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KARL SCHNARF — A PLANT EMBRYOLOGIST BETWEEN THE WORLD WARS

Riassunto — *Karl Schnarf, un embriologo vegetale fra le due guerre.* L'Autore presenta una breve biografia del botanico austriaco KARL SCHNARF (1869-1947) la cui opera e le cui vedute di tipo embriologico-evoluzionistico, confermate dalle recenti scoperte, effettuate con tecniche più sofisticate, non sono state sfruttate perché scritte in tedesco.

Abstract — The author presents a short biography of the austrian botanist KARL SCHNARF (1869-1947) whose works and ideas-concept in the field of evolutionary and embryological Botany are still undervaluated or completely unknown because published in german.

Key words — K. Schnarf, plant embryology.

Plant embryology had had its first summit in the 19th century; one of the leading scientists was G.B. AMICI, who was born exactly 200 years ago. Another fruitful time — by the use of advanced light microscope methods — was in the '30 and late '40 of our century. Since the advent of convenient preparation methods in electron microscopy during the late '50 and '60 the interest in this field of botany has grown worldwide, especially in Italy, France, or India. Our knowledge in plant embryology, but also in the very closely related palynology (microsporogenesis!) has grown very rapid, and the amount of facts almost cannot be overlooked. The base of our present knowledge are nevertheless handbook written in the past by careful and clever scientists. In my contribution I would prefer to throw some light on such a scientist.

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The Viennese botanist K. SCHNARF (1879-1947) should be seen as one of the «classical» plant embryologists in our century. Although widely forgotten today (at least in non-German speaking countries), he nevertheless deserves our appreciation. After his death two short biographical notes were published (in German, by K. HOEFLER, in 1952, and by R. BIEBL in 1955), but a lot of interesting facts of his scientific life are unpublished so far. Happily his — single — collaborator, Ms. Rosalie Wunderlich, is still alive and active. Basing on what she most recently told me I will give in part a new look on the personality and work of this today underrated embryologist.

For judging Schnarf especially as an author of embryological handbooks we should have first a glimpse on his scientific and economic circumstances. A very modest man, his original professional was to teach Natural History in Viennese Higher Schools. Looking on this and on his highly active role in the at that time renowned Zoologisch-Botanische Gesellschaft, he very interestingly could find indeed time enough for his scientific studies as a private, but highly respected botanist (he was Corresponding Member of the Austrian Academy of Sciences, a rather rare distinction).

He was graduated in 1904 and got his «*venia legendi*» for the University of Vienna in 1923, but made no academic career. He published 39 scientific contributions in various journals, two books on cytology and plant anatomy, and — above all — three handbooks on plant embryology (see the bibliography at the end of this article).

He underwent such time-consuming work as the writing of handbooks lacking any help with the exception of the very last years. After his untimely farewell to his original job as a teacher in 1936 because of severe cuts within the Austrian Government, he lived in extremely modest private conditions. But his scientific equipment during the '20 and '30 was also wretched.

He could use only a single, very primitive room for his microscopes, the microtome and the paraffin-embedding equipment. The gasheated oven lacked any fume-cupboard, and there was no running (cold) water available! This room was located not in the Botanical Institute, but in the old-fashioned Vienna Botanical Museum nearby, which was destroyed during the war. After this he and his students had within the Botanical Institute two rooms with — what progress! — warm running water. Despite these most wretched conditions Schnarf's scientific fame had grown so much during the years, that he — and no regular member of the institute itself — replaced

for a year the famous botanist R. von Wettstein, the head of the Botanical Institute up to the '30, in teaching all his students. Later on he had even the chance to become the new head of the Botanical Institute of the University of Graz (Austria), but in the end he was not elected.

We hardly can imagine such wretched conditions which were not uncommon in his time. We are used nowadays to more or less generous institute facilities and equipment, and indeed modern investigations cannot be done without this. In this respect we should be glad that indeed in the past there were some men writing such important handbooks as Schnarf has done. The conditions could be even worse: H. Netolitzki, Schnarf's close friend, prepared in the '30 his handbook on the angiosperm seed anatomy, which was also published in the large Linsbauer handbook series on Plant Anatomy. He used to visit the Vienna Botanical Institute yearly for recent literature, because in his own Botanical Institute in Tschernowitz there was an extremely lack of literature, to say nothing of other equipment.

But now we should have a look on Schnarf's outstanding embryological work, especially on the handbooks: they caused his fame as the leading plant embryologist in the '30 and '40. R. Wunderlich (pers. comm., 1986) told me that originally O. Porsch, another Viennese flower biologist and embryologist, was asked by the editor of the famous, large «Handbuch der Pflanzenanatomie» (now in continuation under «Encyclopedia of Plant Anatomy»), K. Linsbauer, to prepare a contribution on embryology. Porsch presented K. Schnarf as author, and Linsbauer accepted. Schnarf then prepared a single, hand-written manuscript (there were no copies of all his handbook manuscripts!) and went to Linsbauer to present and to deliver his single manuscript. Indeed this manuscript of the «Embryologie der Angiospermen» was published in 1929. After this some colleagues urgently suggested to Schnarf to write another manuscript for the same publisher (Gebrueder Borntraeger Berlin), but not for the Linsbauer handbook series: this «Vergleichende Embryologie der Angiospermen» was published in 1931.

Both books had a wide and fine resonance since they were written very clear and extremely thorough, covering all the literature published in this field. Because of this and because Schnarf had prepared the manuscripts in time, Linsbauer asked him oncemore to write further manuscripts, especially on gymnosperms, for his

handbook series. Already in 1933 the «Embryologie der Gymnospermen» was published, while the «Anatomie der Gymnospermen-samen» was printed in 1937. To round this series he tried to prepare a book on the embryology of pteridophyta. Some preliminary results are published by him and R. Wunderlich in his last book «Vergleichende Cytologie des Geschlechtsapparates der Kormophyten» (1941), but the whole manuscript remained unfinished.

One cannot underrate Schnarf's impact on plant embryologists especially in Central European countries then and even nowadays. According to R. von Weitstein, the famous botanist and writer of an excellent botany textbook, the «Embryologie der Angiospermen» was the very first, but nevertheless highly successful attempt to cover all the known facts in angiosperm embryology. But it seems, that his «Vergleichende Embryologie der Angiospermen» is indeed acknowledged as his most important work. This book founded a new scientific branch in botany, the Systematic Embryology, most important to recent embryology/palynology and also to modern taxonomy and systematics. Since 1931 no further book was published on this subjects despite the huge amount of embryological/palynological literature from the '30 to now. Reviewing the literature you will find also that only his «Embryologie der Gymnospermen» (from 1933) has found a successor within the Encyclopedia of Plant Anatomy, published by H. SINGH (in 1978), who calls Schnarf's old book still the only comprehensive compilation on the subject.

Singh's book is written in English, and exactly this is the point. Recently the Biological Sciences have changed their Lingua Franca into English, and most scientists ignore non-English literature, despite their respective quality. Up to now an adequate embryological handbook, covering ultrastructural aspects in general, and especially aspects of the female flower parts, written by a single author, is lacking. But perhaps this is impossible because of the extreme specialization in our time. Beside this, we know very well, that ultrastructural investigations of e.g. the megasporangium is much more time-consuming than to investigate the microspores; nobody can make career with only a handful of papers.

The publisher of that handbook series recognized very well the importance of Schnarf's embryological work and tried shortly after the Second World War as late as in the '60 to print an English version, at best a revised edition which included the recent literature.

This would have been a rather simple affair, because Schnarf's collaborateur, R. Wunderlich, has added very carefully the current literature and is still working on this topic. I remember a day as late as in 1977, where the last attempt was made to start such a project, but it was impossible: a new handbook must include the ultrastructural findings in the whole field of embryology/palynology since the '60, but should not forget the elder literature.

It is a pity from this standpoint that not a single of Schnarf's book has been translated and published in English. From this I suppose his work has not found adequate resonance in the English-speaking countries. Naturally, today Schnarf's handbooks are widely out of date, especially with respect to fine-structural investigations, which fill nearly all recent papers. But doubtlessly his handbooks are still storehouses for all botanists working in this field: embryology, palynology, taxonomy etc... Beside the complete listing of the literature up to the '30 we can find characteristic features for each angiosperm family with respect to the archesporium, the tapetum, the microspores/pollen grains, the megasporangium, the embryo sac, the fertilization/pollination process, and the young embryo itself.

Last but not least some words on Schnarf's ideas in plant embryology, which are of high interest also in our time. Although he was mainly interested in the embryological aspects of the female parts of the Higher Plants including the endosperm and the seed anatomy, the male gametophyte had also his attention. He mainly studied the anther tapetum, especially the systematic distribution of various kinds of the anther tapetum, and also the systematics of bi- and tricellular pollen grains. Although he of course never could use an electron microscope, he clearly saw that we must speak of «generative cells» and not only of generative or sperm nuclei, as mostly done before and also afterwards (SCHNARF 1937 b). He was no palynologist in our sense (in his time palynology differed highly from our recent science: G. ERDTMAN was just starting in the '40 to publish his fundamental books founding the modern palynology), but he clearly saw not only the importance of systematic knowledge of sperm cells etc., he gave also a comprehensive survey on pollen development, especially concerning pollen mother cells and the tapetum (SCHNARF 1929, 1937 b).

Another important idea by SCHNARF (see his preface to the «Vergleichende Embryologie der Angiospermen») is regarding all our

theories on phylogeny in Higher Plants: He denies the view that the gametophyte, although extremely reduced in angiosperms but still existing as «the lost generation», had had its own phylogenetic history and pathway. Therefore we must draw any phylogenetic consequences in Higher Plants not only from the sporophyte, but must include the gametophytic pathway.

It should be stressed that SCHNARF already in 1937 — in his «Ziele und Wege der vergleichenden Embryologie der Blütenpflanzen» — found that in contrast to the angiosperms the so-called «gymnosperms» should be seen not as a single, coherent group: the various taxa must be interpreted as a more or less artificially formed bundle of branches missing inner coherence. Thus only by practical reason the «gymnosperms» are the contradict to the angiosperms as a whole. This quite modern view — that the «gymnosperms» are represented by at least two, very peripherically related taxa, the cycadophytes and the coniferophytes, not speaking of a lot of extinct, small, little known groups — became only recently confirmed by the synoptical listing of characters in «gymnosperms» contributed by e.g. embryology, fossil and recent palynology, ultrastructural anatomy, cytology, molecular biology or phytochemistry. Modern botany textbooks present this insight as a new and surprising fact, but already half a century ago this aspect was no matter of debate because of the thorough embryological studies by K. SCHNARF.

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