

Mycoplasma-Like Organisms Associated with Stunting of *Gypsophila paniculata* L.

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Abstract. A new undescribed yellows-type disease of *Gypsophila paniculata* L. was found. Since a stunted growth is the predominant symptom the disease has been termed stunting. Electron micrographs of ultrathin sections revealed numerous mycoplasma-like organisms in diseased phloem tissues. Attempts to maintain the diseased *Gypsophila* plants for further investigation of this disease failed for the present in spite of all applied modifications in nutrient media.

In the family *Caryophyllaceae*, mycoplasmal diseases have been described in some weeds and ornamental plants. KLEINHEMPEL *et al.* (1972) reported the presence of mycoplasma-like organisms (MLO) in *Stellaria media* (L.) VILL. with stunting and flower greening symptoms. A similar disease on chickweed was observed by BEGTRUP and THOMSEN (1975) in Denmark. BEGTRUP and LANGE (1977) demonstrated the presence of MLO in two additional caryophyllaceous weeds, *i.e.* *Silene vulgaris* GARCKE and *Agrostemma githago* L. In South Europe, symptoms of witches' broom, proliferation and virescence were described with simultaneous demonstration of MLO in two ornamental species of the genus *Dianthus*. RAGOZZINO *et al.* (1977) found witches' broom of *Dianthus barbatus* L. in Italy and PLOATE *et al.* (1977) described virescence of *Dianthus caryophyllus* L. and proliferation of *D. barbatus* L. in Rumania.

Only an anonymous (1978) note suggesting the possibility of *Aster* yellows in *Gypsophila* stocks was recently published in The Grower. This note concerning the problem of plant material improvement through meristem cultures has merely an advertising character.

The present paper calls attention to an undescribed yellows-type disease of *Gypsophila paniculata* L. and demonstrates MLO in electron micrographs of ultrathin sections prepared from these plants. Attempts were performed to maintain the diseased *Gypsophila* plants in tissue cultures for further investigation of the disease.

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MATERIAL AND METHODS

Diseased *Gypsophila paniculata* L. plants showing severe stunting were observed for the first time in summer 1981 on plots of the Breeding Station in Heřmanův Městec.

Small pieces of veinal tissue of young leaves were taken at the end of July and processed as described by ULRYCHOVÁ *et al.* (1980). Sections were prepared with an ultramicrotome Reichert OM-U2, stained with uranyl-acetate and lead citrate and examined with a Tesla BS 200 electron microscope.

Explants from the shoot tips about 10 mm long were established both from healthy or symptomless and diseased *Gypsophila* plants growing in the field. The technique of *in vitro* propagation of *G. paniculata* was described by KUSEY *et al.* (1980). We followed this technique combined with our commonly used methods (PETRŮ and ULRYCHOVÁ 1975, ULRYCHOVÁ and PETRŮ 1975).

RESULTS AND DISCUSSION

Diseased *Gypsophila paniculata* plants are severely stunted and generally are devoid of flowers (Figs. 1 and 2). The stunted growth is striking from the beginning of the vegetation period and since it is the predominant symptom, the disease has been termed stunting. The stunting results from the conspicuous shortening of internodes. Affected plants do not set flowers. We did not observe any transient type of *Gypsophila* plants among the severely stunted and visually healthy plants during the vegetation period. We suppose therefore these stunted plants must have been infected the previous year or summer and the symptoms became intensified only the following year.

In ultrathin sections typical pleomorphic mycoplasma-like organisms (MLO) were found in sieve elements of diseased plants (Fig. 3). We did not find such bodies in the vascular region of apparently healthy plants grown on the same plot as stunted *Gypsophila* plants. The microorganisms were of a shape and size range typical of MLOs. They occurred mostly as oval or

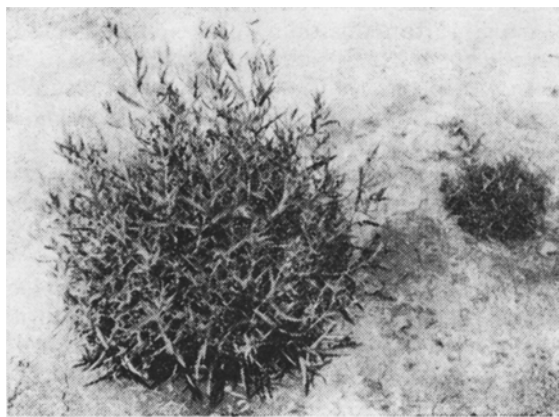


Fig. 1. Severely stunted *Gypsophila paniculata* plant (on the right) and a healthy plant (on the left) in the field.

spherical forms with trilaminar unit membrane visible as two black lines separated by an electron lucent space and contained ribosome-like material and fibrillar strands of DNA (Fig. 4).

The failure to maintain the stunted *Gypsophila* plants after their transfer from the field to the glasshouse led us to trials to get diseased plants in *in vitro* cultures derived from shoot tips of these plants. BEGRUP and LANGE (1977) were also unsuccessful in experiments with plant material taken from the field and were unable to induce root formation on cuttings from MLO infected *Agrostemma githago* plants. After the establishment of tissue cultures from the tips of infected *Gypsophila* plants, we observed in diseased explants rather a slower callogenesis and organogenesis set. Out of twenty explants eight died, five grew very slowly and the seven remaining grew decently. MLO were found in samples from newly formed shoots examined electron-microscopically two months after the explant establishment. The frequency of MLO occurrence in sieve elements of the newly formed shoots was distinctly decreased in comparison with the original plants growing in the open. The shoots were isolated after three to four months and transferred to the nutrient medium suitable for rooting. In spite of all efforts and modifications, we did not succeed in inducing root formation and the isolated shoots gradually died. The same trials with some modifications in the used nutrient media recommended for rooting were repeated the following year with the same failure. Healthy or symptomless *Gypsophila* plants behaved differently and in agreement with the results of KUSEY *et al.* (1980); 50% of these plants rooted in our experiments. The agreement of the results as regards the failure to induce root formation in MLO infected both *Gypsophila paniculata* and *Agrostemma githago* (BEGTRUP and LANGE 1977) plants led us to the conclusion that this pathogen causes profound physiological changes in the affected caryophyllaceous plants incapacitating them from rooting. The severe stunting and lack of reproductive organs indicate the mentioned physiological disorder, too. The solution of the problem of rooting in MLO infected *Gypsophila paniculata* plants is however very important for further studies of transmission possibilities and of relationship of the pathogen to lupine witches' broom (ULRYCHOVÁ *et al.* 1980); the bed of stunted *Gypsophila* plants adjoined a large plot of *Lupinus* hybrids showing a severe degree of brooming on many plants.

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Figs. 2—5 at the end of the issue.

BOOK REVIEWS

HÖHNE, J., WILHELM, P. G.: ZWÖLF MONATE IM GARTEN. Planen-Pflanzen-Pflegen-Ernten. — Verlag Paul Parey, Berlin—Hamburg 1980. 374 pp. DM 38.00.

This book is an authoritative guide to the plant domain, the pride of our gardens and parks. It is also an experienced adviser of all those who wish to learn the art of growing decorative and utility plants, shrubs and trees, which would reward the gardener with an abundance of flowers and a high crop of fruits.

Practical advices concern a number of breeding procedures based on a sound knowledge of the optimum design and lay-out of a garden, of chemical and physical properties of soil, and of the requirements of individual plants on nutrients, light, water and temperature. Specific and varietal composition of plants, their vegetative and generative propagation, harvesting and storage of fruits, and other topics are discussed. The principles of fight with pests and weeds are given in great detail. The text is complemented by the description of principal technical aids and equipments needed to the maintenance of lawns, trimming of shrubs and trees, to sprays, etc.

A very sympathetic trait of the book is the specification of the requirements of plants on abiotic and biotic environmental factors for each month of the year. This will facilitate the preparatory work of a gardener, as a thorough consideration of physiological needs of plants in relation to their growth reduces the risk of neglecting an essential and timely step, to which an inexperienced grower is often exposed.

The book is richly illustrated with black-and-white and coloured photographs and supplemented with instructive diagrams and tables. The success of this book with readers is documented by the fact that it appears in 19th edition since 1958.

DANUŠE HODÁŠOVÁ (Praha)

MAGEE, P. N. (ed.): NITROSAMINES AND HUMAN CANCER. Banbury Report 12. — Cold Spring Harbor Laboratory 1982. 599 pp. US \$ 67.—; outside US \$ 80.40.

N-nitrosamines comprise a group of chemicals that are potent mutagens and/or carcinogens in most species tested, and although they occur minimally in nature, precursor amines and nitrites form nitrosamines in animals and plants. The 12th Banbury Conference, held in 1982, was planned to bring together experts engaged in the biochemistry, metabolism and genotoxic effects of nitrosamines that have been detected in some foods, beverages and in the atmosphere. The introductory session presents papers demonstrating evidence that human beings are susceptible to N-nitroso compounds. However, as stated in the afterword, none of the information presented at the Conference provides unequivocal evidence that the nitrosamines are involved in the causation of human cancer. Nevertheless, the data do suggest that the possibility of such an effect should not be excluded. The subsequent session present papers dealing with the comparative metabolism, alkylation reactions and analytical methods applied for the detection of nitrosamines in various media. The highest known concentrations of exogenous nitrosamines occur in the rubber and leather-tanning industries. As to non-occupational exposures, nitrosamines have been detected in tobacco smoke, foodstuffs, alcoholic beverages, in cosmetics etc. The session, which covers the environmental occurrence of nitroso compounds, also includes a group of papers on the action of N-nitrosocimetidine, originating by nitrosation of the drug cimetidine in the acid environment of human stomach. The concluding papers present data on the incidence of nitrites and amines in the human diet and the dose response relationship in nitrosamine carcinogenesis. As in all previous Banbury Reports, each session is accompanied by an informal discussion.

T. GICHNER (Praha)

M. ULRYCHOVÁ ET AL.
MYCOPLASMA-LIKE ORGANISMS AND STUNTING OF GYPSOPHILA

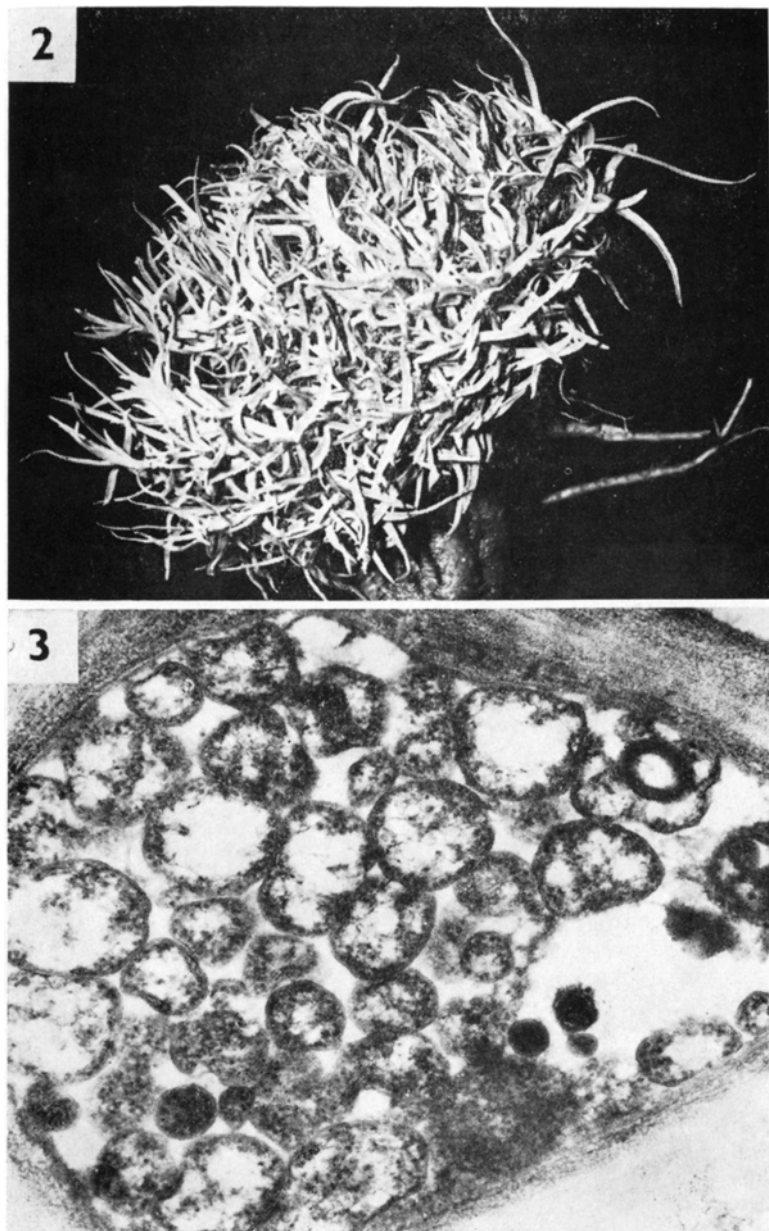


Fig. 2. A detail of the stunted *Gypsophila* plant showing conspicuous shortening of internodes.

Fig. 3. Mycoplasma-like organisms in a sieve tube of stunted *Gypsophila paniculata* plant (50 000 $\times$).

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MYCOPLASMA-LIKE ORGANISMS AND STUNTING OF GYPE

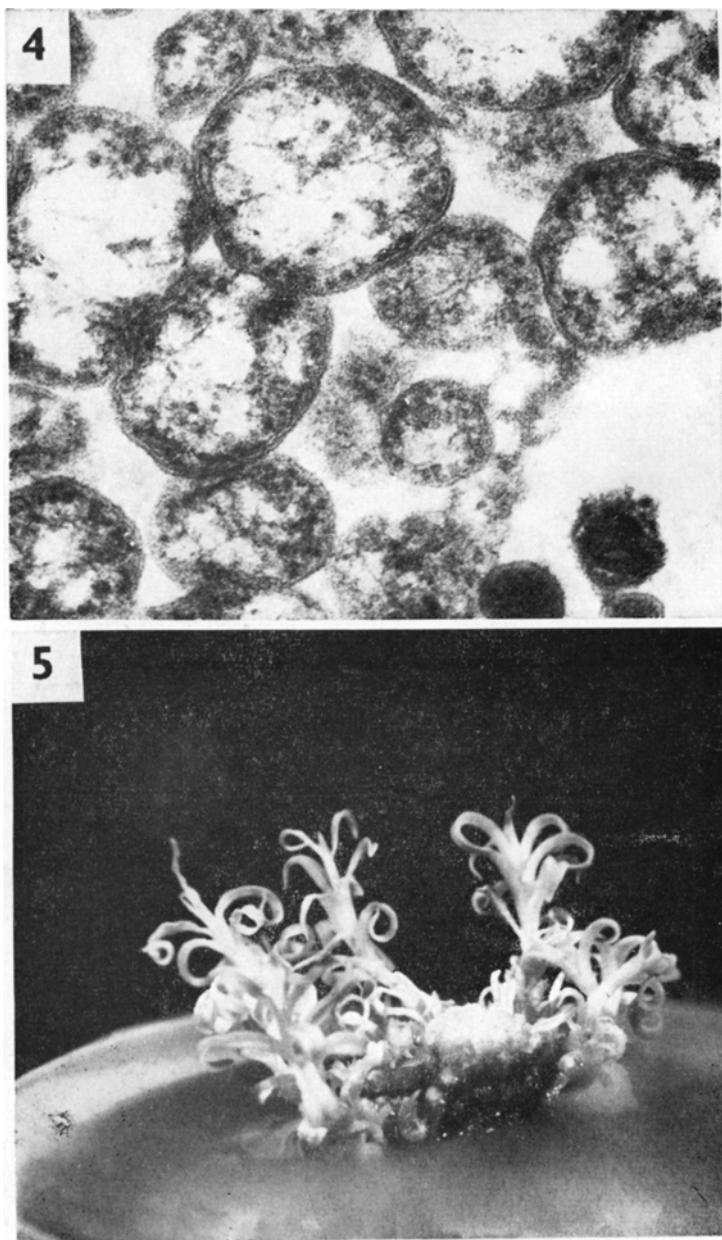


Fig. 4. Spherical mycoplasma-like organism containing ribosome-like material and fibrillar strands of DNA and bounded by a trilaminar unit membrane (105 000 $\times$).
Fig. 5. Primary explant with callus and newly formed shoots derived from the tip of stunted *Gypsophila paniculata* plant three months after the culture establishment.