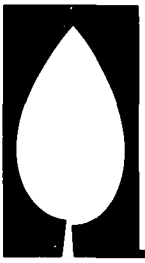
Statens
Planteavlsforsøg

Plant diseases and pests in Denmark 1980

97th annual report
Research Centre for Plant Protection

Lyngby 1981



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97th annual report
Compiled by The National Plant Pathology Institute and The National Pesticide Research Institute

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Content Side

A. NATIONAL PLANT PATHOLOGY INSTITUTE

I. GENERAL SURVEY OF PLANT PATHOLOGY SUBJECTS 198o, H. Rønde Kristensen

The work performed by the Institute for Plant Pathology in 198o has, in spite of the general economic depression, been characterized by considerable activity in all disciplines.

It has been possible to maintain and even increase the activity in some areas because of significant subsidies from various funds.

Such "extra" money has enabled 8 scientific workers and several technical assistants to deal with the following subjects:
Establishment of damage thresholds for mildew and other harmful agents attacking cereals.
Bremia lactucae and other fungi infecting lettuce.
Testing pre-basic material of seed potatoes for Corynebacterium sepedonicum.
Establishment of healthy nucleous stocks of horticultural plants and of potatoes.
Production of attenuated strains of tomato mosaic virus for "vaccination" of tomatoes.
Testing cucumber varieties for virus resistance.
Studies of Meligethes spp in rape.
Integrated control of rape pests.
Biological control of aphids in greenhouses.
Estimation of economic damage thresholds for soil seedling pests on beet roots.
Investigation into insecticide resistance in Danish populations of the peach-potato-aphid (Myzus persicae).
Development of laboratory methods to evaluate insecticides and fungicides which may be used in integrated control schemes together with biological control in glasshouses by means of Phytoseiulus persimilis and Encarsia formosa.
When performing work within the above-mentioned projects as well as in the other tasks carried out by the Institute, close cooperation has been established with other Danish and foreign rese-

arch institutes.

In 1980, 50 journeys abroad were undertaken by 23 scientific workers from the Institute for Plant Pathology, which, during the same year, has been visited by colleagues from the following countries:

Austria, Belgium, Canada, Czechoslovakia, Egypt, England, Finland, France, Germany, Hungary, India, Ireland, Luxembourg, the Netherlands, Norway, Pakistan, Portugal, Switzerland, Scotland, Spain, Sweden and the USA.

The plant health control and the production of healthy plants

Since the approval of the EEC Plant health Directive (77/93 EEC) of 21. Dec. 1976 the directive has undergone certain amendments as cited in the council directive of 18 March 1980.

The decisions in the Plant Health Directive have been implemented in the following two Danish Ministrial orders:

Order no. 135 about import and export of plants of 15 April 1980 and order no. 149 of 24 April 1980 about control of horticultural plants for further culture.

As early as 1955 an act concerning compulsory health control with nursery plants was carried through the Danish Parliament - an act which the Danish Nurserymen's Association wanted to be passed.

The new ministrial order of 24 April 1981, which was also desired by the producers' organizations, includes all production and all sales of every kind of horticultural plants to be used for further cultivation or planting.

These plants can only be offered for sale if the plants as well as the place of production has been approved by the Plant Protection Service.

In order to obtain this approval certain conditions must be fulfilled which, in many cases, goes far beyond the EEC requirements, the main purpose being to secure a high standard of health in all plants offered for sale in Denmark as well as abroad.

As this compulsory control involves many different plants, it has been necessary to work out several sets of regulations for the

various groups of plants such as nursery plants, pot plants, corms and bulbs etc.

The year 1980 can be considered as a milestone in Danish production of healthy horticultural plants, not only because of the great extension of the compulsory health control but also because of the foundation of a special station for the propagation of elite material of horticultural plants established by the growers' organizations.

Production of nucleous stocks and elite plants have for many years, been carried out by the State Research Stations (for plant pathology and horticulture) - and propagation material has in the past been delivered directly to the growers from these stations.

The new station which began to operate in 1980 shall, in the future, take care of the multiplication of the healthy elite plants delivered from state research stations.

This multiplication, which takes place under very rigorous plant health conditions, shall provide the basis for the production of horticultural plants in Danish nurseries.

To sum up, it can be stated that the reforms regarding health controls and production of healthy plants which have now been carried through will undoubtedly be beneficial to Danish consumers and also to the producers - concerning the export possibilities.

Also within the production of seed potatoes considerable effort has been made in order to secure a high standard of health.

Based on meristem culture and following multiplication by stem cuttings and tuber production, considerable amounts of the most important potato varieties are available and will now be placed at selected growers which are prepared to meet the very rigorous requirements demanded.

The origin of this new production has been very carefully tested for virus- and bacterial diseases.

Furthermore, all the clones in the "old" prebasis material have been tested for potato ring rot by the immuno-fluorescens method; all the tests were negative.

Several members of staff from the Institute for Plant Pathology

have been involved in the production of healthy nucleous material of horticultural plants and potatoes.

Furthermore, the Institute is carrying out comprehensive diagnostic work in support of plant health control.

In connection with the Danish potato breeding work the Institute is also testing for resistance to various pests and pathogens.

Apart from plant pathological work several staff members have participated extensivly in Danish as well as in international organizing work- in working groups, committees, commissions and councils.

In Denmark this is especially true with regard to the Plant Health Board and the Nursery Control Commission as well as working parties established by these bodies.

Internationally EPPO and the ISHS-Plant Protection Commission in particular should be mentioned.

The Institute for Plant Pathology has also contributed to the current EEC negotiations concerning harmful organisms.

In November 1980 the Institute for Plant Pathology undertook the local organization of the EPPO conference on Pest and Diseases risks from Exotic material imported into the EPPO Region. The conference, which was held in Elsinore, was attended by 57 participants from 16 countries.

II. Advisory Work

1. Diseases and pests of agricultural plants 198o

Ole Bagger

Cereals and grasses

The wintering of the winter seed was satisfactory all over the country. However, as far as the winter rye was concerned, some plants were destroyed in the winter season, mainly by snow mould. The damage was, in the main, seen on the lightest soils and on west-facing hills. Some of the fields were replowed, but it was mainly a question of sporadic resowing, especially of spring barley.

In the very slighty developed winter wheat fields, the winter damage was but trifling. Likewise, the winter barley fields got relatively well through the winter. Only in the few winter barley fields sown after winter barley, the wintering was poor, and there replowing was necessary.

The wintering of grass seed crops was generally good all over the country. Only along hedges and banks where the snow had settled for a very long time, a good deal of damage was observed. The worst damage occurred in second-year meadow grass fields and in Italian rye grass fields. However, in most cases it was, in the main, only a question of a thinning of the plant population.

Sand drift. On April 19, a strong earth drift set in over most parts of the country. From the lightest soils the earth was swept away, exposing the newly sown grain, which had just begun germinating. Resowing was done in a few areas, but in the greatest number of cases the damage looked worse than it actually was. The sowing of spring cereals took place in most parts of the country immediately after Easter, falling, in 198o, on April 6-7.

Cold and night frost influenced the cereal fields during the whole of the early summer period. As late as May 22, night frost was recorded down to as much as 5 to 8C below zero in large parts

of the country. Especially in the low-lying areas, the cereals were destroyed by the frost.

Grey speck (manganese deficiency) was, due to the very dry weather conditions, rather widespread in the winter cereals as well as in the spring cereal fields. The precipitation, which, in most parts of the country, set in about the first half of June, contributed to the manganese deficiency symptoms being not as bad as might be feared.

Yellow top disease (copper deficiency) was of no great importance in 1980.

Powdery mildew (Erysiphe graminis). In a few winter rye fields, rather severe attacks of mildew were seen in May. The attacks were, however, not as severe as in 1979.

In a few cases, widespread attacks in the winter wheat fields were observed. As late as in the month of May, it was, in most cases, a question of weak attacks only. In June, the attacks spread rather vigorously in a few winter wheat fields, also in the Solid variety. It was, in particular, in the islands that a good deal of severe attacks were seen. At most places in the country, the attacks petered out in early June, only to return more vigorously towards the end of June. In July, neither the winter wheat nor the winter rye fields showed any essential spreading of the attacks.

In the spring barley fields powdery mildew generally occurred with weak attacks only, which, however, were fairly widespread. In july, the powdery mildew developed rather vigorously, however, especially on the numerous unripe grains that were found due to the ample precipitation.

Take-all (Gaeumannomyces graminis) mainly occurred with weak attacks, which, among other things, was brought about by the unusually dry autumn and the very dry early summer period late in 1979 and early in 1980, respectively.

Eyespot (Cercosporella herpotrichoides). Observations of the possibilities of infection by the fungus during the whole period from the autumn until mid-May proved that there seemed to have been a need for control in 45 p.c. of the winter wheat fields and 40 p.c. of the rye fields. The spread in the intensity of the attacks of eyespot varied, however, a good deal from one part of the country to another. Due to the very dry weather conditions prevailing until after mid-June in most parts of the country, the attacks of eyespot ceased, and everywhere the attackswere considered to be rather moderate.

Leaf stripe of barley (Drechslera graminae) occurred also in 1980 with weak attacks. An investigation in June made by the National Research Center for Plant Protection in fortuitously chosen barley fields showed that, in 1980, as an average for the whole country only 4 p.c. of the fields were attacked, and the attacks were mainly weak.

In the control fields of The State Seed Testing Stations, leaf stripe was only found in 7 samples out of a total of 3,216 investigated samples. It was solely a matter of weak attacks, i. e., below 0.1 p.c. attacked plants.

Loose smut of barley (Ustilago nuda) was only seen with extremely weak attacks. An investigation made by The State Seed Testing Stations of 4,923 barley samples showed a total of 915 infected by loose smut of barley; only 1 sample showed attacks in more than 1 p.c. of the plants. In 763 samples, the attacks were found in less than 0.1 p.c. of the plants.

Loose smut of wheat (Ustilago tritici)was only found in 12 samples out of a total of 764 investigated winter wheat samples. In totally 29 investigated spring wheat plants no loose smut was found.

Loose smut of oats (Ustilago avenae) did not occur in an investigation of a total of 163 oat samples made by The State Seed Testing Stations.

Bunt of wheat (Tilletia caries) was observed in August-September with only a few attacks. In all observed cases, undressed seed of own production has, as usual, been used. No bunt was found at the investigations made by The State Seed Testing Stations.

Yellow rust (Puccinia striiformis) was observed in May in a few Vula fields, for instance in Funen. In June, a number of weak attacks were seen, also in the Vuka variety of winter wheat. The attacks spread in July, and in a few Vula wheat fields severe attacks were observed.

Barley rust (Puccinia hordei) was observed in July in a few spring barley fields, but primarily with weak and insignificant attacks. At Højbakkegaard, a rather severe attack was seen in the Rupal variety towards the end of July. The same was the case on Bornholm where weak attacks of barley rust were found in the Rupal variety, for instance in varietal experiments.

Leaf blotch of barley (Rhynchosporium secalis) was rarely seen in the early summer due to the very dry weather conditions.

However, in July under the moist weather conditions, the attacks began, to some degree, to spread.

Glume blotch of wheat (Septoria nodorum) spread rather vigorously in several winter wheat fields in June-July. The moist weather during the heading period of the wheat brought about rather severe attacks, which became very widespread. On account of the heavy precipitation it was difficult, not to say impossible, to drive in the fields at the proper time for sprayings. Also in August the disease spread further under the moist weather conditions. The attacks of glume blotch of wheat were, however, deem-

ed to be highly varying from one field to another. In several fields, however, highly shrivelled grains only were harvested due to severe attacks of glume blotch.

Ear blight (Fusarium spp.) was rather widespread in the winter wheat fields, primarily, however, only with weak attacks. It might have been supposed that, with the very moist weather conditions during the whole harvesting period, the spreading of the Fusarium fungi would have been excessive. Investigations of spring barley and winter wheat grains showed, however, surprisingly few attacks of Fusarium whereas rather severe attacks of Drechslera sativum were observed.

Snow mould (Fusarium nivale) was rather widespread in March-April especially in the winter rye fields. Only weak attacks of snow mould were found in the winter wheat fields. In the winter barley fields rather more snow mould was seen, and due to coinciding attacks of snow rot fungi, replowing of a number of winter barley fields was carried through.

Snow rot of cereals (Typhula incarnata) was found in the spring in several winter barley fields, often with severe attacks. The worst effect were seen in the fields sown after winter barley. Thus, winter barley after winter barley is a dangerous combination but, weather permitting, this can be combated to some degree by control with Bayleton.

Clover, lucerne, peas etc.

The wintering of the leguminous plants in the grass fields was satisfactory in parts of the country. Everywhere the wintering of the clover plants was characterized as extremely good, whereas there were grasses, primarily English ryegrass, which were destroyed by snow mould.

Clover rot (Sclerotinia trifoliorum) was only seen with extremely weak attacks in the spring season. In the autumn, rather more widespread attacks were observed, at most places, however, characterized as weak.

Verticillium wilt (Verticillium albo-atrum) occurred with weak attacks in the lucerne fields.

Grey mould (Botrytis cineria) was, under the very moist weather conditions in June-July, seen in several pea fields. However, the attacks were not described as particularly widespread, especially because the prevailing variety, Bodil, is rather short and very erect so there is a drier microclimate, which has an unfavourable effect on the fungus.

Leaf and pod spot (Ascochyta pisi) was observed in a few pea fields in August.

Beets

Precipitation. Several beet fields were almost drowned when the heavy precipitation started in June and, in particular, in July. Several fields were flooded for a long time, and at several places the soil was soaked to such a degree that the plants suffered from lack of oxygen. This was particularly bad in Southern Jutland where the precipitation had been most abundant.

The wintering of beets for seed production at the permanent site was satisfactory all over the country.

The wintering of fodder beets in clamps was also satisfactory. In the beets lifted first under the very dry weather conditions in the autumn, a severe putrefaction set in.

Spray damage. A number of soil herbicides retarded to some degree the growth of the beets under the very dry weather conditions. For instance, the use of Betanal brought about scorching at several places.

Herbicide damage in beets. Wind-borne material from adjacent cereal fields was rather frequently seen in 1980.

Strangles occurred very aporadically in 1980. Only 2 very weak attacks were observed.

Grey speck (Manganese deficiency) was estimated as rather widespread in May-June, however mainly with weak attacks.

Heart rot and dry rot (Boron deficiency) was observed in 1980 with only few and insignificant attacks. In the very dry spring season it seemed as though the attacks might become more vigorous, but with the ample precipitation in June and later on, the attacks remained insignificant. Magnesium deficiency occurred with weak and insignificant attacks only.

Yellows (Beta virus 4). The attacks had a relatively late start; in October they were characterized as rather widespread, though weak.

Black leg (Phoma betae, Phytium spp. et al.) occurred under the dry weather conditions with weak and insignificant attacks only. At most places, the beets germinated extremely well and concequently the black leg disease had no great effect. However, in a number of beet fields rather widespread attacks of chronic black leg occurred in June-July.

Ramularia leaf spot (Ramularia betae) occurred in a few beet fields with rather severe attacks in Funen and on Langeland. It was primarily a question of Ramularia betae attacks: only a few of the spots were caused by black leg, Phoma betae, fungi.

Beet rust (Uromyces betae) was observed with only extremely weak and insignificant attacks. In October, indications of beet rust were seen in a few beet fields.

Swedes, rape and other cruciferous crops

The wintering of the winter rape fields was not too good, the reason being, among other things, black frost in the spring. Cold and frost necessitated the resowing of a number of newly sown spring rape fields. It was, however, primarily on the low-lying areas that the black frost was hard in the last days of May.

Club root (Plasmodiophora brassicae) was, in 1980, seen at a few places in the country with weak and insignificant attacks only.

Root rot (Phoma betae, Pythium spp. et al.) was seen in a few swede fields, especially in the late-sown or re-sown fields.

Sclerotinia rot (Sclerotinia sclerotiorum) was, in 1980, seen with rather widespread attacks due to the very moist weather conditions. In practically all winter as well as spring rape areas, attacks of Sclerotinia rot were observed; at most places, however, the attacks were weak. In 1980, the attacks were estimated to be the most severe since 1972. In most fields, however, the attacks were so weak that they did not affect the yield.

Grey mould (Botrytis cinerea) was also rather widespread in the rape fields. The attacks of grey mould were, however, weaker than those of Sclerotinia rot. At the time of the swath-cutting of the spring rape, however, a good deal of attacks were observed, especially on the silicles.

Dark leaf spot (Alternaria brassicicola) was not found in material collected from spring rape fields at various places in the country. In a few winter rape fields, attacks of the big spored form (Alternaria brassicae) were observed. This fungus is not as serious as the smaller spored form. On several of the samples taken from rape fields throughout the country, widespread attacks of secondary Alternaria species were seen, which, together with other secondary fungi, made the rape selicles look drab.

Potatoes

The wintering of potatoes in clamps was, by and large, satisfactory in most parts of the country.

The sproutning of the potatoes was satisfactory in most parts of the country.

Cold in connection with night frost up to May 22 had a very severe effect on the potatoes which now had finished the sprouting.

Thus, in Vendsyssel, all the sprouted potatoes were destroyed by frost after a temperature of 2-3°C below zero in the surface of the soil. The early varieties which, at the Tylstrup Experimental Station, had been given about 25 mm of water the day before, got through the cold without any serious frost injuries.

Leaf roll (Solanum virus 14) and rugose mosaic (Solanum virus 2 (Y)) only occurred with attacks, which, however, were described as rather widespread.

Black leg (Erwinia carotovora var. atroseptical) was rather widespread: however, the attacks were mainly weak.

Wart disease (Synchytrium endobioticum) was, in 1980, only found at one place in North Schleswig.

Potato blight (Phytophthora infestans) occurred with widespread and often severe attacks due to the very moist weather conditions. The attacks were unusually severe in 1980, and only as far back as in 1960 and 1961 the agricultural advisers reported more severe attacks.

The first attacks of potato blight were observed in end-June at various places, mainly in gardens. Warnings against potato blight were sent out on June 27 and repeated on July 14. Also many tubers were attacked by potato blight and suffered from later blight due to the very difficult conditions at the time of lifting. At several places, the potatoes remained unlifted in the

fields on account of flooding.

Black scurf (Rhizocthonia solani) was observed in May-June with rather widespread, but mainly weak attacks. In several parts of the country, the attacks were estimated as relatively moderate, the sprouting of the potatoes being good. In October, the attacks of black scurf on newly lifted potatoes were deemed to be very moderate and weak.

2. Pests 1980

Ole Bagger

Cereals and grasses

Cereal nematodes (Heterodera avenae) occurred in 1980 only with few and extremely weak attacks during the very dry weather conditions in the spring month. The favourable conditions of growth made the attacks inconspicuous, but also the widespread use of nematode-resistant varieties contributed, to a high degree, to the decrease of the attacks during recent years.

Grain thrips (Limothrips cerealium) and rye thrips (L. denticornis) occurred in June-July with rather widespread attacks, primarily in the winter cereal fields. Also in several spring barley fields, yellowish-white parts could be seen in the leaf sheaths and the upper leaves.

Grain aphids (Sitobion avenae) and oat aphids (Rhapalosiphum padi) appeared rather late in the cereal fields as, not until rather late in June, a few aphids were observed. During the whole of July, only a few scattered aphids occurred, especially in the southern parts of the country. The wintering of, for instance, oat nematodes on bird cherry trees seemed, in fact, to be very sparse in the spring period. In July, too, the attacks were rather weak in wheat as well as in barley fields. During the whole period of growth, the aphid attacks in the cereal fields remained so slight that only at a very few places control measures were needed. In July, a slight propagation took place in a few winter wheat fields, primarily of the grain aphids.

Wireworms (Agriotes spp.) appeared in the spring months with weak and insignificant attacks only.

Crane flies (Tipula paludosa) were observed during the spring months in very few numbers only. In a few grass fields, for instance in the district of Gram, however, a few severe attacks

were observed.

Bibionid flies (Bibio hortulanus) were, in 1980, only seen in a few spring barley fields sown after farmyard-manured beets.

Diplophus febrilis was seen in a few grass fields in Southern Jutland. In May, a few attacks were also observed in some cereal fields sown after grass.

Wheat midges (Contarinia tritici and Sitodiplosis mosellanal) occurred in 1980 with only weak and insignificant attacks. In 1980, the attacks were, all over the country, characterized as weak and insignificant.

Hessian flies (Mayetiola destructor) only occurred to a very slight extent in the cereal fields.

Field meadow grass gallmidges (Mayetiola schoberi) were observed in the autumn months in a number of meadow grass fields in the districts around Roskilde and Næstved. In a few, as a rule second-year meadow grass fields, the attacks were rather severe without, however, being characterized as catastrophic as regards the wintering of the crop.

Saddle gall midges (Haplodiplosis equestris) had their period of flying in early June as was the case in the previous years. However, in the country as a whole, only a few attacks were observed. In the district of Ringsted, however, a few very severe and unexpected attacks were seen in a number of barley fields.

Frit flies (Oscinella frit) occurred in the spring with rather weak attacks. In a few winter cereal fields sown after grass a rather severe thinning out was seen. In June, however, rather widespread attacks of frit flies were observed, for instance in a number of late-sown oat fields.

In May, rather severe frit fly attacks were seen, and this was the case in June, too. The control was not particularly effective at all places, presumably because of the extremely fine conditions of growth for the maize.

Wheat Bulb flies (Hylemya coarctata) were seen in May in a number of wheat fields sown after spinach or early peas for canning, respectively. Primarily, the attacks were severe in Zealand and Funen. Besides, the Wheat Bulb flies were, in particular rather widespread on the islands, but in most of the fields the attacks were rather weak and of no great importance.

Slugs (Agriolimax spp.) occurred in several cereal fields with widespread and, at times, with destructive attacks. The most severe attacks were found in winter seed fields sown after clover, grass, or meadow grass, and where the slugs had been able to propagate under the very moist weather conditions prevailing during the end of the period of growth in 1980. In several winter seed fields the thinning of the plant population was very conciderable, and at several places the plants could not even get to the surface of the soil. In, for instance, some directly sown fields, the slugs hollowed out the swollen seed. The same was the case in fields where the soil structure was poor, for instance on the most clayey spots.

Rooks (Corvus frugeligus) destroyed in May a number of maize fields by eating the seed. In the district of Holbæk, a number of maize fields were rather severely thinned out.

Clover, lucerne, peas etc.

Stem nematodes (Ditylenchus dipsaci) were without importance in 1980, only a few weak attacks having been observed.

Clover seed weevils (Apion spp.) occurred in 1980 with only moderate attacks in the undersown fields.

Pea and bean weevils (Sitona spp.) were also observed with weak and negligible attacks only.

Grey field slugs (Agriolimax agrestis) propagated vigorously in the moist autumn weather and were observed in several clover fields. Rather severe attacks of slugs were seen in many cereal fields after, for instance, white clover.

Beets

Beet nematodes (Heterodera schachtii) were of no great importance in 1980. Due to the rather good conditions of growth for the beets and the ample precipitation, beet nematodes have not been observed as far as symptoms are concerned.

Cabbage Thrips (Thrips angusticeps) occurred in the spring with only rather moderate attacks, which, at most places, were characterized as weak.

Capsid bugs (Lygus rugulipennis, Lygocoris pabulinus and Calocoris norvegicus) occurred in June with rather severe attacks at a few places, especially in Southern Jutland.

Black bean aphids (Aphis fabae). In the spring of 1980, a total of 120 spindle bush localities were investigated, mainly in the islands, but wintered black bean aphids were found on 4 bushes only, corresponding to 3 p.c. of the localities investigated. Therefore, no early severe attacks of black bean aphids were expected in 1980. Indeed, black bean aphids only occurred with few and weak attacks in June. The first black bean aphids were found at Lyngby on June 9, but on Lolland-Falster, for instance, not until the week from June 19 to 25. In mid-July, black bean aphids could be seen in about one third of the beet fields, but only from the

end of June a slight propagation took place. In August, the attacks of black bean aphids were still characterized as weak, and at the end of August, the attacks petered out on their own.

Peach potato aphids (Mycus persicae). In the spring of 1980 sprout samples were taken from 165 beet clamps, and wintered peach potato aphids were found in 21 p.c. of the clamps. On the basis of the reports on beet clamps from the agricultural advisers, the number of beet clamps on May 15 was estimated at 1,600 and only about 300 on June 1. In view of these small figures, no early attacks of peach potato aphids and the ensuing severe attacks of beet yellows were expected to occur in 1980.

In fact, the attacks of peach potato aphids continued to be very weak. The first peach potato aphids were found in beet fields at Lyngby on June 9. but only after mid-June they were found in a few beet fields on Lolland-Falster. During the whole of June only weak and solitary attacks of peach potato aphids were observed. Also during the whole of July, the peach potato aphids remained on a very low level; thus, on Lolland-Falster, peach potato aphids were only found in about 50 p.c. of the beet fields investigated in mid-July. In August, peach potato aphids were likewise seen with weak and insignificant attacks only.

Beet carrion beetles (Blitophaga opaca) occurred in May-June with rather widespread attacks, mainly in Jutland. The attacks were rather widespread during the spring months but of a slightly weaker character than in the preceding years.

Pygmy mangold beetles (Atomaria linearis) were observed in May with few and very weak attacks only. All over the country, the attacks of Pygmy mangold beetles were reported to be of no great importance.

Springtails (Collembola) were observed in a single beet field in Funen, the attack being rather severe. From the country as a

whole, no reports of damage caused by springtails in other beet fields have been received.

Sand weevils (Cneorrhinus plagiatus) occurred, for instance, in Funen, a number of attacks having been observed especially on the light soils.

Mangold flies (Pegomyia hyoscyami). In the last days of May and in the beginning of June, a rather extensive egg-laying by mangold flies was observed. At most places, however, only weak attacks of the larvae were seen. Under the dry weather conditions, the hatching was not very good. In August, rather severe attacks were seen in several beet fields. The attacks by the later generations were generally characterized as weak.

Rosy Rustiv moths (Hydroecia micacea) were seen with a rather severe attack on a single locality in Vendsyssel. In May-June, the larvae gnawed in the beet stems; where the attack was most severe, about 15 p.c. of the plants were damaged.

Noctuid moths (Noctuidae). The larvae occurred in early June with very severe attacks, mainly in Jutland. Also in a few beet fields on the islands a few owlet moth larvae were seen, eating the leaves. On a few localities the attacks were so severe that spraying was tried with, for instance, Orthene.

Swedes, rape etc.

Cabbage thrips (Thrips angusticeps) occurred in the spring of 1980 with weak attacks only.

Cabbage aphids (Brevicoryne brassicae) were observed in August-September with weak and insignificant attacks only.

Blossom beetles (Meligethes aeneus) were seen in the winter rape fields with only weak attacks. Due to the very cool weather they

primarily flew to the fields after the flowering had begun. In early June, the blossom beetles were observed in the spring rape fields with rather widespread attacks, which, at a few places, were characterized as rather severe. On the whole, the attacks of blossom beetles must be characterized as relatively moderate in 1980.

Flea beetles (Phyllotreta spp.) were seen in May-June with very weak attacks only.

Cabbage seed weevils (Ceuthorrhynchus assimilis) occurred with few and, in the main, weak attacks.

Diamond-back moths (Plutella xylostella) were, in June, only seen with a few weak attacks, mainly in Jutland.

Cabbage butterflies (Pieris brassicae and P. rapae) were observed in July-August, mainly with weak and insignificant attacks. Also in September, the attacks were characterized as weak and insignificant in the swede fields.

Swede gall midges (Contarinia nasturtii) occurred in 1980 with weak and insignificant attacks only. In a few rape fields, however, could be seen the so-called witches' brooms caused by the presence of the larvae.

Brassicae\pod midges (Dasyneura brassicae) started flying in the last days of May. On the basis of catches in traps and hatching cages, spray warnings were sent to the agricultural advisers on May 20. Warnings against 2nd generation were sent on June 19, likewise on the basis of hatchings at various places in the country.

The attacks in the spring rape fields by the 1st as well as by the 2nd generation were characterized as weak and without any great importance. In the winter rape fields it was, in most cases, only a question of weak and insignificant attacks.

Cabbage root flies (Delia brassicae) were observed in June-July with only weak and insignificant attacks in the swede fields. In September-October, the attacks by the later generations were characterized as rather more widespread and with more severe attacks than in the preceding years. The attacks were particularly severe in resown or late-sown swede fields.

Turnip root flies (Delia floralis) were observed in Nothern Jutland in 1980 with rather severe attacks in late-sown swede fields. In swede fields sown at the normal time, no attacks by turnip root fly larvae were seen.

Potatoes

Colorado beetles (Leptinotarsa decemlineata) were recorded in July in only a total of 4 cases by The State Plant Protection Service. In a garden at Nørre Broby in Funen were, on July 3, found eggs, larvae, and summer beetles, which may indicate that here it was a question of an attack from preceding years. At Højer in North Schleswig a similar attack was found in a garden on July 4. At Broager in North Schleswig and at Neksø on Bornholm, Colorado beetles were found washed ashore in July.

Cutworms (Agrotis segetum) were, in 1980, only observed with scattered and extremely weak attacks, the main cause being the frequent and ample precipitation while the larvae were young.

Carrots

Carrot flies (Psila rosae). In the Lammefjord district were, for instance in September, observed a number of attacks in the carrots by carrot fly larvae. However, the attacks were, in the main, characterized as weak.

3. Diseases and pests of horticultural plants 1980 by M. H. Dahl

Climatic damages

Heavy drifts of snow broke branches of trees and bushes and the alternation of frost and thaw caused scorching on conifers and on evergreen bushes. Sandstorms uncovered seedbeds and in other cases carried layers of sand to lawns. Storage damages were found in clamped vegetables. Newly planted trees in avenues did not resume growing due to lack of oxygen in the soil.

Fungal diseases

Grey mould (Botrytis cinerea) prevented roses grown outdoors from developing buds. Yield losses in strawberries were found late in the season. On stems of raspberry bushes scleroties developed from the same fungus, causing withering. Contrary to customs Downy mildew (Peronospora sparsa) was commonly found in outdoor-roses. In peas leaves as well as pods were attacked by Downy mildew (Peronospora pisi). Anthracnosis (Marssonina panattoniana) has not previously been found in Denmark, but due to oil economy measures this fungus caused the destruction of lettuce grown in greenhouses.

Dutch Elm Disease (Ceratocystis ulmi). The Plant Health Board has appointed a committee on Elm Disease. During the summer of 1980 this committee cleared up the occurrence of the disease by the distribution of questionnaires. Except for Lolland and the nothern part of Jutland, Dutch Elm Disease was found all over the country and new attacks were found in about ten localities.

Bacterial diseases

Bacterial canker (Pseudomonas mors-prunorum, or P. syringa) on Prunus laurocerasus became serious in many nurseries. Experience has shown that the canker disappears when diseased trees are planted in parks and gardens.

Bacteriosis (Xanthomonas corylina) in hazel destroyed the nut-shells causing reduction of the crops.

Pests on horticultural plants

As early as the end of March the Lily beetle (Lilioceris lilii) caused damage on Lillium as well as on Fritillaria.

In spite of heavy attacks in 1979 Leaf hoppers (Psylla spp.) were hardly seen in 1980.

Cabbage root fly larvae (Delia brassicae) was found in all head-growing cabbage species. The principal explanation for this is inefficient spraying technique.

Cutworm (Agrotis segetum) in vegetables was only a minor problem - probably due to frequent showers.

Quite unexpectedly Thrips (Thysanoptera) caused such heavy suctions on leek leaves that later on in summer the leaves became white mottled.

For ten years in succession the sawfly (on birch) (Arge pullata) has ravaged the birches in a district south of Copenhagen. By mid-summer even large birches were largely without leaves. As the majority of the attacks were found in gardens and in summer residence areas, sprayings with pesticides could only be carried out with difficulty considering the risk of winddrift to neighbouring areas.

Garden chafer (Phyllopertha horticola). In many localities great areas of lawns totally withered because the roots of the grass plants had been totally gnawn of by the larvae.

III. BOTANY DEPARTMENT, Arne Jensen

1. Experimental work

Bacterial diseases (Ib G. Dinesen)

Potato ringrot (Corynebacterium sepedonicum). In the period from September to December Danish pre-basic material of potatoes was investigated for potato ringrot. From each clone, a sample of 50 tubers was taken and the immunofluorescens method was used. A total of 726 samples was investigated, which covers the clones from 1975, 1976, 1977 and 1978. No positive reaction was found in any of the samples.

In order to ensure that no ringrot bacteria is present in sed potatoes derived from meristemcultures, a test is done first on the mothertubers and later on the meristemplants and some of the tubers produced from these plantes.

Fireblight (Erwinia amylovora). The disease was rather severe in some hawthorn hedges in West-Jutland but in the regions where the disease was first discovered rather limited attacks could be found, especially in the fireblight garden at Bøtø on Falster. The experimental work in 1980 was aimed particularly at working out a forecasting method based on the "E. Billing system" and the collection of weather data, calculation and drawing of figures are computerized at the Dataanalytic Laboratory.

Bacterial diseases in potplants

In connection with the production of healthy nuclear stock at the Glasshouse Crop Research Institute, Årslev, Pelargonium is being tested for Xanthomonas pelargonii. Furthermore, healthy looking plants of Dieffenbachia sp. and Kalanchoë blossfeldiana are being collected and tests for Erwinia chrysanthemi are being initiated,

using the immunofluorescens method.

Cavity spot in carrots. In co-operation with other institutes experiments are being carried out on different cultivation methods in a field where cavity spot had recently occurred. Despite very rainy weather in July and August and clear symptoms of cavity spot it was not possible to find anaerobic bacteria in relation to the early formation of cavities. It was also difficult to find any correlation between inter-row cultivation and cavity spot.

Fungal diseases

Take-all and eyespot (Gaeumannomyces graminis and Cercosporella herpotrichoides) (H. Schulz).

In 1980 a total of 1,111 samples were assessed for take-all. Only in rye and winter barley were the attacks more numerous than in previous years. 1,413 samples were assessed for eyespot, including 302 samples in the Spring, with a view to giving prognoses, warning and spraying instructions.

Spore catching and weather observations showed good infection possibilities from mid-September to snowfall in December and again from the end of March to the end of April. It was assumed that 45 per cent of the wheat and 40 per cent of the rye fields needed spraying. Dry weather in May and June prevented eyespot from becoming a significant disease in 1980.
Sharp eyespot (Rhizoctonia sp.) was rather widespread and a few severe attacks occurred in wheat and rye.

Chemical control of eyespot (H. Schulz)

In continuously grown wheat and rye at three experimental stations, Benlate (0,5 kg per hectar) was effective in controlling eyespot but the increases in yield were not profitable. In co-operation with the Pesticide Institute experiments with different new compounds were carried out on winter wheat. Some of

these compounds were effective in reducing the disease and caused a significant yield increase.

Other work on root diseases in cereals (H. Schulz)

Small plot experiments with continious cereal growing in 9 different soiltypes showed generally lower incidence of take-all than in 1979 and higher yields. The yields were significantly higher in spring barley and winther wheat in particular. Another small plot experiment showed that spring rape has no beneficial effect as a postharvest crop in continuous spring barley. This result is in accordance with the one obtaines in 1979 but goes against findings from the preceding 5 years.

In our field experiments with increasing number of years with barley we changed to winter barley. In 1979 the take-all attacks showed the same tendency as in spring barley and the lowest yield was found in the 3rd to 7th year plots and the difference from highest to lowest yield was 30 per cent.

Tresh hold studies on mildew in spring barley (Sten Stetter)

A new project aimed at finding tresh hold values for mildew and other diseases and pests in cereal was started in 1980. The work has been concentrated primarily on mildew on spring barley and a special key has been produced in order to make assessing the disease levels easier.

Field experiments on control of mildew with Bayleton and Calixin were carried out on 2 varieties at 3 localities using different criteria for spraying (first attack, 1 per cent, 5 per cent and 10 per cent cover with mildew on active leaves). Assessments were done twice a week on all leaves separately on 10 plants per plot, The attacks were of a different nature in all three places and no clear correlation was found between the attacks at spraying time and yield increase. On an average 0,21 ton per hectar was obtained for 1 treatment independent of mildew level at spraying.

The work is being continued in growth chambers and in the field in 1981.

In connection with this project observations on the spidemiology of mildew was studied in relation to the growing of winter barley.

Leaf and eardiseases of cereals (Boldt Welling)

In a great number of wheat fields severe attacks by glume blotch (Septoria nodorum) were observed in 1980. With a view to investigating the possibilities for warning against this disease assessments were made in experiments on chemical control. It became clear that we need surveys early in the season and that in many cases a chemical control was made too late.

In spring barley attack of leaf spot fungi occurred more widely than usual due to wet weather conditions.

In co-operation with other research stations we have investigated the mildew attack in barley variety mixtures.
The level of infection varied very much, but in cases of severe attack less mildew was found in the mixtures compared with attacks on the single varieties.

Winter barley (Boldt Welling)

The area sown with winter barley was approximately 6,000 hectares. It is compulsory to spray the winter barley twice with efficient fungicides. Observations showed that these measures were efficient when they were carried out early and carefully. In some cases when the rules have not been followed, severe attack of mildew could be found in the spring barley quite a long distance away from the winter barley. Therefore the restrictions for growing winter barley have been retained. Investigations into the overwintering of winter barley showed very clearly that early sowing (at the beginning of September) in some cases causes severe damage from Typhula incarnata, especially where winter barley had been grown in the last two years. Spraying in the Autumn with triadimefon (Bayleton) or seed treatment with the same active ingredient in most cases reduced the amount of damage

considerably.

Grain quality (Boldt Welling)

A limited amount of work has been done on investigating the mycoflora of grains stored under different conditions. High water content followed by rising temperatures in some of the samples gave good conditions for development of mould fungi but in this experiment no mycotoxins seem to have been produced.

Diseases of grasses (Boldt Welling)

In permanent lawngrass experiment with different fertilizing severe winter damage was caused by Fusarium nivale in common ryegrass. Especially in plots fertilized with nitrogen and with no P or K given.

Strangles and root diseases in sugarbeets (H. A. Jørgensen)

Due to widespread occurrence of strangles in sugarbeets in 1979 investigations were started into this disease. Samples from 50 fields were collected at three growth stages and assessments on the symptoms were done together with isolation of the most dominating fungi, most frequently Fusarium oxysporum, Pythium ultimum and Phoma betae were found. In 1980 only very few plants with strangles could be found and no relation to fungal attack could be proved. The investigations continues in 1981.

Fungus diseases in spring sown oilseed rape (Arne Jensen)

Due to the very humid weather in the Summer 1980 rather severe attacks of Sclerotinia sclerotiorum was observed, especially in regions with intensive growing of rape. In some fields more than 20 per cent of the stems had been attacked. In a field where rape was grown after several years of cereal growing severe attacks also occurred and one explanation could be that a dominant weed Galeopsis speciosa could have multiplied and survived the inoculum during this period. Many of the weed plants

were found to have been attacked.

Potato wart (Synchytrium endobioticum) (H. Mygind)

From the Potato breeding station at Vandel, 243 samples of potato tubers were sent in for resistance tests. The test was done by using the Spiekermann compost method and multiplication of the fungus takes place in an isolated field. Inoculum from a new locality proved to be much more virulent than inoculum which had been in use for many years and seems to have been in a decline situation perhaps due to infection by virus-like particles (shown by Lene Lange, 1979). Some work has also been done on testing soil from old sites with wart diseases in order to see if the fungus is still present, in addition testing of soil treated with methylbromide has been carried out. In all cases no infections could be found and the areas are free to be grown with resistant potato varieties.

Grey mould (Botrytis cinerea) in tomatoes (H. Mygind)

Grey mould on the stems is still one of the most important diseases in glasshouse tomatoes. Registration of the attacks and recording of temperature and relative humidity was carried out in 8 glasshouses. Observations were made at 14 day intervals and samples of the fifth upper leaf were taken in order to analyse the nitrogen content. Preliminary treatment of the results points out the frequency of grey mould not only depends on the temperature and humidity level in the glasshouse but is also connected to low Nitrogen content in the plants.

Downy mildew (Bremia lectucae) in letuce (K. Thinggaard and H. A. Jørgensen)

Mapping of the races of Bremia lactucae in Danish glasshouse crops of lettuce is being continued. Up to now 19 races have been found and there seems to be a rapid change in the races from one year to another. The relative frequency of the 11

virulensfactors (V) is determined. V 1, 3, 4 and 7 had relative frequencies between 0,5 and 1,0 while V 2, 5, 6, 8, 9 and had from 0,33 to 0,46 and V11 had the lowest frequency 0,11. The work provides a basis for chosing varieties of lettuce with suitable resistance and in 1980 it was possible to give advice to those lettucegrowers, who had problems with downy mildew.

Plant diseases in water culture of glasshouse crops (H. Mygind and Ib G. Dinesen)

A new project has been started at the Plant Pathology Department at the Agricultural University in co-operation with us. Our work has involved us in taking part in the working-group meetings and in the collection and investigation of plantmateriel from 8 glasshouses with pot plants in water culture systems. The plants were examined for root pathogenic fungi in particular and mostly the Pythium species were found. In one case severe attacks of Fusarium oxysporum was found in Monstera deliciosa, presumably due to heavy seed infection.

The "tide and flood" system seems to give least disease-problems.

Healthy nuclear stock of pot plants (H. Mygind and Ib G. Dinesen)

Healthy motherplants of Campanula isophylla are kept at the Glasshouse Crops Research Institute and regular testing proves that they are free from wilt caused by Fusarium tabacinum.

Growers who have used cuttings derived from this healthy stock of Campanula have overcome the problems with wilt.

As mentioned by H. Rønde Kristensen page 7 healthy nuclear stocks of other cultivars of pot plants are produced and will be tested for pathogenic fungi and bacteria which are transmitted by cuttings. Concerning bacteria see page 29.

Dutch elm disease (Ceratocystis ulmi) (H. A. Jørgensen)

The distribution of this disease is mentioned on page 27 . The work concerning this disease is mainly done by other institutes and we have only examined 21 samples of elm suspected of attack by Ceratocystis ulmi; only one was positive.

Diagnostic work (H. A. Jørgensen, H. Mygind and Ib G. Dinesen)

In the course of the year the Botany Department received about 360 samples of plants for diagnosis for bacterial and fungal diseases. Mostly it was a question of horticultural plants and among the most frequently occurring fungi Pythium, Phytophthora, Rhizoctonia and Botrytis can be mentioned. Among the bacteria Erwinia amylovora and E. carotovora were predominant.

2. New attacks of diseases in 1980

Fungal diseases, H. A. Jørgensen

Among the samples forwarded to the Botany Department for diagnosis for fungal attacks a few plant species with attacks which supposedly have not been observed before in this country were found:

Pythium mamillatum Meurs, causing root rot of Ageratum houstonianum;
Phyllosticta decidua Ell. et Kell. on leaves of Veronica speciosa, and
mildew, Oidium piperis Uppal, Kamat et Patel on leaves of Peperomia verticillata.

Bacterial diseases, Ib G. Dinesen

In August Pseudomonas corrugata Roberts and Scarlett was isolated from stems of tomatoes in a glasshouse on Funen. It is the first record of this bacteria in Denmark and we have not yet investigated how widespread and severe it is.

IV. VIROLOGY DEPARTMENT, H. Rønde Kristensen

1. Experimental work

In the serological laboratory great emphasis has been placed upon work using the ELISA method and its application in diagnosing various plant viruses - especially potato leaf roll virus.

Within the electron microscopy promising results have been obtained using immuno-electron microscopy.

In connection with the new seed potato programme, serological as well as electron microscopical methods have been used to a fairly great extent.

Investigations concerning viruses of cereals and grasses have, in 1980, been restricted to survey work.

Investigations regarding the growth of potato meristemes and stem cuttings during different growth conditions in test tubes have been continued.

Furthermore, storage experiments with test tube cultures of potatoes have been performed.

Establishment of meristem cultures of many different horticultural plants have been continued with promising results for woody as well as for herbaceous plants.

The production of attenuated tomato mosaic virus for "vaccination" of tomato plants is now being terminated because of extensive use of TMV-resistant plants.

The trials on the spread of virus diseases through the nutrient solution (in running water) are being continued.

Infection trials in pepper using different tomato mosaic strains have been carried out and the influence of infecting leeks with leek streak-virus and shallot latent virus has been investigated.

Virus diseases of agricultural plants (B. Engsbro)

Establishment of meristem plants and elimination of virus diseases by use of different sized meristem tips from potatoes

Meristem tips originating from 16 potato varieties were divided into two groups, each comprising approximately 3oo meristem tips (group 1, tip size o,15-o,2o mm, group 2, tip size o,2o-2,25 mm). 28% and 38%, respectively, developed into good plants with good rood system.

Investigations for virus diseases showed that 79 per cent of the meristem plants developed from smaller and that 67 per cent developed from bigger meristem tips, were healthy, although they originated from the sprouts of diseased potato tubers.

This difference was mainly due to the potato virus S, which proved to be very difficult to eliminate from 2 varieties by use of the bigger meristem tips, while use of the smaller meristem tips eliminated the virus at normal proportions (5o-loo per cent) also from these 2 varieties.

Establishment of potato cuttings in soil instead of test tubes

In connection with the work on multiplying potato cuttings in test tubes for later cultivation in soil, it has been proved, that it is possible to establish the small one-leaf potato cuttings directly in pit soil.

After being kept at high humidity in a glasshouse for the first week or two, nearly loo per cent of the cuttings were rooted and a good plant had begun to develop from the bud.

After another 1 to 2 weeks the plants were ready for transplanting.

Tuber formation on potato cuttings in test tubes

During the work on storage of potato cuttings in test tubes it has been found, that plants kept under bad conditions try to form organs, small tubers, to create a new generation.

The same is found in test tubes, where the plants have used nearly all the "food" and are near to wilting.

By blocking off light and air exchange to the test tubes at lo-12^{o} C, plants in good growth conditions were forced to form tubers in the test tubes.

From 915 plants in test tubes 1 tuber was formed at 73 per cent, 2 at 17 percent and 3-5 tubers at 4 per cent of the plants.

The tubers were at the size 3-1o mm, and most of the bigger ones were able to form new plants after transferring to pit soil in a glasshouse.

After storage for shorter or longer periods at lower temperatures, the tubers can be used for continued growth of the variety in test tubes at 12-2o^{o}C.

Virus diseases on fruit trees (Arne Thomsen)

Horse shoe wound diseases in apple. In an experiment on varietal susceptibility to horse shoe wound pathogen (2o apple variethies budded with infected 'Cox's Orange' in 1974), 3 varieties namely 'Cox's Orange', 'Golden Delicious', and 'Ingrid Marie' showed horse shoe wound in 1977-198o.

So far no symptoms like horse shoe have been observed trees of 17 varieties among these 'Discovery', 'Mutzu' and 'Summerred'.

Chat fruit in apple. In a field experiment, the pathogen chat fruit is found to have a slow spread in trees of the variety Cox's Orange' while no spread is found in the variety 'Ingrid Marie'.

Apple rootstock - Meristem-tip culture. Meristem-tip cultures of apple rootstocks in 198o have resulted in plants with roots from the varieties A_2, EMIX, M1o6 and M111.

Pear meristem-tip culture. Meristem plants with roots have been established from material of the pear variety 'Greve Moltke'.

The root development was established in a medium at low nutrient level containing 1 ppm IBA.

Virus diseases in fruit bushes (Arne Thomsen)

Raspberry, meristem-tip cultures. Meristem plants with roots are

established from the varieties 'Malling Jewel', 'Radbaud', 'Veten' and 'no 226o'.

According to virus tests the established meristem plants are virus free and are propagated in glasshouse by means of rootshoot.

Red currant, meristem-tip culture. In 1978 9 meristem-tip cultures were established from the red currant variety 'Rondom' infected with raspberry ringspot virus (spoon leaf of red currant).

Tests carried out in 198o showed no virus infection in the resulting meristem plants.

Virosis in strawberry (Arne Thomsen)

Strawberry, meristem-tip cultures grown in soil under glasshouse conditions has been possible from cultures of 'Senga Sengana' after storage in test tubes at $8^{o}C$ for 24 months.

Mycoplasma-like organisms in strawberry are proved to be present in strawberry plants with sterile and deformed flowers.

Virus Diseases in Vegetables (N. Paludan)

Tomato mosaic virus (TomMV)

Produced attenuated TomMV-vaccine has been tested continuously, but the demand for vaccination of tomato plants has decreased considerably during 1980. The reason for this is an increased use of TMV-resistant varieties and especially the variety 'Ida', which shows great promise. On account of this there will be hardly any demand for vaccination the next year, and the production of TMV-vaccine will cease from 1981.

Spread of Cucumber green mosaic virus (CGMV) by the watering system

Healthy cucumber plants were grown in a soilfree culture in a constant recirculating nutrient solution together with CGMV-infected plants. Leaf contact did not occur, while root contact

occurred after 10 days. Root samples were rinsed in running tap water for half an hour to remove any contaminated virus. Top and root samples were taken out after 1, 3, 6, 10 and 16 days of culture, respectively. Root infection as an average of 2 x 25 plants, was shown in 0, 4, 0, 8 and 10 per cent, respectively, while top infection could not be shown

Spread of Lettuce Big-Vein Disease (LBVD) by the watering system

Healthy lettuce plants were grown in a soilfree culture in a constant recirculating nutrient solution together with LBVD infected lettuce plants with Olpidium brassicae spores in the roots. Leaf and root contact did not occur. The infection time ranged from one hour to 16 days, after which the plants were cultured under isolated conditions for symptom assessment. LBVD symptoms occurred in 61 per cent of 2 x 90 plants, independent of the infection time.

Pepper mosaic (tobacco mosaic virus (TMV))

Infection experiments were carried out in order to identify occurring TMV-strains in the Danish pepper cultures. Seeds of different pepper plants from Dr. B. Rast were, together with 2 Dutch TMV pepper strains received. Nicotiana tabacum 'Xanthi' and pepper 'Hot Lips' developed local lesions and systemic mosaic, respectively against both the tomato, tobacco and pepper strains of TMV. The tobacco virus strain developed systemic infection in N.t. 'White Burley'. The pepper virus strain caused smaller local lesions in N.t. 'Xanthi', did not infect N.t. 'Samsun' and developed systemic infection in the pepper variety 'Bruinsma Wonder' in contrast to the tomato and tobacco virus strains.

Resistance against the mentioned TMV-strains was tested using different pepper varieties and crosses. Resistance against tomato-, tobacco- and pepper virus strains has been found in 19 of 26, 17 of 23 and 0 of 26 tested, respectively.

Seed infection in commercial pepper seed was investigated. The TMV-tomato strain has proved to be the only one in 8 of 23 seed samples (35 per cent), the main part coming from TMV susceptible varieties.

Survey of the spread of TMV in the Danish pepper culture has been carried through in 1980. Diseased plants were observed in 10 of 13 nurseries, and the TMV-tomato strain was found to be the only one in 22 of 31 collected samples.

Leek Yellow stripe virus (LYSV) and Shallot latent virus (SLV)

A wintering experiment was carried out with 9 varieties of leek ranging from varieties hardy to cold to less hardy. In the beginning of April, overwintering plants were found only in the varieties 'Ara Platina', 'Durabel', 'Ligina', 'Siegfried Frost' and 'Winta'. LYSV-infected leeks did winter with 25, 25, 17, 13 and 8 per cent and LYSV + SLV-infected leeks with 0, 0, 7, 4 and 3 per cent, respectively (20-100 plant/variety). Untreated leeks, grown 200 m north, wintered with 71, 43, 0, 71 and 14 per cent, respectively (7 plants/variety).

Virus diseases in ornamental plants (N. Paludan and A. Thomsen)

Storage of carnation cuttings in tubes. Storage experiments with the variety 'CC White Sim' were continued at 1°C in darkness over periods of 1 and 2 years, respectively. Carnation cuttings and cuttings with incipient shoot and root growth were used. After the experiment had been finished, cuttings were taken in order to investigate the growth ability of the stored plant material.

The experiments show that carnations can be stored up to 2 years with 100 per cent growth and only 2.5 per cent of contamination (3 og 120). The growth was very limited and only in few cases have the plants grown to the top of the test tubes (12 cm) over a 2 year storage period. Stem cuttings from plants stored for 2 years are ready for potting after 1 month's additional growth at 20°C with 16 hours illumination a day.

Storage of Chrysanthemum cuttings in tubes. It has been shown that it is possible to store Chrysanthemum cuttings for 1 year at different low temperatures. In the meantime, great variability in growth and development has been observed. In order to investigate which is the best plant material and temperature for storage purposes, top and stem cuttings from plants stored for 1 year were grown for 1 month at 12°C and 16 hours illumination a day. The optimal storage for Chysanthemum showed to be either as cuttings at 3°C in darkness or as small plants at 1 or 3°C in darkness. Top cuttings have been better than stem cuttings concerning a rapid development.

Pelargonium pedigree program. Established nuclear stock plants situated at the Glasshouse Crops Research Institute have been tested for virus infection. No reinfection has occurred during the past year. Virus free plants of other varieties have been established including 'Comtesse Irene', 'Penny Irene', 'Pink Cloude' and 'Springtime Irene'. Out of a total of 43 established meristem-tip plants, virus infection has been proved in 30 per cent and genetical alterations such as rugoused deformed leaves in 12 per cent. Genetical alterations only occurred in the varieties 'Comtesse Irene' and 'Penny Irene'.

Genetical tested pelargonium material, including the last 5 of a total of 15 varieties in the pedigree program, has been received from the Glasshouse Crops Research Institute. Virus infection has been proved in all 10 clones and meristem-tip culture started.

Storage experiments with pelargonium cuttings in tubes for 1 year have been finished. The best results were achieved at 9 and 12°C with 16 hours illumination a day but only 30 per cent of the original material did survive.

A survey of virus symptoms in Dieffenbachia was carried out in the month of October at 9 different growers' nurseries comprising 4,500 plants. Virus like symptoms were only observed in 2 mother plants in one grower's nursery.

Kalanchoe viroses. Preliminary investigations concerning virus infection in Kalanchoe have been started. To prove existing virus infection it has been better to use top grafting with shoot of Kalanchoe daigremontiana which has shown to be both the most sensitive and the most fast reacting indicator plant. The symptoms, which became visible within 1 month, consisted of white streaks, mosaic and deformed leaves.

The seasonal influence on the development of mosaic symptoms on virus infected Kalanchoe plants has, in the months of February, August and October shown to be 43, 21 and 29 per cent, respectively as an average of 14 varieties each with 40 plants.

Kalanchoe meristem-tip cultures have been started in 6 different media and the first plants have been potted after 2 months culture. The growth and development were best in the medium with the lowest concentration of inorganic nutrients.

Survey of virus like symptoms in Kalanchoe was carried out in the month of October concerning 6 growers and altogether 3,000 assessed plants. Virus like symptoms were not observed in the main variety 'Anette' or in the varieties 'Norisfeuer' and 'Sylvia'. In contrast, mosaic symptoms occurred in the yellow flowering varieties at all the growers' and furthermore in some other varieties of secondary importance.

Rose, meristem-tip culture. Meristem plants with roots are established from the following varieties: 'Chicago Pease', 'Peace', 'Schneewittchen', 'Sonja', 'Queen Elisabeth' and 'New Down'.

Cotoneaster dammeri, meristem-tip culture. Examination of different pH levels showed the most harmonious plant growth in medium at PH 5,5. The maximum multiplication effect from BAP obtained at pH 5,o.

Dutzia magnifica, meristem-tip cultures. By meristem-tip culture established from Deutzia magnifica mosaic virus was eliminated.

Five clones of Deutzia magnifica have been subjected to examination and the best clone will be further propagated.

Serology and purification (Mogens Christensen)

Potato leafroll virus (PLRV). The following 32 potato varieties which were included in the pedigree work on potatoes and which were cultivated in the greenhouse at Blangstedgaard were by the ELISA method tested for infection with PLRV: Alpha, Amia, Apollo, Aspargeskartofler, Bintje, Desirée, Dianella, Erstling, Frila, Hansa, Jaerla, Kaptah, Kennebec, Kenva, Majestic, Minea, Octavia, Ostara, Patroness, Posmo, Primula, Rosva, Saturna, Sharpes Express, Sieglinde, Sientje, Sirtema, Tertus, Up to date, Urgenta, Vandel 69 og Vandel 7o.

The immunoreagents for the investigation were most kindly provided by Dr. R. Casper, Braunschweig and Dr. B. D. Harrison, Dundee. By spot tests 4 clones of each variety were tested and all the tested plants were found to be free from PLRV infection. Some of the pedigree material grown at the Fiilsø area was also tested by the ELISA method for PLRV and potato virus Y (PVY) using immunoreagents from Inotech i Switzerland.

16 lots covering 13 varieties were tested and in each of the following 5 varieties, Bintje, Octavia, Sientje, Spunta and Up to date one plant was found to be infected with PLRV. The infected plants had not been detected by the visual examination in the greenhouse.

As to PVY infection the ELISA test agreed with infection trials using the tobacco variety Xanthi as test plant.

The ELISA method. Immunoreagents to potato virus M, (PMV) Potato virus S, (PVS) Potato virus X (PVX) and Potato virus Y purchased from Inotech in Switzerland, were compared with immunoreagents prepared at the Plant Pathology Institute.

The reagents to PVM, PVX and PVY produced at the institute reacted just as specific but stronger as the purchased ones, while the PVS reagents produced at the institute did not react quite as well as the purchased ones did.

The following equipment has been tested.

1) Titertek Autodrop dispenser

2) Titertek Multiskan fotometer
3) Gugerli-Pollähne testborer or samplerdiluter-dispenser
4) Pollähne roller sappresser
5) Skatron Multiwash, washingmachine

The first four instruments mentioned worked very well, while Skatron Multiwash did not serve the purposes when washing plates containing either leaf extract or tuber extract.

Delivering of antisera. 315 ml of antisera (corresponding to 65o.ooo tests) has been delivered to control and breeding institutes in Denmark and the other Nordic countries.

Electron microscopy (J. Begtrup)

During the year 198o 16o5 samples were examined under the electron microscope, and 4o different viruses were found in 57 different species.

With the embedding technique 115 examinations were carried out; this is less than for the year 1979, which is due to a delay in the project "MLO in Denmark".

During 198o immuno electron microscopy has been greatly applied.

The development of the new IEM technique is now a reliable and a safe method for identification of several viruses, when a useable antiserum is available. A description of the method to carry through analysis of 2o different isometric viruses has been worked out and now being used as a routine method in EMLAB here at the institute. Among the viruses diagnosed are Tomato ringspot virus, Cucumber mosaic virus, Arabis mosaic virus and Tomato aspermy virus.

Besides the IEM-technique the cut squeeze method is still being greatly used.

2. New attacks of virus diseases 1980

Virus infection was detected in the following species:

Bougainvillea sp. (TMV-tobacco strain)
Euphorbia loricata (Ring spot virus)
Euphorbia pulcherrima (Mosaic and Cryptic virus)
Hoya australis (transferred to tobacco)
Jasminum sp. (transferred to tobacco)
Kalanchoe sp. (Bacilliformed particles)
Yucca elephantipes (Tobacco necrosis strain A).

V. ZOOLOGY DEPARTMENT, K. Lindhardt

1. Experimental work

Cereal root nematode (Heterodera avenae) (J. Jakobsen)

The testing of the four resistance breaking populations which were revealed in Jutland was continued. The reactions to a testsortiment of cereal varieties seem to show some differences between the populations and further testing will be necessary. Measurements have shown no distinct variations from Heterodera avenae although the figures as an average are smaller than those of the normal species.

Fungi parasitizing the cystcontent of cereal root nematodes (M. Juhl)

Treatment of the soil with fungicide was used to show the significance of the parasitic fungi for the reduction of the nematode numbers. In the autumn there was a considerably higher number of eggs and larvae in those plots which had been treated. Investigations now also comprise a mycorrhiza fungus, Glomus sp.

Experiments on the significance of the winter temperature of the soil for the activity of parasitic fungi were continued for the fourth year. Soil heated to about $5^{o}C$ during winter contained far fewer eggs and larvae - in samples taken in the following spring as well as in the autumn. Further fungal parasitism of eggs and larvae was much higher in treated than in untreated soil.

Potato root nematode (Globodera rostochiensis) (K. Lindhardt)

About 8,900 soil samples were received from the Government Plant Protection Service and examined for the presence of cysts of potato root nematodes. The samples originated mainly from the production of controlled seed potatoes, but also from nurseries, bulb growers and exporting market gardens. A special examination of the occurrence of this nematode on the island of Samsø, where early potatoes have been widely grown for many years was started.

For the Potato Breeding Station at Vandel a number of new varieties were tested for resistance to nematodes. In all 3,2oo tubers were tested comprising about 2,ooo clones for a first testing and about 6o for a second testing.

In a glass house a propagation of Globodera pallida Pa 2 and Pa 3 has been started with a view to a later testing for resistance to these nematodes, which have never been found in Denmark.

Control of aphids (J. Reitzel and J. Jakobsen)

At four stations, experiments were made on barley and winterwheat to see the effect of insecticides applied on different dates. However, aphids were too scarce and too unevenly spread to obtain meaningful results.

In cages in a barley field the effect of some newer pesticides was examined. Unfortunately these results also varied too much, possibly due to the presence of ground- and rovebeetles in the cages.

Insecticide resistance in Danish peach potato aphids (Myzus persicae) (Ole Carsten Pedersen and Jørgen Reitzel)

Problems with peach potato aphid control due to resistance have been known in Denmark since 1969. The aim of the current project is to introduce the in England recently developed totalesterase -assay for the diagnosis of resistant individuals. Later on the frequency and geographical distribution of resistance will be assessed. Furthermore, we aim to investigate whether there are biological correlates to resistance. These could be differences in multiplying potential or in the yearly cycle (holocyclic ↔ anholocyclic).

Biological control of aphids in glasshouses (J. Reitzel)

The investigations concerned the use of the gall midge, Aphidoletes aphidimyza against Myzus persicae infesting glasshouse crops, especially Capsicum annuum. The experiments were carried out by

the biology student Lise Stengård Hansen and mainly comprised times and ways for introducing the gall midges. The results obtained were so satisfactory that chemical control was superfluous.

Feromone traps for warning against cutworms (larvae of Agrotis spp.)(P. Esbjerg)

Natural and synthetic feromones of Agrotis segetum were tested in the field to see the effectivity of the various components of the artificial feromone compared with the natural one. These experiments are part of a larger Swiss-Danish project lasting several years. A new type of trap has been developed which is considered to be considerably more effective than previous models. Also investigations on the variation of the density of Agrotis larvae in relation to climate and culture methods with a view to establishing prognoses and integrated control are comprised.

Agrotis larvae raised on artificial food and under uniform conditions have been used for experiment with some newer insecticides but this work must continue in 1981 to obtain safe results.

Integrated control of pests in cruciferous oil plants (B. Bromand and F. Lind)

Main items of these investigations concerning Meligethes aeneus, Ceutorrhynchus assimilis and Dasyneura brassicae are: Damage thresholds in spring sown rape, possibilities of spray warnings, forecasting, field- and laboratory investigations of new pesticides e.g. pyrethroids. A special device has been developed for the rapid extraction of larvae and pupae from soil samples.

Methods for testing the effect of pesticides on the predacious mite Phytoseiulus persimilis and the parasitic wasp Encarsia formosa (Lise Samsøe-Petersen and J. Reitzel)

Due to the results of residues it has been considered necessary to put a greater stress on the deadly effect of the pesticides and the effect on the capacity of reproduction of the insects while

the generally used criteria are the capacity to eat and to parasitize. Results of this work cannot be expected until at the end of 1981.

Soil inhabiting pests of sugarbeets (Lars Monrad Hansen)

This investigation has been started and is sponsored by a private committee of sugarbeet growers. It is especially concerned with the occurrence and biology of Collembola (Onychiurus spp.) and millipeds. In different parts of the country, but mostly on the eastern islands, a large number of soil samples were taken and processed. They represented various soil types, and the use of varying amounts of manure and straw. A preliminary report has already been worked out but the work will be continued in 1981.

2. New attacks of pests in 1980

Two insect species imported with ornamental greenhouse plants (K. Lindhardt and P. Esbjerg)

A new moth has been introduced from tropical areas in particular with imported plants (among others Dracaena spp. and Yucca spp.).

The moth is Opogona saccharoides (syn. O. subervinella), which is polyfagus and therefore potentially very harmful. In other countries Cactus and Sansevieria are also among the host plants. The duration of the larval period is 2-3 months, while the adult moth has a life span of only 6-8 days. Only the adults may be controlled chemically, as the larvae prefer darkness and keep inside the plant tissue boring tunnels.

Another pest which was accidently introduced to greenhouses is the serpentine leaf miner (syn. the American leaf miner) Liriomyza trifolii. This fly was introduced with chrysanthemum cuttings imported from nurseries in Kenya. As experienced elsewhere, control of this species is more difficult than control of the more common leaf miner, Phytomyza syngenisiae, but fortunately this fly does not seem to be widespread in Danish glasshouses yet.

B. NATIONAL PESTICIDE RESEARCH INSTITUTE

Approval Scheme, E. Nøddegaard

The Institute carries out experiments with pesticides for use in agriculture and horticulture with a view to having the pesticides approved.

Firms submitting pesticides for testing receive confidential information about the results.

Approved pesticides are specified in the publication:"Pesticides approved by the State Committee on Crop Husbandry".

The list is revised every year in January. A supplementary list is published in April. Only pesticides registered by the Environmental Protection Agency for use in accordance with the approval are listed.

I. AGRICULTURE (Knud E. Hansen and Bent J. Nielsen)

Fungal diseases

Seed treatment of cereals. The experimental work with non-mercury compounds has been continued. Some active ingredients were tested, partly individually and partly in combinations for a better all-round effect.

Against barley leaf stripe (Drechslera graminea). 12 compounds have been tested in field and greenhouse experiments in 2 lots of spring barley. When untreated 8-15 per cent of the plants were attacked.

Generally the best effect was obtained with compounds containing imazalil, prochloraz, nuarimol and the mixed compound Baytan Universal.

Against stripe smut of rye (Urocystis occulta) and bunt of wheat (Tilletia caries). 8 compounds have been tested in field experiments. Both diseases were controlled effectively by carbendazim - and propiconazol-containing compounds. Baytan fully controlled stripe smut, but only double dosage had a satisfactory effect against bunt.

In a few experiments on winter rye some attack by Fusarium nivale occurred which produced a reduced number of plants. Compounds which contain carbendazim increased the percentage of overwintering plants from 54 p.c. in untreated, to 94-98 p.c. after seed treatment, while other compounds had a weaker influence on the overwintering.

In 8 yield experiments in spring barley no significant yield increases were obtained by treatment of seed with weak attack by germinate-inhibiting fungi. The same results were obtained in 3 experiments on winter rye and -wheat.

Powdery mildew (Erysiphe graminis) on cereals. A project financially supported by the Danish Agricultural and Veterinary Research Council has been started with special reference to investigations into the possibilities of preventing or restricting transference of powdery mildew via winter cereals to the following year's spring sown crop.

To this end, several fungicides have been screened for mildew effect, primarly used as seed treatments.

Several newer fungicides with systemic action have some effect against early attack by mildew. But for most compounds the effect is too short term to give an effective control.

Few compounds seem to have an effect which lasts long enough to prevent overwintering on winter barley by correct treatment and dosages.

Brown rust (Puccinia hordei). Experiments with 3 compounds used as 1 and 2 sprayings are continued. No attack by rust occurred. In defiance of this sprayings by Bayleton 25 WP in particular gave marked increases in yield.

Eyespot (Cercosporella herpotrichoides). Experiments with testing compounds have been carried out in areas where attack has been registered. As in previous years, the best effect was obtained by carbendazim and benomyl containing compounds. Thiophanat-methyl, thiabendazole and prochloraz had a slightly weaker effect on eyespot. The biggest yield increase was obtained by prochloraz, combination of propiconazol and carbendazim, and in a single experi-

ment by combination of thiabendazole and captafol. Like this, there has been no correlation between the effect against eyespot and yield increase. It suggests the presence of other fungi which can influence the results.

Pests

Fritflies (Oscinis frit). Experiments have been carried out on maize with seed treatment, furrow treatment before sowing and spraying during growth.

Furrow treatment with carbofuran reduced the amount of heavily attacked plants from 17 p.c. in untreated plots to 1 p.c., and gave the highest yield increase. Spraying with pyrethroids or organophosphate compounds had a slightly weaker effect. Controlling frit flies resulted in a higher yield of plants and more cobs.

Peach potato aphids (Myzus persicae). 3 granules and different types of spraying compounds were tested for effectiveness against green aphids.

Granules which contain aldicarb or thiofanox gave effective control for a longer period than carbofuran granule.

In the spraying experiments a good effect was obtained by systemic compounds such as pirimicarb and methmidophos. Pyrethroids and organophosphate compounds without systemic activity had no effect or a minimal one. As shown in earlier experiments it is difficult to kill green aphids by contact insecticides because the pests mostly live on the under side of the leaves.

Blossom beetles (Meligethes aeneus) and cabbage seed weevils (Ceutorrhynchus assimilis) in rape. 5 synthetic pyrethroids, 4 organophosphates and methoxychlor have been tested by spraying in winter- and spring rape.

The experiments were carried out in the flowering season. Counting the number of insects was done by sweepings, several times after spraying.

Against blossom beetles different types of compounds had nearly the same effect. Carbophenothion had slightly less effect probably because of dosage being low.

Against cabbage seed weevils the pyrethroids were more effective than both the phosphate compounds and methoxychlor were.

II. HORTICULTURE (A. Nøhr Rasmussen and E. Schadegg)

Fungal diseases

Apple scab (Venturia inaegualis)

Because of abundant rainfall more scab occurred than had done for several years, even though the attacks started late in the summer. The most severe attack occurred on 'Golden Delicious'. 9 compounds were evaluated. Liquid formulations of carbendazim and thiophanat-methyl had a better effect but caused more russeting than wettable powders. Baycor 25 WP and PLK-Vondozeb had an adequate effect on the scab and caused little russeting. Of older compounds tested captan and captafol had the same, and folpet, a weaker effect than the newer compounds.

Pear scab (Venturia pirinae)

The attack was weak. Among 5 compounds tested, captafol and folpet had the best effect.

Sooty Blotch (Gloeodes pomigena) on pear

Abundant rainfall and lack of sunshine caused severe attacks of sooty blotch both on fruits and leaves. None of the compounds tested against pear scab entirely prevented the attacks from Sooty blotch. Best results were obtained from folpet and captan.

Apple powdery mildew (Podosphaera leucotricha)

In two experiments the effectiveness of 33 compounds approved over several years was to check up on the powdery mildew, using the approved dosage rates. In both experiments triadimefon 5% a.i., fenarimol 12% a.i., binapacryl 48% a.i. and two combined compounds contenting sulphur 53% a.i. + Nitrothalisopropyl 16,7% a.i. and binapacryl 20% a.i. + lindan 7% a.i., respectively were significant more effective than sulphur Wettable Powder.

American Gooseberry mildew (Sphaerotheca mors-uvae) on black currant

Both experimental varieties 'Boskoop Giant' and 'Wellington' were heavily attacked by mildew. A new formulation of triadimefon (5% a.i.) and dinocap E.C. both gave satisfactory effect, whereas thiophanat-methyl had but a slight effect.

Leaf spot (Gloeosporium ribis) on black currant

The attacks by leaf spot were very heavy, of the seven compounds evaluated PLK-Vondozeb (maneb + zineb) and a liquid formulation of mancozeb (Dithane LF) were most effective, but the effectiveness of captan (Orthocid 83) and mancozeb (Dithane M 45) was also satisfactory.

Grey mould (Botrytis cinerea) on strawberries

The abundant rainfall which occurred in 1980 caused the greatest attack by grey mould seen for many years. Therefore the effect of the six compounds tested was very small. The best effect was obtained by totylfluanid, carbendazim and thiophanat-methyl which gave an excess yield of 12, 8 and 7 kg of berries per 100 m^2, respectively. A later spraying with iprodion on green berry increased the effect against the grey mould but decreased the yield of berries by 7 kg per 100 m^2.

Fairy rings (Marasmius oreades in lawns (E. Schadegg)

In an experiment in which spraying took place just after the thaw on 26 March, oxycarboxin kept the grass free of Mushrooms of Marasmius oreades until the middle of July whereas carboxin as granule and wettable powder had no effect at all.

In another experiment when spraying took place while the mushrooms grew in the turf, on 25 June, oxycarboxin kept the plots free from mushrooms for the rest of the summer. Carboxin was less effective.

III. New pesticides tested in 1980 (E. Schadegg)

In 1980 the Pesticide Research Institute evaluated,including reference compounds, 57 fungicides, 47 insecticides and 44 fungicides for dressing of cereals, other seeds and potatoes, or totally 148 compounds in 141 experiments, out of which the pesticides mentioned below have been approved by the State Committee on Crop Husbandry.

Fusarium in spring barley
Grananit Plus, RH 2661

Leaf stripe (Drechslera graminea) in spring barley
Grananit Plus, RH 2661

Peach potato aphid (Myzus persicae)
Pirimor G

Fruit tree red spider mites (Panonynchus ulmi)
Acricid flowable (new formulation)

Blossom beetles (Meligethes aeneus)
PLK-Penncap-M, Ambush, Ripcord, Decis, Sumicidin 20 EC, AC 22275

Turnip seed weevil (Ceutorrhynchus assimilis)
Ambush, Ripcord, Decis, Sumicidin 20 EC, AC 22275

Snails (Gastropoda spp)
Mesurol sneglegift 1%

Powdery Mildew (Spharotheca fluginea) in glasshouse
Nimrod EC

Eyespot (Cercosporella herpotrichoides) on winter wheat
Derosal flowable 50%, Derosal flowable 45%, Derosal Combi Derosal flowable

Powdery mildew (Sphaerotheca pannosa) on roses in the open
Nimrod EC

Powdery mildew (Sphaerotheca macularis) on strawberries
Bayleton 5 WG

American gooseberry mildew (Sphaerotheca mors-uvae) on black currants
Bayleton 5 WG

Apple powdery mildew (Podosphaera leucotricha)
Bayleton 5 WG, Acricid flowable (new formulation),
Apple scab (Venturia inaequalis)
Topsin M-Fl., PLK-Vondozeb, Derosal flowable 50%,
Derosal flowable 45%

C. PLANT PROTECTION ADVISORY DEPARTMENT, GODTHÅB

by A. From Nielsen

The department was etablished in 1979 in order to initiate a closer co-operation within plant protection between the National Agricultural Research Council and the National Committee on Crop Husbandry. The main aims are: extension service in plant protection and testing pesticides for use in agriculture. These aims are being carried out in closer co-operation with the staff from the National Department of Crop Husbandry within this area.

EXPERIMENTAL WORK

Shootflies in grass (S. Holm)

Investigations carried out with maize and different grasses indicate that Oscinella frit is the dominant species.

Cereal leaf beetle (Lema spp.) (S. Holm)

Experiments in order to determine an economic threshold value in spring barley are being continued.

Results show that correlation between the number of eggs and the subsequent damage to the leaves is poor. The best time for estimating the need for control is in growth stage 9 (Feekes scale).

A provisional threshold value of 5 larvae per 10 straw with ears has been worked out for spring barley.

Mildew (Erysiphe graminis) in winter barley and adjacent spring barley (J.Simonsen)

Winter barley was released for common use by the 1979/80 season, if combined with mildew protective sprays. In the middle of May, 37 winter barley fields, mainly in the eastern part of Jutland, were examined at growth stage 7-9 (Feekes scale). Mildew was found in 6 of these fields, in which fungicidal treatment had been carried out too late or inaccurately. Adjacent spring barley was exa-

mined directly and by incubating samples in greenhouse, where 6 then revealed mildew, and 5 of these cases the neighbouing fields contained mildew infected winter barley.

In mid-June this examination was repeated, but now extending the examination range. Some winter barley fields now had 25-50 pct. mildew, and the spring barley (stage 9-10) here often reached 10-50 pct. mildew within 1-1½ km from the winter barley, but only 5-10 pct. beyond 2 km. When the winter barley had no mildew,the adjacent spring barley had no mildew or only as "normal" for the area.

Virus in Cocksfoot (J. Simonsen)

Along with the increasing use of cocksfoot virus symptoms have appeared in several places, mainly in older fields. Mainly in only few plants, but in some cases as much as 20-40 pct. have symptoms. Different viruses have been reported on cocksfoot. Investigations here in Jutland since 1978 only revealed "Cocksfoot mottle". Samples from 30 localities were checked by test plants and electronmicroscopy. Only two of them also had some elongated particles, resembling "Cocksfoot streak". It should be noted that this virus has been reported from East-Denmark (Engsbro 1975).

Mechanical transmission was proved by a small outdoor experiment.Young seedlings of cocksfoot were either sap inoculated or cut with a scissor dipped in inoculum. After 3 months the control had 6 pct. infected plants (invaded by cereal leaf beetle) while in the other groups there were 32 pct. and 39 pct., which during winter increased to 46 and 53 pct.

The fields gave evidence for mechanical transmission as infection rate coincided with the mowing pattern of the harvester.

Investigation of potato tubers discarded at grading (J. Bak Henriksen)

Causes of discarding tubers at grading were investigated in samples of cull from about 40 potato lots in 1979 and 1980. Deformed tubers were an important cause of the removal of tubers as

cull. Soft rot (Erwinia sp.) was the main cause of rot in both years, where the amount of precipitation was heavy in the autumn. In 1980 heavy attacks by late blight (Phytophthora infestans) occurred in some lots.

Seed treatment of potato tubers (J. Bak Henriksen)

The number of plants with blackleg symptoms in the middle of July was reduced in 1980 by treating the tubers at planting with 50 ml Solacol (validamycin) or 0,7 litre TOG (thiabendazole + 8-hydroxyquinilin) in 10 litres of water per ton and with 1000 g Tecto P 5 (thiabendazole). The number of deformed tubers were reduced a few per cent by the treatments with Solacol and TOG.

Effect of precipitation in relation to lifting time on the occurrence of storage diseases in potatoes (J. Bak Henriksen)

In 1979 lifting 30 hours after 18 mm fall of rain decreased the number of soft rot infected tubers compared with lifting immediately after rain. The soil temperature was soon the same as at lifting and 24 hours after rain, but the air was more dry. In 1980 lifting 24 hours after 16 mm fall of rain was without any effect. Drying of the samples one day at 10° C decreased the number of infected tubers, when they were stored at 12° C in the first two weeks.

Effect of soil temperature at lifting on occurrence of storage diseases in potatoes (J. Bak Henriksen)

In one experiment carried out over four successive years potato tubers were lifted within a day or two at soil temperatures between 1 and 12° C. Lifting at soil temperatures below $8\text{-}10^{\circ}$ increased the amount of tuber rot during storage. At some of the treatments lifting at 1 or 1.5° C increased the amount of partly rotten tubers from 10 to 90 per cent. The percentage of infected tubers depended more on the cause of disease, the temperature in the first two weeks after lifting and + or - treatment with thia-

bendazole.

Where gangrene (Phoma exigua var. foveata) was the main cause of disease the most severe attack occurred among tubers stored at $4^{o}C$ immediately after lifting, whereas tubers lifted at high soil temperature, treated with thiabendazole and stored for 2 weeks at $12^{o}C$ were least infected.

Where soft rot (Erwinia sp.) was the main cause of disease, the most vigorous attacks occurred among those lifted at the lowest temperature and stored in the first two weeks at $12^{o}C$.

On an average of all years and soil temperature at lifting the tubers were least infected, when treated with thiabendazole and immediately after lifting stored at $4^{o}C$.

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