taxonomy, systematics, ecology, anatomy, conservation biology, biodiversity, and ethnobotany, as well as being used for teaching and by the public. They are a veritable gold mine of information. Herbarium comprises specimens that have economic value—for instance, those that are used in a industry such as food production—and that are that allow for hands-on study. Herbarium is used to train students in botanical identification as well as in the development of understanding in plant taxonomy (Gallego and Sanchez, 2011; Crowe et al., 2017).

Atlas is an important tool in the study of anatomy. The most common anatomy learning resource is no doubt an anatomy atlas (Jurjus et al., 2018). We could apply this way to another subject. Dahlia (2020) stated that herbarium atlas was a useful learning media to learn plant morphology. Her research revealed significant increasing in the quality of student learning on the subject. In our study, we have made photographic atlas from our herbarium collection. The atlas can be used by students as a learning material and by teacher an aid in teaching plant taxonomy. While teaching a teacher can show this atlas if fresh material is not available at the time of giving the course.

Conclusion

We have successfully developed a Photographic Atlas of Nglanggeran Plant Herbarium as a teaching aid. learning source, and literature for teachers, students and persons interest in this area of expertise. We can use this atlas as guidance in identification of Ngglanggeran plants, studying its diversity, and also morphology and taxonomic aspects.

References

Adhie, B. (2009). Selintas Tentang Kondisi Geologi Gunung Api purba Nglanggeran Desa Nglanggeran, Kecamatan Patuk, Kabupaten Gunungkidul. Leaflet.Yogyakarta: Disparbud Gunungkidul.

Crowe, A., Dirks, Wenderoth, M.P. (2017). Biology in Bloom: Implementing Bloom's Taxonomy to Enhance

Student Learning in Biology. CBE—Life Sciences Education 7 (4).

Dahlia. (2020). Development of Herbarium Book as Biology Instructional Media in Plant Morphology Subject for Biology Education Undergraduate Students, University of Pasir Pangaraian. Bioeducation Journal 4 (1). DOI: https://doi.org/10.24036/bioedu.v4i1.252

Gallego, E., Sanchez, J. (2011) Virtual Laboratory and Herbarium as Teaching Tools for Botanical Sciences: Experiences in Mycology, Weed Science and Pathology Courses. *EDULEARN11 Proceedings*. pp. 2951-2955.

Jurjus, R.A., Butera, G., Krum, J.M. *et al.* Design of an Online Histology and Pathology Atlas for Medical Students: an Instructional Aid to Self-Directed Learning. *Med.Sci.Educ.* **28,** 101–110 (2018). https://doi.org/10.1007/s40670-017-0512-3

Widodo, W., Amin, M., Al-Muhdar, M., & Luthfi, M. (2014). Morpho-Anatomical Analysis of Cosmostigma racemosum (Asclepiadoideae) Flowers. *Biology, Medicine, & Natural Product Chemistry, 3*(1), 35-46. doi:https://doi.org/10.14421/biomedich.2014.31.35-46

Widodo, W. & Luthfi, M. (2016). *Morphological study of Fagraea ceilanica (Gentianaceae) in Mount Nglanggeran, Yogyakarta, Indonesia*. *Biodiversitas, 17*(2), *454-460*. doi:https://doi.org/10.13057/biodiv/d170208

Widodo, W., & Luthfi, M. J. (2017). *Short Communication: Characteristic of Anodendron paniculatum (Apocynaceae) in Mount Nglanggeran, Yogyakarta, Indonesia*. *Biodiversitas, 18*(2), *645-651*. doi:https://doi.org/10.13057/biodiv/d180228

Widodo, W., & Luthfi, M. J. (2017). Rediscovery of Premna lucidula Miq (Lamiaceae) in Mount Nglanggeran Gunungkidul. *Proceeding International Conference on Science and Engineering*, *1*, 59-65. https://doi.org/10.14421/icse.v1.270

Widodo, W., & Luthfi, M. (2017). Checklist of Flowering Plants (Magnoliophyta) of Mount Nglanggeran, Gunungkidul: Confirmation and Update of Flora of Java and APG III. *Biology, Medicine, & Natural Product Chemistry*, *6*(1), 19-36. doi:https://doi.org/10.14421/biomedich.2017.61.19-36

Widodo, W., & Luthfi, M. (2016). New Record Marsdenia tenacissima (Asclepiadoideae, Apocynaceae) In Gunung Ijo Baturagung Yogyakarta. *Biology, Medicine, & Natural Product Chemistry,* *5*(1), 1-8. doi:https://doi.org/10.14421/biomedich.2016.51.1-8

Yalmancı, S.B., Sönmez Girgin, S. (2017). The impact of using herbarium material on pupil's academic success in learning plant diversity. International Symposium of Education and Values (ISOEVA).