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Englische Zusammenfassungen der im Berichtsjahr 1984 abgeschlossenen Dissertationen und Diplomarbeiten

Summaries of Ph D and Diploma Thesis

Dissertationen (Ph D. thesis)

LENHERR Andreas. Biosystematische und chemotaxonomische Untersuchungen in der Artengruppe Stachys recta L.
Diss.ETH Nr. 7453. 131 S.
Biosystematical and chemotaxonomical investigations within the group of Stachys recta L.

Plant material (voucher specimens, living plants and leaves for chemotaxonomy) was collected during several excursions in Switzerland, Italy, Yugoslavia, Albania and Greece. Representative samples of 13 species were taken from 50 origins. In the following list the investigated species are presented; the number of origins for each country is added in parenthesis:

Group of Stachys recta: S. recta (6xCH, 3xI, 3xYU), S. anisochila (2xYU), S. atherocalyx (2xAL), S. baldacii (1xAL, 2xYU), S. beckeana (1xAL, 4xYU), S. labiosa (5xI), S. leucoglossa (3xGR), S. parolinii (3xGR), S. subcrenata (3xYU), S. tetragona (2xGR).

Species from other groups: S. angustifolia (2xGR), S. annua (I, YU, AL, GR; each 1x), S. menthifolia (2xYU, 1xAL, 1xGR).

For S. beckeana, S. leucoglossa and S. tetragona material from the locus classicus was available.

Morphological studies. The group of Stachys recta can be distinguished from the other investigated species by characteristics of the upper lip of corolla (S. angustifolia, S. annua) or of the hairness of the stem (S. menthifolia).

Detailed descriptions for all species of the S. recta-group are given. Where possible, the material investigated was compared with type specimens. Each diagnosis is completed by a line drawing of the habitus as

well as of the calyx, corolla and nutlet in detail. In a digital synoptic the species of the S. recta-group are subdivided according to their typical characters. So far the species of the S. recta-group have been distinguished from other groups by their minute bracteoles. But 4 bracteoles of S. beckeana are mostly of the same length as the calyx tube, bracteoles of S. tetragona are always half as long as the calyx tube. The size of the bracteoles hence is not a typical characteristic for this group.

Chromosome numbers of all 50 origins have been determined in cells of root tips (by Dr. M. Baltisberger). All species of the S. recta-group have the same chromosome number of $2n=34$. The chromosome numbers of S. anisochila, S. beckeana, S. parolinii and S. tetragona were determined for the first time. According to previous studies the chromosome number $2n=34$ is compulsory within the S. recta-group. However, this number occurs in other groups, too (see S. annua and S. mentifolia). From all species studied only S. angustifolia differs in the chromosome number with $2n=24$.

Crossing experiments. All species of the S. recta-group tried so far could be crossed reciprocally with S. recta s.str. From the investigated species of other groups S. annua did not hybridize with S. recta s.str. and S. mentifolia did only hybridize if S. recta was used as mother plant. Seeds of the studied species are generally not germinating in culture without pretreatment. By scarification of the fruits with quartz sand on a shaking machine a germination of 70% was reached.

Isolation and identification of some plant constituents. As reference compounds for chemotaxonomical analysis 5 iridoids and 3 flavonoids from one origin of S. recta have been isolated using different chromatographical methods. Their chemical structure was established by analysing spectroscopical data. The following iridoids were identified: harpagide, acetyl-harpagide, ajugol, ajugoside and melittoside, all proved previously to be present in several species of the genus Stachys. The isolated flavonoids are 7-O-2(2''-O-6'''-O-acetyl- -D-allopyranosyl- -D-glucopyranosides) of 4'-O-methylisoscuteallarein, isoscuteallarein resp. 3'-hydroxy-4'-O-methylisoscuteallarein. The second and third flavonoids were isolated and identified for the first time. So far the sugar components of all flavonoids isolated from species of the genus Stachys have been described as mannose or glucose. Flavonoids containing mannose could not be recorded.

Chemotaxonomical data confirm the morphological classification of the 13 investigated species. Concentration of iridoids in the extracts from different origins of a species varies up to 4 times. Nevertheless extracts of the same species but from different origins are clearly more uniform than extracts of different species.

WEGELIN Thomas. Schaffung artenreicher Magerwiesen auf Strassenböschungen. Veröff.Geobot.Inst.ETH, Stiftung Rübel, 82, 104 S. Eignung von verschiedenem Saatgut für die Neuschaffung Mesobrometum-artiger Bestände. Eine Untersuchung in der Nordschweiz. Veröff.Geobot.Inst.ETH, Stiftung Rübel, 82, 104 S.

Creation of Mesobrometum-type grassland. Evaluation of different seed mixtures (to induce the formation). A study in northern Switzerland.

This study, carried out from 1980 until 1982, deals with the possibility of inducing the formation of Mesobrometum-like grassland (i.e. semidry, unfertilized meadows) on road embankments. Four seed mixes composed of two basically different mixes were utilized, both with and without Lolium perenne, a species known to cover open soil very quickly. All four mixes, however, had seeds of 12 rarer species characteristic of Mesobrometum-type grassland in common. Three study areas in northern Switzerland were chosen: the first one on the slope of embankment, the second one where the road cut through a limestone ridge, and the third one on a slope where a layer of topsoil rich in organic matter had been added. All three study areas had a slope of 60% and an aspect between SSE and WSW. Each study area was subdivided into random blocks on which the different seed mixes were sown.

The soil of the one study area where topsoil in organic matter had been added was distinctly different from that of the other two areas. Here we found a markedly higher content of organic matter, nitrogen and exchangeable calcium; the carbonate content, on the other hand, was considerably lower. The soils found at the limestone ridge showed great variability; some contained stones and rocks in percentages up to 45%. The average distribution in particle size in all three study areas, however, was very close to that observed in typical clay soils. It seems that the water and nutrient supply tended to be limiting in some areas. On the embankment, the soil in places was compact to such an extent that it became difficult for the roots to penetrate, which, in turn, limited the water supply intake for the plants.

The development of vegetation was surprisingly uniform with all the different treatments and in all three areas studied. During the third year of the experiment, the vegetation cover reached 65% and 85% on plots where seed was sown; on the other hand, the cover values recorded in control plots where no seed was sown were usually below 50% and particularly low within the range of the limestone ridge. The moss cover never exceeded 10%. Regarding the species diversity, the number of species per 1 m² found during the third vegetation period was on the average over 15; within the three study areas the species number per 1 m² observed was lowest on the limestone slope and highest on the slope with added humus. In the case of the soil with added humus-rich topsoil, however, the significance of the seed pool should not be underestimated. An analysis of the species found according to their life forms showed that hemicryptophytes were prevalent from the very beginning. Summer therophytes, on the other hand, were found to some extent only during the first vegetation period on areas without added humus and had disappeared almost completely on plots with added humus by the end of the third ve-

getation period. In the third year of the experiment, the number of winter therophytes was considerably reduced as well.

Grasses covered between 30% and 40% of the study areas by the end of the third year of the experiment, while forbs covered between 15% and 28%, additional humus layer, where the recorded cover values for forbs were 6% and 2%, respectively. It was in the legumes cover where we recorded the most significant differences between the three study areas; on the average, legumes covered between 10% and 40% but were markedly less abundant in the study area with added topsoil than in the two other areas. In some areas, extremely large covers of legumes were observed, particularly towards the end of the vegetation period, which possibly resulted in the suppression of other species. The cover percentage of Lolium perenne, which was added to the mixture in order to obtain a satisfactory cover quickly during the first vegetation period, diminished rapidly in the course of the second and third years. Apparently Lolium perenne had no adverse effect on the development of other species.

Among the species whose seeds were present in the mixes sown, Plantago lanceolata, Sanguisorba minor, Lotus corniculatus, Festuca duriuscula, Dactylis glomerata, and Achillea millefolium thrived on all the plots. Festuca ovina, Bromus erectus (containing a considerable percentage of Bromus cf. stenophyllus Link.) and Poa pratensis grew well only on plots rich in humus, whereas Poa compressa occurred mainly in the two study areas poor in humus. Trisetum flavescens, Coronilla varia, Holcus lanatus and Chrysanthemum leucanthemum showed no clear patterns. Only two of the rarer species that the seed mixtures contained were able to become established to any extent: Dianthus carthusianorum was found within all three study areas, whereas Thymus pulegioides occurred only on areas poor in humus.

Immigration into the areas studied from the surroundings was found to be very limited; the few outside species that germinated originated mainly from fertilized grasslands or are known to be ubiquitous. An analysis of the species found in the study areas according to their sociological affinity to Mesobrometum and Arrhenatheretum type grasslands, respectively, showed higher percentages for ubiquitous species and for species characteristic to Arrhenatheretum type grassland than for those linked closely to Mesobrometum type grassland. Based on these observations, we can therefore include that the seeds of all of the desirable species must be contained within the seed mixes utilized; the only exception to the use of these mixes would be in situations where the desirable species grow in the immediate surroundings of the area to be sown.

It was found that commercially available seed mixtures very often contain seeds of stands with conditions quite different from the ones in the area where they will be sown (different ecotypes) and sometimes these mixes contain seeds of completely foreign species. The inherent danger in the use of such mixes containing seeds of unadaptable ecotypes and of possibly foreign species is discussed. It is suggested that hay made regionally on existing Mesobrometum type grassland and an appropriate mixture of locally grown seed be used to induce the formation of this vegetation type on road embankments more successfully.

Conclusions drawn for practical applications are summed up under "Schlussfolgerungen".

DIPLOMARBEITEN (Diploma thesis)

BOLZERN Heinz. Polymorphismus der Cyanogenese bei Ranunculus montanus s.l. auf Karbonat und Silikatgestein. 87 S. (Manuskript).

Polymorphismus of cyanogenesis in Ranunculus montanus s.l. upon carbonate and acidic silicate.

The thesis deals with Ranunculus Grenierianus and R. montanus s.str. studied from pioneer high altitude sites in the surroundings of Davos (E Swiss Alps).

Cross phenotype frequencies respectively calculated for 500 plants studied from carbonate and 500 plants from acidic silicate showed pronounced differences between the two alpine substrata: cyanogenic plants represented 48% of the material from carbonate but they occurred in much lower frequency upon silicate (26%).

As far as particular allelic configurations are concerned, the amount of acLi plants with neither glucoside nor enzyme was negligible. No acyanogenic glucosidic plants AcLi were found in the material studied. The acLi plants carrying enzyme only represented 42.6% in the material from carbonate (300 plants studied), a much higher frequency viz. 67.5% being found in the material from acidic silicate (400 plants studied). The HCN-tests were mostly carried out with dhurrin extracted from Ranunculus montanus s.str. soon after the snow melted. The glucoside content proved to be exceedingly high (5360 mg/Kg fresh weight).

Readings in some tests parallelly run with various glucosides and/or enzymes were rather inconsistent and require further elucidations.

Soil analyses carried out in samples from the sites studied for cyanogenesis revealed that the bound nitrogen occurred mostly in form of $\text{NO}_3\text{-N}$ both in siliceous as well as calcareous soils.

The results obtained suggest that the polymorphism of cyanogenesis in R. montanus s.l. may be influenced by complex factors. Some aspects of genetics and population biology as well as the HCN-test methodology are briefly discussed.

HSU Elisabeth. Biosystematische und chemotaxonomische Untersuchungen in der Artengruppe Betonica officinalis L. 81 S. (Manuskript).

Biosystematical and chemotaxonomical studies within the group of Betonica officinalis L.

The biosystematical (including chemotaxonomical) studies within the genus Betonica were continued with 4 taxa from the group of Betonica officinalis (= Stachys officinalis): B. hirsuta L., B. officinalis L. s. str., B. serotina Host and B. stricta sensu Hess and Landolt. The following results were obtained:

1. In consequence of the morphological and chemotaxonomical studies as well as the subalpine/alpine stations of B. hirsuta this species can be distinguished well from the others of the group.
2. A division within the rest of the group is difficult because B. officinalis is forming different ecotypes resembling sometimes to other taxa.
3. TL-chromatographical data show no differentiation within the group (without B. hirsuta).
4. In Switzerland and adjacent areas there can be distinguished 4 taxa (according to the 'Flora der Schweiz'). A key is given (but valuable only for Switzerland).
5. Studies on herbarium specimens from the whole Europe show that the subdivision (possible in Switzerland) has no value for a larger area.
6. B. stricta sensu Hess and Landolt and B. officinalis L. var. alpestris Kirschleger are synonyms. B. stricta Aiton on the other hand, is a younger name for B. danica Miller and both can be considered as B. officinalis L. s. str.
7. Chromosome countings of all taxa studied yielded in $2n=2x=16$ chromosomes corresponding with literature.
8. Two unknown iridoids could be isolated from leaves of B. officinalis. They have an unusual structure; further investigations will be done.

MARTI Karin. Zum Standort seltener Flachmoortypen: Das Rispenseggenmoor im Mittelland. 69 S. (Manuskript).

To the site of rare fen types: The Caricetum paniculatae in the midlands.

The Caricetum paniculatae in the Swiss Midlands has been characterized by vegetation analyses. Furthermore, its site conditions have been investigated with particular attention to the light and temperature factors.

In order to calculate the potential light influx onto the sites, a method of O. Hegg was applied, whereas the effective light quantity received over a certain period was determined by a photochemical method. By application of the sugar-inversion method (Palmann method) mean temperatures were derived. In comparison with the Caricetum elatae the results of the investigations indicate that the site conditions of the Caricetum paniculatae vary in a more restricted range.

Considering the various sites (forest swamp, at a brook, along the dam of a storage lake, in floating mats) and especially the appearance of the Caricetum paniculatae at the dam of the lake of Klingnau, Carex panicula shows the strategy of a pioneer plant.

- RYSER Peter. Samenvorrat im Boden und Mikrostandorte für das Aufwachsen neuer Pflanzen in Wiesen des Randens bei Schaffhausen.
78 S. + Anhang. (Manuskript).
(Gekürzte Fassung s.S. 41 in diesem Band).
Seed reserves in the soil and micro-habitats for new plants
in the meadows of the Randen (near Schaffhausen).
(See page 41 of this volume).

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