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## 1. INTRODUCTION

At the time of Hieronymus Bock (1498-1554) Lemna was supposed to be a first development stage of watercress. VALLISNERI (1714 according to MARIE-VICTORIN 1931) was the first to describe flowers of Lemna. In 1729, MICHELI observed flowers of Lemna again. He named the flowering Lemna plants Lenticula and the non-flowering ones Lenticularia. LINNE (1753, 1771) distinguished five species (Lemna polyrhiza, L. gibba, L. minor, L. trisulca, L. arrhiza) within the Lemnaceae family all of which he attributed to the genus Lemna. The first monographic treatment of Lemnaceae was published 1839 by SCHLEIDEN. In 1868, HEGELMAIER completed his extensive monograph. Twenty-seven years later (1895) he wrote a new survey of the family with supplementary information. His monograph was so competent and extensive that it took nearly a hundred years until a new monograph appeared (DAUBS 1965). The emphasis in the work of HEGELMAIER was put on comparative morphology and histology. He studied the development of members of Lemnaceae with such an accuracy and such a technical skill that his work was not matched since, though the methods have been improved considerably in the last hundred years. The present monographic treatment does not contain all the details of HEGELMAIER's ontogenetic descriptions of the Lemnacean organs. Scientists interested in the ontogeny and histology of Lemnaceae still must consult the monograph of HEGELMAIER. Due to his absolutely reliable but sometimes pedantic perfection he wrote in a rather complex language with frequent involved passages which makes the reading of his papers difficult, even for people of German mother tongue. DAUBS (1965) has the merit of having investigated much living material especially from the New World. He had access to new literature particularly from the English speaking countries. However, since his monograph was written as a dissertation, it is not astonishing that his achievements were rather incomplete. The work of HEGELMAIER was evaluated only in part, probably due to his very complex and not easily understandable language. Also, DAUBS reviewed only herbarium specimens from nine North American herbaria. For comparison, the present author consulted 120 herbaria from all over the world. The incompleteness of DAUBS' monograph inspired DEN HARTOG and VAN DER PLAS (1970) to examine critically the taxonomic status of the different

members of Lemnaceae in a "Synopsis of Lemnaceae". Partial reviews of taxonomy and ecology of the family were done by THOMPSON (1898) for North America, and by LUDWIG (1909) and KANDELER (1979) for Europe. A modern synecological treatment of the family (mostly for Europe) originates from SCHWABE-BRAUN and TUEXEN (1981b).

Within the last sixty years the family of Lemnaceae became more and more important as suitable research material for plant physiology and phytochemistry. Some of the advantages of Lemnaceae are: fast and predominantly vegetative reproduction (genetically uniform clones), only small laboratory space requirement, and aseptic culture. In addition, the family aroused attention as a food source due to its high productivity and its high protein content. Furthermore, Lemnaceae are used as multi-purpose test objects and for nutrient and mineral removal from sewage water. The literature on Lemnaceae has been growing exponentially for the last 30 years. HILLMAN (1961) cites 250 titles in his review of the descriptive and experimental literature of the family Lemnaceae. In 1980, the list of titles on Lemnaceae had increased to about 1300 titles (LANDOLT 1980d). The bibliography of the present work which will be published in volume 2 (LANDOLT and KANDELER 1987) contains more than 3000 titles.

The present author began his studies on Lemnaceae 1953 in California with comparative physiological and ecological investigations (cf. LANDOLT 1957). Since then, work on Lemnaceae was continued slowly with some supplementary physiological work and with the building up of a representative collection of more than 1000 living clones of Lemnaceae from all over the world. Some fieldtrips in Europe, North America, Argentina, Malaysia, and Australia completed the knowledge on the family. An original intention to write a monograph on Lemnaceae always had to be postponed due to many other duties and obligations. Ten years ago, I began to invest more time to complete the monograph, but sometimes the new literature grew faster than the available time to study the papers. Also, some of the new papers were so specialized that I no longer felt able to handle them competently. Fortunately, with Prof. Dr. Riklef Kandeler from Vienna (Austria) I found not only a very competent co-author for the second volume of the monograph but also a very cooperative and generous friend. Prof. Kandeler has been familiar with the family of Lemnaceae for more than 30 years and he has the true perspective of modern plant physiology and phytochemistry.

The aim of this monograph is to give a survey of the present status of knowledge on Lemnaceae. All characteristics and all possible aspects should be presented and discussed. It appeared to be impossible to evaluate every paper dealing with Lemnaceae in detail, but we hope that a representative selection is given and that at least the bibliography in volume 2 is more or less complete.

The names of the species used in literature have been adapted to the present nomenclature (e.g. Lemna aequinoctialis instead of L. perpusilla or L. paucicostata, or W. borealis for W. punctata). Where the identity of the species used for experiments was not correct according to the knowledge of the present author, the name has been changed but the name used originally is put in brackets ("named as").

The first volume contains the morphology, ecology, geographical distribution, taxonomy, and nomenclature of the family. The second volume deals with phytochemistry, physiology, and application. It also includes the bibliography. In order to give as complete as possible a survey it could not be avoided that some findings and results appear in more than one chapter.

It is hoped that the present study may help to further the better understanding of the special characteristics and metabolic processes within the family of Lemnaceae. Also it is intended to stimulate work with Lemnaceae and the following up of the many problems which are still to be solved.

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