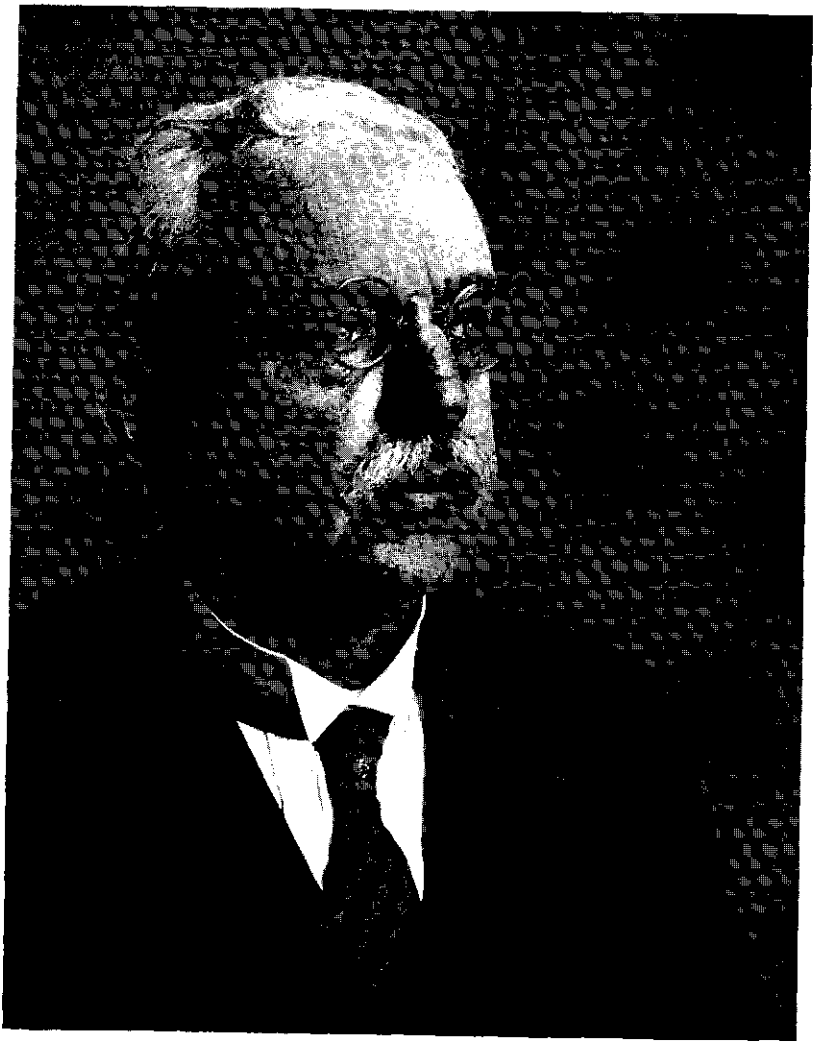
BOTANY IN THE NETHERLANDS



F. A. F. C. WENT † (1863—1935)
Late President of the Organizing Committee

BOTANY IN THE NETHERLANDS

EDITED FOR THE ORGANIZING COMMITTEE OF THE SIXTH INTERNATIONAL BOTANICAL CONGRESS

BY

M. J. SIRKS
Hon. First Secretary

LEIDEN
E. J. BRILL
1935

CONTENTS

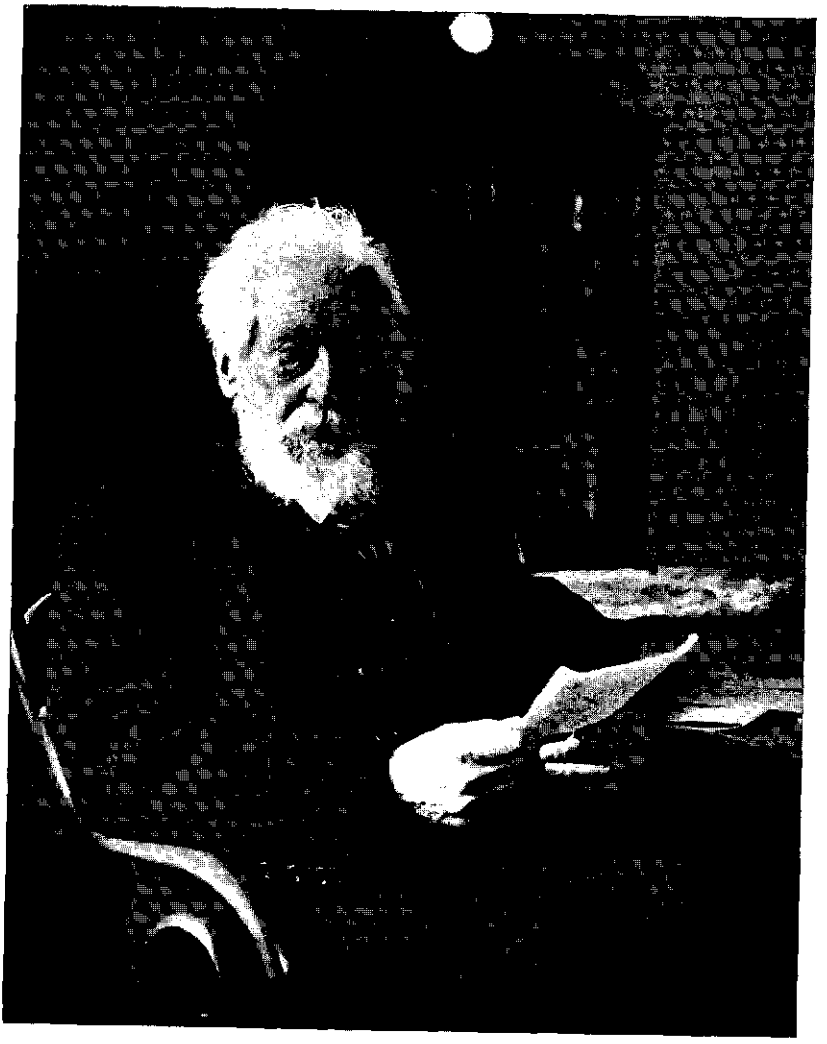
PREFACE

The Dutch Organizing Committee for the Sixth International Botanical Congress is herewith offering to the foreign members a sketch of the history and the present position of botanical science in the Netherlands and their Oversea Territories. It hopes that this summary will be of some use, more especially to those who wish to visit any of the Institutions, described hereafter.

The description of every laboratory or institution is made by its director, those of the societies by the president or the secretary, who are responsible for the contents of these paragraphs. The drawing of Dodoens' portrait was made by the skilled hand of Professor Dr W. A. Goddijn. The whole editing and the historical introduction is due to Dr M. J. Sirks, who certainly is to be thanked for the trouble taken also in this respect.

F. A. F. C. WENT.

July 1st., 1935.



HUGO DE VRIES †
(1848—1935)

I. HISTORICAL INTRODUCTION

Botany in the Netherlands goes back to the middle of the sixteenth century, the flourishing age of the Herbals, the period in which Botany as an offspring of the dominant medical science passed through its first real struggle for an independent existence. The Low Countries took so much interest in the plant world, that the printer Isingrin at Basle (Switzerland), who in 1542 printed the Latin edition of FUCHS' De Historia Stirpium Comentarii, published in the following year a translation in the language of the Netherlands "Den nieuwen Herbarius dat is d' boeck van den Cruyden" (1543), a splendidly illustrated folio-volume [1]).

At that time a young Dutch medical man, REMBERTUS DODOENS or DODONAEUS (1517—1585) wandered through Europe, visiting a number of Universities in Germany, France and Italy and went to Basle, where he came under the stimulating influence of FUCHS' work. DODOENS' interests were attracted to Botany and its charms. He returned to Mechelen where he was born in 1517, the son of a Frisian, Dodo Joenckema, who had come to reside there, and decided to prepare another work similar in nature, but better adapted to the needs of his fellow countrymen than the translation of FUCHS could be. DODOENS' work took a number of years before he could entrust his careful publisher Jan van der Loe at Antwerp with the printing: after certain partial publications, the complete herbal „Cruydeboeck" was published in 1554. Hence this year may be considered to have marked the Birth of Botany in the Netherlands.

DODOENS' fame soon spread among scientists; the famous University of Leuven offered him a professorship, which honour he declined, but in later years the recently-founded University of Leyden secured his services and in 1582 he was appointed professor ordinarius in the faculty of medical sciences. Though the lack of a botanical garden prevented DODOENS from any activity as „professor of botany" in the real sense,

1) A number of the old books mentioned here, will be shown at the exhibition in the Building of the Zoological Garden „Artis".

he may be considered to have been the first botanist as a University professor in the Netherlands. DODOENS' appointment demonstrated that Botany had come of age in our country. Leyden University enjoyed the presence of DODOENS among its professors for a few years only; his death in 1585 deprived botanical science of one of its most famous scholars. Botany, however, had been admitted as a University science; two years later (1587) GERARDUS BONTIUS (1536—1599) was appointed professor of botany, and it was his privilege to enter on his duties a few months after the Board of Trustees of the University had decided to found a botanical garden (April 13th. 1587). The Leyden Hortus Botanicus was the fifth among the great Botanical Gardens of the world to come into existence. The broad view taken by the Leyden Trustees soon brought another botanist of great renown to this University: in 1592 CAROLUS CLUSIUS (1526—1609) accepted their call. CLUSIUS immediately completed the project for the Botanical Garden, and we owe to his genius and activity the laying out of such a garden in a manner, far beyond the capacity of the general run of botanists of that period. CLUSIUS' garden not only contained medical plants; he developed it into a general botanical garden, where he made a number of interesting sowing experiments, inter alia with tulips. The first real centre of botanical studies in the Netherlands had found its home. In grateful memory of him a botanical garden according to CLUSIUS' plans has been recently reestablished as a section of the present University Garden at Leyden.

The close relations between Holland and the Eastern Indies awakened the interest of scientific men in the tropical flora of those regions. JACOBUS BONTIUS (1592—1631), the younger son of the Leyden botanist, became a medical doctor for the East Indian Company. In this capacity he visited part of the East Indian Archipelago where he made numerous notes on the flora and fauna of this unkown world. His own work „De medicina Indorum" (1642) did not contain any of his botanical observations; they were left by him to GULIELMUS PISO, who published them as a part of his own work (1658). Soon after, BONTIUS' initiative was followed by one of the Company's big men: H. A. VAN RHEEDE TOT DRAKESTEYN (1637—1691), Governor of the Coast of Malabar, a man of great organizing ability, who, with the help of missionaries, brahmins and native designers, collected a great number of drawings and Latin descriptions of the rich flora of those countries, so that, when he returned to Holland he was able to publish a most brilliant work in twelve folio-volumes „Hortus Indicus Malabaricus"

(1678—1703) in which he was aided by botanical professors, including A. SYEN (1640—1678, Leyden University) and JOANNES COMMELINUS (1629—1692, Amsterdam Athenaeum).

While VAN RHEEDE made his collections on the Malabar coast, a man of lower rank in the Company's service, but in scientific sense greatly superior to him, the „merchant" G. E. RUMPHIUS (1682—1702), lived in the Moluccas, far from the help of scientists. RUMPHIUS' zeal in collecting and drawing plants and other products of Nature's „cabinet of curiosities" was past all belief. In 1670 he had the most terrible misfortune possible to a scientist: he was stricken with blindness. Nevertheless he did not decrease his strenuous efforts; he continued to collect and carried on the drawing work by means of native assistants. His scientific work was not much favoured by his superiors; most of them shut their eyes to it, and did not help in any way. During RUMPHIUS' life none of his manuscripts were ever published; his zoological notes were collected and edited by his friend Dr. D'ACQUET in 1705, but the botanical studies, much more „dangerous" in the opinion of the commercial directors of the East Indian Company, were left unpublished until the Amsterdam professor of Botany JOHANNES BURMANNUS (1706—1779) assumed the responsibility of this most meritorious work, the „Herbarium Amboinense" being published in six parts in the years 1741—1750.

University professors of Botany in the seventeenth century for the most part were medical men, who taught Botany as a discipline, but without any personal research in this field. Some exceptions may be mentioned: the Groningen professor ABRAHAM MUNTING (1626—1683, whose classical volume „Waare oeffening der planten" may be considered as a very useful treatise on general botany), the Amsterdam botanist JOHANNES COMMELINUS (1629—1692) and the Leiden professors A. SYEN (1640—1678), P. HERMAN (1640—1695; first studies on the flora of Ceylon, Musaeum Zeylanicum) and P. HOTTON (1648—1709, Thesaurus phytologicus).

The outstanding figure among the 17th. century botanists in the Netherlands, however, was a man not connected with any university, the Delft amateur ANTONY VAN LEEUWENHOEK (1632—1723), a selfmade technical microscopist by the grace of God, who brought the world of the invisible before the eyes of his astonished colleagues. His fame was universally acknowledged by the scientific world. LEEUWENHOEK's numerous observations on zoological, protistological and botanical materials were of an exactitude such as is rarely found even among experts; his work brought him worldwide renown. His

„Sendbrieven" and his „Opera omnia" give full evidence of his right to be counted among the most eminent men in biological science: Founder of Microbiology may be his title of honour.

The flourishing period of the seventeenth century came to an end; the following one was an era of moderate prosperity in botanical science. Botany in the Universities was still controlled by medical professors. Among them a few enjoyed a widespread reputation, like HERMAN BOERHAAVE (Leiden, 1668—1738) and PETRUS CAMPER (Groningen, 1722—1773), but their fame was almost entirely built upon medical work; the only real botanist was JOHANNES BURMANNUS (Amsterdam, 1706—1779), the editor of RUMPHIUS' Herbarium Amboinense mentioned above. A few other facts deserve mention: LINNAEUS lived in Holland from 1735 until 1738. He was a student at Leyden University, took his degree at the small University of Harderwyk (June 24th., 1735) on a thesis „De nova hypothesi febrium intermittentium" and published the first editions of his classical works in Holland (Systema naturae, Leiden, 1735; Fundamenta botanica, Amsterdam, 1736; Hortus Cliffortianus, Amsterdam, 1737; Flora lapponica, Amsterdam, 1737; Genera Plantarum, Leiden, 1737). In commemoration of this bicentenary of the first edition of Systema naturae, an exhibition has been arranged at Amsterdam during the Congress. Botanical exploration of the Netherlands' colonies was at that time not very important: the work of FRANÇOIS VALENTYN (1666—1727) „Oud- en Nieuw-Oost-Indien" and the first botanical collections from Surinam by DALBERG and ROLANDER (1753) were the only prominent features of this exploration. Special mention may be made of the work of JAN INGENHOUSZ (1730—1799), born at Breda, whose publication „Experiments upon vegetables, discovering their great power of purifying the common air in sunshine and of injuring it in the shade and at night" (1779) is one of the classics of plant physiology.

On the whole, the eighteenth century can be considered as a rather unfruitful period, except for a few events of importance. As soon as the new era had begun, a strong revival set in. In 1800 the Utrecht professor of Botany JANUS KOPS (1765—1849) began the publication of a series of illustrations of indigenous plants „Flora batava", which has been continued until 1934. The old and honoured University of Harderwyk (closed in 1812) nominated as professor the young botanist C. G. C. REINWARDT (1773—1854), who later played such an important part in the Botany of the Netherlands Indies, while the chair of Botany at the Amsterdam Athenaeum was occupied by

GERARDUS VROLIK (1775—1859), who by his discoveries in the field of the „potato disease" became the first phytopathologist in this country. Above all, it was the renewed botanical exploration of the East Indian Flora that set its seal upon the development of Botany in the Netherlands; REINWARDT, who since 1810 had been professor at Amsterdam, took the leading part. In 1815 he was sent to the Netherlands Indies, charged with the organization of „Education, Medical Service, Agriculture, Manufacturing and Scientific Research". It seems self-evident that a scientific mind linke REINWARDT's should put the last part of his mandate in the first place. Very soon after his arrival he submitted to the Government a number of proposals, among which the most far-reaching, from a botanical standpoint, was the establishment of a botanical garden. This was founded on May 18th., 1817 and developed later into the Botanical Garden of Buitenzorg of worldwide fame. REINWARDT left the Netherlands Indies in 1822 to accept the professorship of Botany in the University of Leiden, where he died in 1854. He never published any description of his rich botanical collections, leaving this task to his successor, W. H. DE VRIESE (1807—1862) who edited the „Plantae Reinwardtianae" in 1856. REINWARDT's work in the Netherlands Indies was continued by C. L. BLUME (1796—1862), director of the Buitenzorg Botanic Garden from 1822 until 1826 and since 1829 director of the National Herbarium at Leiden. The „Hortus Bogoriensis" (Buitenzorg Botanical Garden) passed through a few years of depression, but in 1831 a very able, practical man, J. E. TEYSMANN (1809—1892) was appointed Curator of the Garden. TEYSMANN's task was a very heavy one: though a subordinate, he succeeded in upholding the interests of the garden against all efforts by the military staff of the Governor-General to annex it to the garden of the Governor's palace. TEYSMANN was temporarily aided by a few assistant-curators, including J. K. HASSKARL (1811—1894), who took an important part in the study of the East Indian Flora and who brought the first plants of Cinchona from South America to Java, partly as young plants, partly by means of seeds, which were sent to Leyden, and from there as seedlings to Java. In 1868 the Hortus Bogoriensis was again put under the direction of a man of science. R. H. C. C. SCHEFFER (1844—1880) took this post and kept it until his untimely death; his successor Melchior TREUB (1851—1910) was destined to develop the Hortus into one of the most interesting botanical gardens in the tropics.

Independently of the botanical garden, F. W. JUNGHUHN (1809—1864) made his studies on the Flora of Java; he came

to the Netherlands Indies as an officer of the military medical service, but a few years later was elected a member of the „Indian Science Committee", and as such he took a leading part in the geological and botanical exploration of Java. His monumental work „Java" (1850—1854) is still considered to be one of the most important contributions to our knowledge of the natural history of Java.

Finally, among those, who studied the flora of the tropical regions of the Netherlands, should be mentioned a man, who never visited these parts of the world, but whose publications on East Indian plants are among the most valuable: F. A. W. MIQUEL (1811—1871), who was first a professor at the Amsterdam Athenaeum, and later at Utrecht University and at the same time was director of the National Herbarium at Leyden. MIQUEL was a taxonomist of the Netherlands „par droit de naissance" but a student of the tropical flora „par droit de conquête".

Not only were University professors of Botany in the nineteenth century interested in the tropical flora, but a number of unofficial botanists contributed interesting works on this subject, especially of the cryptogamic flora (Bryophytes and Ferns). We may mention R. B. v. d. BOSCH (1810—1862), F. DOZY (1807—1857), J. H. MOLKENBOER (1816—1854) and C. M. v. d. SANDE LACOSTE (1815—1887), each publishing a number of works, while the main publication of DOZY and MOLKENBOER's „Bryologia javanica" was edited after their death by v. d. BOSCH and v. d. SANDE LACOSTE. Those four men formed a circle of friends, who in 1845 took the initiative in starting the Nederlandsche Botanische Vereeniging (Netherlands Botanical Society), which is still the scientific botanical centre of the Netherlands. They were soon assisted by W. F. R. SURINGAR (1832—1898), who in 1857 became a professor of the Leyden University, and by C. A. J. A. OUDEMANS (1825—1906), professor of the Athenaeum at Amsterdam.

With a few exceptions, taxonomical and morphological studies prevailed until the second half of the nineteenth century, but since then, the development of Botany in the physiological sense and its division into many branches have become more and more apparent. About 1830 agronomy had already found a student in the Groningen professor, H. C. VAN HALL; in later years physiology assumed great importance from the work of HUGO DE VRIES (1848—1935), professor at Amsterdam, who was also one of the founders of modern genetics. C. A. J. A. OUDEMANS (1825—1906, Amsterdam) rendered splendid service to mycology and pharmacognosy, M. W. BEYERINCK

(1851—1931, Delft) was a prominent microbiologist, J. W. MOLL (1851—1933, Groningen) a morphologist of the first rank, and J. P. LOTSY (1867—1931) was wellknown by his taxonomical work, his studies in plantgenetics and as the secretary of the former Association Internationale des Botanistes. At present Botany in the Netherlands is cultivated in a great many institutions and societies, each of which is described in the following pages.

The reconstructed Hortus Clusianus (1592) at Leyden

II. INSTITUTIONS OF UNIVERSITIES AND UNIVERSITY COLLEGES

THE GOVERNMENT UNIVERSITY AT LEYDEN

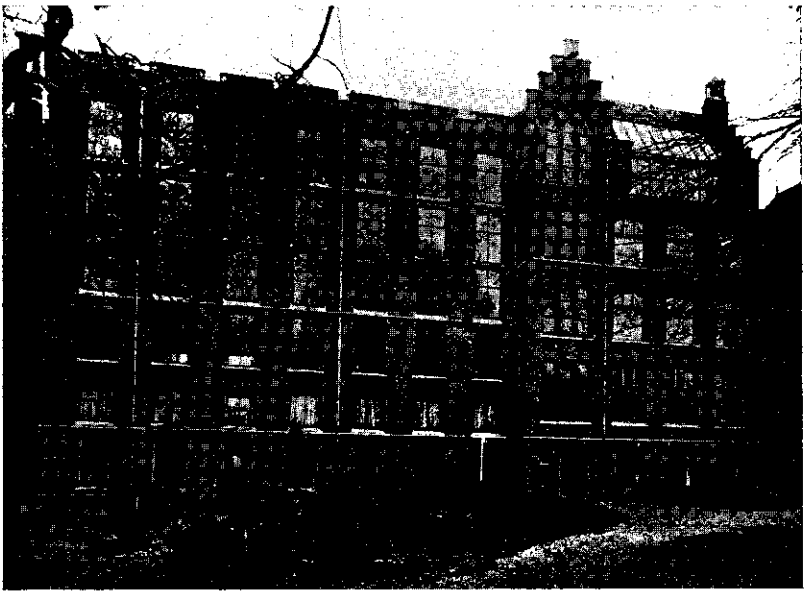
THE BOTANICAL LABORATORY (BOTANISCH LABORATORIUM)

The Leyden Botanical Laboratory and the Leyden Botanical Gardens (Present Director Prof. Dr. L. G. M. BAAS BECKING) date from 1587. The Gardens are the Fifth oldest in existence. They were only preceded by those at Pisa, Padua, Bologna and Leipzic. They were laid out by CLUYT; the first inventory from CLUSIUS dates from 1592. The first conservatory was built in 1599. The Garden was enlarged several times, e.g. under BOERHAAVE 1717, van ROYEN 1736, BRUGMANS 1817. A large number of economic plants have been distributed all over the world from this Garden. Horticulture owes a great deal to the original SIEBOLD imports from Japan, of which about 60 are still to be found in the Gardens.

Historical trees: *Laburnum* about 1600, a Tulip tree of 1685, a red hawthorn of BOERHAAVE's time, a *Lycium* of 1736, and others. The Hortus Clusianus of 1592 has been reconstructed. *Cluytia, Pavia, Clusia, Hottonia, Boerhaavia, Royenia, Brugmansia* and *Vriesia* are genera named after Leyden botanists. The relation with the tropics was already strongly developed under HERMAN ($\pm$ 1690), the 19th-century directors REINWARDT and DE VRIESE followed this tradition. General Botany made its entry with SURINGAR in 1862; three of his best-known pupils are Melchior TREUB, Hugo DE VRIES and Martinus Willem BEIJERINCK. The Laboratory at present specializes on the physical side of photosynthesis (spectroscopy and colloid-chemistry of chlorophyll, formation of chlorophyll from protochlorophyll, influence of H_2S on photosynthesis), on factors of environment (milieu, salt-organisms, a.o.), on antagonism of ions.

THE NATIONAL HERBARIUM (RIJKSHERBARIUM)

History. Founded at Brussels on March 31st, 1829, removed to Leiden in October 1830 (at first Rapenburg 33; from 1912 in the new building Nonnensteeg 1). Directors: 1829—1862: Prof. C. L. BLUME; 1862—1871: Prof. F. A. W. MIQUEL (in charge); 1871—1898: Prof W. F. R. SURINGAR (in charge); 1899—1906: Prof. J. M. JANSE (in charge); 1906—1909: Dr. J. P. LOTSY; 1910—1931: Dr. J. W. C. GOETHART; 1932



The National Herbarium (Rijksherbarium), Leiden, back side. Left hand half (7 windows): collection rooms, right hand half (3 windows): working rooms; between: staircase hall.

—1933: Dr. W. A. GODDIJN (acting); 1933-hodie: Prof. H. J. LAM.

Present Staff. Director: Dr. H. J. LAM (Phan., especially *Burseraceae, Sapotaceae* and *Verbenaceae;* phytogeography of Malaysia; flora of New Guinea), professor of systematic botany and phytogeography at the Government University at Leyden;

Conservator: Dr. J. TH. HENRARD (Phan., especially *Gramineae;* monographer of *Aristida* and *Digitaria*; nomenclature of Phanerogams);

Chief-Assistant: W. J. LÜTJEHARMS (Crypt., especially Fungi; history of Mycology; biological philosophy).

1st. Cl. Assistant: Dr. S. J. VAN OOSTSTROOM (Phan., especially *Convolvulaceae;* monographer of *Evolvulus*).

2nd. Cl. Assistant: Miss Dr. J. TH. KOSTER (Crypt., especially Algae; Phan., especially Compositae).

In addition, there are the following subaltern functionaries: 1 administrative clerk-librarian, 1 clerk with 1 attendant and 1 or more voluntary attendants (unemployed) in charge of the collections, 1 draughtsman-photographer with 1 attendant, 1 secretary to the director and finally 1 attendant for general work.

Collections. The Rijksherbarium is noted for its rich collections of older type specimens, especially of Malaysian species. Its basic collection was that of BLUME, later on augmented by those of ZIPPEL, KUHL and VAN HASSELT, REINWARDT, DE VRIESE, HASSKARL, BUSE, VAN DE SANDE LACOSTE, DOZY AND MOLKENBOER (Bryoph.), KORTHALS, JUNGHUHN, VON SIEBOLD (Japan), PERSOON, SPLITGERBER, W. D. J. KOCH (Synopsis), KÖRBER (Lichens), H. HALLIER, ELBERT, GODDIJN and LOTSY, Mrs. WEBER-VAN BOSSE (including, as well as her own collection of algae, those of KÜTZING, HAUCK and W. F. R. SURINGAR), etc.; and, in later years, a great number of specimens from the Buitenzorg Herbarium. Moreover the herbaria of the Netherlands Botanical Society (mainly plants from the Netherlands) and of the Netherlands Mycological Society are incorporated in its collections, which consist of almost 2 millions of specimens. Its collections are regularly augmented (in 1934: 17000 specimens, including the collection Weber-van Bosse) by purchase or by exchange or donation (thusfar particularly from Buitenzorg and New York). In 1934 about 8000 specimens were sent on loan to other institutions. The Rijksherbarium is second on the list of institutions which are to support Mr. C. E. CARR's trip to Papua, recently undertaken for collecting purposes.

Principal Publications, prepared from studies of materials of the Rijksherbarium or officially issued by the institute are:

BLUME, C. L. Flora Javae 1828, N. S. 1858.
SIEBOLD, Ph. Fr. VON, Flora Japonica I—II, 1835—1844.
BLUME, C. L., Rumphia I—IV, 1835—1848.
——, Museum Botanicum Lugduno-batavum I-II, 1849—1856.
DE VRIESE, G. H., Plantae Indiae Batavae orientalis, quas exploravit C. G. Reinwardt, I—II, 1856—1857.
MIQUEL, F. A. W., Flora Indiae Batavae I—III, 1855—1859; Suppl. (Sumatra) 1860, reprinted 1862.
——, Annales Musei Lugduno-batavi I—IV, 1863—1869.
——, Prolusio Florae Japonicae, 1866—1867.

——, Catalogus musei botanici Lugduno-batavi I. Flora japonica 1870.
——, Illustrations de la flore de l'Archipel Indien, 1871.
BOERLAGE, J. G., Handleiding tot de kennis der flora van Nederlandsch-Indië, I—III[1], 1890—1900.
SURINGAR, W. F. R., Musée botanique de Leiden, I—III, 1871—1905.
GOETHART, J. W. C., and JONGMANS, W. J., Plantenkaartjes voor Nederland, Afl. 1—25, 1902—1907.
Mededeelingen van 's Rijks Herbarium, nrs. 1—70 (incl. Atlas of nr. 20, and 54 a—c, 58 a—b), 1910—1933.
BLUMEA, A Journal of plant-taxonomy and plant-geography, I, 1934—hodie.

The „Mededeelingen" contain papers of various kinds among which the elaboration of HERZOG's Bolivian plants, of ELBERT's collection from the Lesser Sunda Islands and of VAN DEN BOSCH' *Hymenophyllaceae* (by W. A. GODDIJN), together with HENRARD's revision and monograph of the genus *Aristida*, are most prominent.

Though the collections are of a general nature, the great many types of Malaysian plants as well as the close connections with the herbarium of the Botanical Gardens at Buitenzorg, Java, made the study of the Malaysian flora the natural scope of the Rijksherbarium. A complete and concise flora of the Malay Archipelago is still lacking in a modern form, those by MIQUEL and by BOERLAGE, quoted above, being the most recent ones. The older local or partial floras are too well known to need mention here. After much more or less local monographical work had been done (*Bryophyta*, lists of *Fungi, Lichenes* and *Myxophyta, Orchidaceae, Pteridophyta, Verbenaceae*, etc.), the Buitenzorg Herbarium started in 1923 to issue modern and in some way uniform revisions of Malaysian plant families and genera, such as: *Bignoniaceae, Bombacaceae, Buddleiaceae, Burseraceae, Ceratophyllaceae, Cinnamomum, Combretaceae, Corynocarpaceae, Dipterocarpaceae, Droseraceae, Ebenaceae, Flacourtiaceae, Loganiaceae, Loranthaceae, Nepenthaceae, Orobanchaceae, Phallineae* and several *Fungi* genera, *Phylidraceae, Polygonaceae, Sapotaceae, Sarcospermaceae, Stylidiaceae, Styracaceae, Xyridaceae, Zygophyllaceae.*

Since 1933, the Rijksherbarium has followed this example, this being the only way to establish a reliable basis for a concise flora of the Netherlands Indies (most of the monographs contain data on plants from British Malaya, the British part of Borneo, the Philippines and the Australian part of New Guinea as well). The following plant families have, in collaboration

with Prof. DANSER (Groningen) and his pupils, been dealt with, according to this scheme: *Cornaceae* (DANSER), *Compositae* (*Vernonieae* and *Eupatorieae,* KOSTER), *Alangium* (BLOEMBERGEN), *Nyssa* (WASSCHER) and *Rigiolepis* (SMITH), while for the next years monographs are planned of the Malaysian Gramineae (HENRARD), and Convolvulaceae (VAN OOSTSTROOM).

The library of the Rijksherbarium contains some 5600 books (among which are many valuable herbals and other old editions), 736 periodicals (among which about 450 are current issues) and some 15000 reprints. Its journal Blumea is regularly forwarded to about 400 adresses, 54 of these are in the Netherlands, 184 in the rest of Europe, 59 in the U.S. of America, 13 in Central and South America, 14 in Africa, 41 in Asia and 17 in Australia and the Pacific.

Education. Ever since 1832 the Rijksherbarium has had close relations with the Government University at Leyden; these relations have recently been strengthened, in order to further the taxonomical and phytogeographical education of students. Undergraduates are not allowed to enter into the collection rooms or to use the herbarium materials; older students, however, are admitted, under certain conditions (established to secure expert use of the materials), being considered as temporary assistants and charged with various instructions of a taxonomical or geographical nature.

Exhibits 6th I.B.C. On the occasion of the 6th International Botanical Congress some special exhibits of original water colour drawings of plants (both published and unpublished) as well as some other items of interest, will be arranged for the benefit of visitors, who will be most welcome.

THE GOVERNMENT UNIVERSITY AT GRONINGEN

THE BOTANICAL LABORATORY (BOTANISCH LABORATORIUM)

The University of Groningen was founded in the year 1614, during the truce in the war between the republic of the United Netherlands and Spain. It was a provincial institution in the same category as the Dutch university established in Leyden in 1575 and the Frisian university in Franeker. After this latter had been closed, in 1843, the Groningen University was the only one in the northern provinces. Owing to its close connection with the town and the surrounding district it has always borne

a particular stamp, which has manifested itself inter alia in the contact which it has had for many years with agricultural instruction. The province of Groningen is an agricultural centre, far surpassing most other provinces in the wealth of its soil and the level of education of its population. In the 19th century rural economy was taught at the university by J. A. UILKENS and H. C. VAN HALL, and guidance was given to agricultural education in a time when the centralization of higher agricultural education at Wageningen had not yet taken place. There is still a contact with agriculture through the association for higher agricultural education, which organizes courses for agriculturists and has established a special chair in agronomy, occupied at the moment by Prof. J. KUYPER, and the object of which is to provide those students in the faculty of natural sciences who in their later sphere of activity will have to do with practice of agriculture, with guidance. The botanical instruction was given, until the nineteenth century, by professors belonging to the medical faculty. There were, however, some amongst these who concerned themselves more particularly with botany and the laying out of the botanical garden. Only a few names need be mentioned here; HENRICUS MUNTING [1]), 1642—1654, the founder of the present botanical garden, and his son ABRAHAM MUNTING [2]), 1658—1683, RUDOLPHUS EYSSONIUS, 1695—1705, and PETRUS CAMPER, 1764—1773. Professors in botany were H. C. VAN HALL [3]), 1826—71 and P. DE BOER, 1871—90, the founder of the old botanical laboratory (1874).

Botany at Groningen owes very much to Professor J. W. MOLL, who lectured on botany from 1890 to 1917. Although MOLL was originally a physiologist, he directed his great energies chiefly to the organisation and methodics of education and science. This is also strongly manifested in his publications. His efforts to construct good apparatus for physiological experiments, and his treatment of the anatomy and morphology of plants in textbooks and in manuals of instruction, demonstrate this interest in the arrangement of material. In his larger works „Pen Portraits" [4]) and „Phytography" [5]) he designed a system

1) H. MUNTING. Hortus et universae materiae medicae gazophylacium. Groningen 1646.

2) ABR. MUNTING. De vera antiquorum herba Britannica. Amsterdam 1681 e.a.

3) H. C. VAN HALL. Flora Belgii septentrionalis 2 vol. Amsterdam 1825—'40, e.a.

4) J. W. MOLL and H. H. JANSSONIUS. Botanical pen-portraits Martinus Nijhoff. The Hague 1923.

5) J. M. MOLL. Phytography as a fine art. E. J. Brill Leyden. 1934.

for the description of the anatomical and morphological characters of plants which will serve as a foundation for later workers. His strong personality had an influence on education which is still noticeable, the more so, since owing to his initiative a new laboratory was opened in 1899, built by the government architect J. VAN LOKHORST. This now 36-year old building has in many respects been the model for the botanical laboratories subsequently built in other university towns. It would still fulfil all requirements were it not that it has gradually become too small for the ever-growing number of students. Special mention should be made of the large hall for practical work, with its great windows to the north, and the lecture room with its lantern installation. MOLL was one of the first to grasp the importance of satisfactory projection. At the present time there is a collection of nearly 10000 lantern slides. MOLL had designed a room for constant temperature at the time the laboratory was being built. The number of these rooms was later increased, and is now six. At the same time he pointed out that a room for constant temperature need not also be a dark room. This principle that a sunless room is very well-suited for physiological experiments at a constant temperature and has a far less depressing effect on the student seems to be of great value for the future of our laboratories. The laboratory is situated on the south side of the botanical garden. Adjacent to it is the pharmaceutical laboratory, where C. VAN WISSELINGH, the well-known investigator of the cellular wall, lectured from 1906 to 1925.

The botanical garden developed in 1642 from the private garden of Professor MUNTING, and was enlarged in 1882 by the incorporation of the rural economy garden of Professor VAN HALL to an area of nearly one and a half hectares. The obsolete and scattered hothouses contain a great many valuable plants, especially cactuses, orchids, *Bromeliaceae* and *Platyceriums*. MOLL's genius for arrangement also expressed itself in the botanical garden in the introduction of an accurate system of bookkeeping of all the plants in the garden, as also of all the plants previously there, with their origin and further particulars. This system of bookkeeping was subsequently employed in Buitenzorg.

MOLL's successor as director of the Botanical Garden was his pupil J. C. SCHOUTE, 1917—1931. Plans were drawn up by him for the construction of a new laboratory, a suitable site for which was procured in 1918, the country seat de Wolf, in Haren. Unfortunately the unfavourable economic conditions after the war have retarded the realisation of this project. In

1930 a commencement was made with the laying down of an arboretum for the new garden, whilst various plots belonging to this land have already been in use for many years for genetic and agricultural experiments.

On MOLL's resignation as Director of the laboratory and Botanical Garden in 1917, a second chair was founded, which was occupied by him until 1921. In this he was succeeded by TH. WEEVERS, who accepted a professorship at Amsterdam in 1924. On the resignation of Professor SCHOUTE in 1931 W. H. ARISZ was appointed Director, after having lectured on plant physiology from 1926. Professors T. TAMMES and B. H. DANSER work in the Groningen laboratory together with him; they lecture on genetics and plant taxonomy, and discuss their work more fully below.

It is of great benefit to the Groningen laboratory that ex-professor J. C. SCHOUTE, after his resignation as Ordinary, has been willing to continue lecturing as private professor of morphology and to work at the completion of a handbook on external morphology.

It has already been stated that agronomy is lectured on by Professor J. KUYPER, commissioned by the Association for Higher Agricultural Education.

With regard to the physiological investigations, finally, I may state that at the moment investigations are being conducted on the calorimetry of autotrophic bacteria, the microcompensation calorimeter described in the thesis of L. ALGERA being made use of, whilst investigations have been concluded on the assimilation of food and transport through the tentacles and the leaf of *Drosera capensis* in connection with the thesis of J. OOSTERHUIS. More especially has a study been made of the conditions which affect the transport from leaves, whilst research into the significance and the growth of roothairs is in progress. The laboratory is provided with an ample collection of aids to physiological research.

THE SECTION FOR GENETICS (GENETISCH INSTITUUT)

The chair of genetics (Miss Professor Dr. T. TAMMES), the first at a Netherland University, was instituted in 1919. The lectures are given in the Botanical Laboratory; research work is carried on there, in the Hortus Botanicus; and, since 1921, in the experimental garden in the grounds of 'de Wolf' at Haren. They mainly concern genetic analysis, the action of the genes, their cooperation and the lability of the genes in *Linum, Pisum,*

Nigella, Papaver, Callistephus, Eschscholtzia, Vicia, etc. and in *Tenebrio* as a zoological object.

THE SECTION FOR PLANT TAXONOMY (AFDEELING VOOR PLANTENSYSTEMATIEK)

The Taxonomy Section (Professor Dr. B. H. DANSER) has been founded recently (1931). Its main purposes are twofold:

1) Monographic studies on groups of plants for special regions. Thusfar these studies have been confined to a few families from the Netherlands Indies (*Cornaceae, Alangiaceae, Nyssaceae*) and one family from the Philippine Islands (*Loranthaceae*);

2) Experimental studies to solve the problems of taxonomy, especially regarding the matter of limitations of species. Preparatory studies have begun recently, but a proper genus has not yet been found.

THE GOVERNMENT UNIVERSITY AT UTRECHT

THE BOTANICAL LABORATORY (BOTANISCH LABORATORIUM)

In the first centuries after the establishment of this University (1636) Botany was taught by members of the medical faculty, until, in the course of the 19-th century, it developed into an independent science. It was F. A. G. MIQUEL (1859—1871), who largely added to the significance of Botany as a science by his noted work on the flora of Java. But even in his time in Utrecht, Botany was entirely restricted to taxonomy, morphology and anatomy, MIQUEL's successor, N. G. P. RAUWENHOFF (1871—1896) being the first to introduce plant physiology into the University's programme. This line of botanical research, however, was brought to its full development by F. A. F. C. WENT, who directed the institute, 1896—1934.

Being a student of HUGO DE VRIES, WENT spent some time in the laboratories of STRASBURGER and VAN TIEGHEM, before he made his first visit to Java, being granted a stipendium by the „Buitenzorg-fonds". Overwhelmed by Nature in the tropics and deeply impressed by the work and organisation of MELCHIOR TREUB, WENT shortly after his return accepted an appointment with the Java-Sugar Industry. During five years (1891—1896) WENT was director of the West-Java Sugar Ex-

periment Station. These early experiences were of paramount influence on WENT's later work. He inspired his students by his conviction that the further development of the Dutch colonies should be attended by a thorough knowledge of nature in the tropics, i.e. by an adequate development of natural sciences. Along the lines indicated by TREUB, botanical science should give the base for the advancement of European cultivations (sugar cane, rubber, tea, coffee, cocoa, etc.), native agriculture, forestry and pharmaceutical plants (*Cinchona*). He felt that the near future would open a broad field of work for scientists in the colonies, especially for plant physiologists and phytopathologists.

In the first decade WENT was also in charge of education in taxonomy and plant geography, but since 1906 this part of botany was taught by A. A. PULLE, who in 1914 definitely was appointed as ordinary professor and director of the Botanical Museum and Herbarium. To plant pathology, earlier incidentally taught by WENT, in 1917 a new chair was devoted, with which Miss JOHA. WESTERDIJK was entrusted. Finally in 1930 J. A. HONING was appointed as professor in genetics. Although Miss WESTERDIJK, Messrs. PULLE and HONING hold their lectures in the Botanical Laboratory, this survey is further restricted to the work done under WENT's direction, in which plant physiology had the major share.

In this short review we have to omit a large number of investigations on different subjects, which are independent of each other. In the first years of WENT's direction, physiological interest was mainly focussed on microbiological (S. L. SCHOUTEN, 1901 [1])) and mycological subjects (H. P. KUYPER, 1904; C. J. BAART DE LA FAILLE, 1906). But later in this laboratory a line of systematic research initiated from two starting points. One of them was brought about by F. F. BLACKMAN's theory on limiting factors and on the temperature/reaction velocity ratio in vital phenomena. The other was given by A. H. BLAAUW (1909; Rec. 5) in his ideas on the nature of phototropy, which fundamentally attacked PFEFFER's conception of plant movements. The majority of WENT's pupils studied a subject either in one of the two directions or in a combination of the two.

J. KUYPER (1909, Rec. 7) evolved a method, accurate for that time, for investigating influence of the temperature on the rate of respiration, which afterwards was improved upon by D.

---

1) The year indicates the year in which the essay was issued. When published in the „Recueil des traveaux botaniques néerlandais", this is indicated by „Rec." and the number of the volume.

S. FERNANDES (1923, Rec. 20). An accurate apparatus for the measurement of photosynthesis in *Hormidium* was devised by T. H. VAN DEN HONERT (1928, Rec. *27*). In addition, a great number of essays appeared on the influence of limiting factors and temperature on physiological processes, e.g. on germination (Miss. L. C. DOYER, 1915, Rec. *12*), on growth (Miss E. G. C. TALMA, 1917, Rec. *15*), on protoplasmic streaming (M. L. HILLE RIS LAMBERS, 1926; H. P. BOTTELIER, 1934, Rec. *31*), on permeability of protoplasm (D. DE VISSER SMITS, 1925; — and H. RAMAER, 1926, Rec. *23*), on respiration (S. R. DE BOER, 1927, Rec. *25*; E. C. WASSINK, 1934, Rec. *31*) and on assimilation (F. VAN DER PAAUW, 1932, Rec. *29*). The influence of the temperature on the perception of and the reaction on „stimuli" was also investigated (A. A. L. RUTGERS, 1910; Miss M. S. DE VRIES, 1914, Rec. *11*).

Shortly after BLAAUW's (1909, Rec. *5*) discovery of the dependence of the phototropic reaction on the light quantity, an analogous relation was found in geotropism by Mrs. C. RUTTEN-PEKELHARING (1909, Rec. 7). Later W. H. ARISZ (1914) succeeded in establishing a proportionality between the applied lightquantities and the phototropic response. These investigations were stimulated by BLAAUW's theory that phototropism would represent a special case of photo-growth reactions. The succeeding period was devoted to measurements of the growth (especially in *Avena*-coleoptiles) as influenced by illumination and gravity (clinostat rotation) (V. J. KONINGSBERGER, 1922, Rec. *19*; 1923, Rec. *20*; C. VAN DILLEWIJN, 1927, Rec. *24*; F. W. WENT, 1927, Rec. *25, 25a*; H. E. DOLK, 1930). Although a number of new data were obtained, the results failed to yield conclusions on the internal mechanism of growth and tropism. The whole aspect and technique of the problem were changed, however, by F. W. WENT's isolation of growth-substance (1934: KÖGL: auxin) and by his successful attempts to elaborate a method of quantitative analysis (1927, Rec. *25*). A great number of essays were issued in the following years on a) phototropism and auxin (J. VAN OVERBEEK, 1932, Rec. *30*; H. G. DU BUY, 1933, Rec *30*; see also H. G. DU BUY and E. NUERNBERGK: Ergebnisse der Biologie, 9 and 10), b) geotropism and auxin (H. E. DOLK, 1930; M. J. DIJKMAN, 1934, Rec. *31*; J. W. PFAELTZER, 1934), c) distribution and transport of auxin (Miss. I. E. UYLDERT, 1931; H. G. VAN DER WEY, 1932, Rec. *29*), d) auxin formation in roots (Miss C. J. GORTER, 1932), e) influence of auxin on the plasticity of the cell wall (A. N. J. HEYN, 1931, Rec. *28*).

Investigations of this kind persist at the moment. The structure of the cell wall is studied by means of X-ray diagrams

(HEYN). Studies on the growth of roots (auxin, pH and ion activity of the medium) are carried on. Further, a number of graduates are working on miscellaneous subjects with different apparatus.

The major part of the laboratory, however, is devoted to the training of undergraduates. During the first year an elementary practical course in anatomy is given, in which the medical, veterinary, chemical, geological and pharmaceutical students also have their share. During their second year the biologists have to follow STRASBURGER's wellknown handbook on microscopy. In the third year they are taught microbiology. During the following years they have to study two or three subjects by repeating work, that has already been published. For exact physiological work three dark rooms are available in the basement of the building, where the temperature and the humidity of the air can be kept constant.

Present conditions show no change from those obtaining when V. J. KONINGSBERGER took over the direction from F. A. F. C. WENT in July 1934.

THE BOTANICAL MUSEUM AND HERBARIUM (BOTANISCH MUSEUM EN HERBARIUM)

Since the death of F. A. W. MIQUEL in 1871 instruction in systematic botany passed through a long period of decline and decay. N. W. P. RAUWENHOFF, MIQUEL's successor, was a physiologist, and did not occupy himself much with systematic botany. His teaching was confined to elementary lectures in this branch to students in medicine and pharmacy. RAUWENHOFF's successor, F. A. F. C. WENT, who was also a physiologist, but who, owing to his long sojourn in the Netherlands East Indies, was deeply interested in the flora of the tropics, succeeded in 1906 in securing for his pupil Dr. A. A. PULLE an appointment as lecturer in plant taxonomy. Dr. PULLE was familiar with the flora of the colonies, having in 1902—1903 participated as a botanist in an expedition to Surinam, and having visited the East Indies in 1906 on behalf of the Buitenzorg Fund. After PULLE's voyage in 1912—1913 to the upper region of the mountains of Netherlands New Guinea as a member of the 3rd scientific expedition to this country, the lectureship in taxonomy was in 1914 commuted into an ordinary professorship. In 1910 plantgeography had been added to his curriculum.

The large number of botanical students at Utrecht since

1910 have also given rise to a revival of the study of taxonomy. After the years of ascendency of plant physiology a botanical professorate has for the first time been held again by a taxonomist. Consequently the great majority of young taxonomists in the Netherlands are ex-pupils of Utrecht University. Since 1918 when a new building was provided, and more workingspace made available, the study of taxonomy has expanded materially. The great extension and the excellent accomodation of the herbarium have largely contributed to this.

The University owned a small and not very important herbarium. The latter only became important, when, after the death of MIQUEL, his private herbarium had been acquired. During the period, when he was a lecturer at Rotterdam and a professor at Amsterdam, MIQUEL had occupied himself a great deal with the flora of Surinam, and had, through this, obtained possession of the collections published in his Stirpes Surinamenses Selectae (1850). During the compilation of his Flora of the Dutch East Indies (Flora Indiae Batavae) 1855—1860 and his study on *Sapotaceae, Moraceae* and *Cycadaceae*, his collections were especially enlarged with a great number of types published by him. Also his connection with many prominent European botanists considerably enlarged his herbarium, so that, after purchase of these collections, the Utrecht Herbarium had already gained some reputation as a type-herbarium. During the professorate of RAUWENHOFF it was further enlarged, inter alia with a fairly large collection of duplicates from India, which were annually received as a present from the Botanical Gardens at Calcutta.

When in 1906 lectures on taxonomy were re-established at Utrecht, the herbarium was re-arranged and made properly accessible to research. The most important material collected on the expeditions, which nearly every year from 1901 till 1910 penetrated deeply into the unknown interior of Surinam, came entirely to the Utrecht Herbarium, and was worked out by A. PULLE, who, in 1906, with his „Enumeration of the Vascular Plants known from Surinam", published a prodrome for a flora of this country. The material of the expeditions after 1906 was published by him in various papers in the Recueil des Travaux botaniques néerlandais. In 1912 the first part of a pocket flora of Surinam, with identification keys for the families and genera, was published, compiled by A. PULLE.

Meanwhile the curator Dr. I. BOLDINGH had in 1906 and in 1909/1910 made trips to the Dutch West-Indian Islands, of which two studies on the flora and plant-geography of these islands and a complete Flora with identification keys (1913) were

the result. The material of these two travels is also to be found in the Utrecht Herbarium. Meanwhile a Forestry Bureau had been established in Surinam, the officials of which had as early as 1905 begun to collect material of forest-trees. Especially since 1914 the herbarium has been greatly enlarged, owing to the enormous collections of the forester J. W. GONGGRIJP and of the director of the Agricultural Research Station Dr. G. STAHEL. In 1920 Dr PULLE made another journey to Surinam, whilst the curator Dr. J. LANJOUW also visited there and brought home a large collection. In the meantime A. PULLE had also been engaged in arranging a number of plant families from New Guinea, obtained on some important expeditions to the mountains of this island (cf. Nova Guinea Vol VIII, Vol XII and Vol. XIV). Duplicates of the collections obtained on these trips and co-types of the new species are (now) in the Utrecht Herbarium.

In 1918 a new botanical Laboratory was opened for use. The Herbarium and the Museum are to be found in a separate wing of this building, together with workrooms for the staff, research-workers and students. Ampler means made it possible to purchase more collections and to supplement and extend the long neglected systematic library.

After 1918 the staff, as well as older students, have occupied themselves with several kinds of botanical research work, of which a short survey is added here.

A. PULLE, F. A. F. C. WENT, S. BIRNIE, W. SLIS, C. VAN STEENIS, F. W. WENT, J. LANJOUW and F. VERDOORN published articles in „Nova Guinea" on Dutch East Indian Flora. VAN SLOOTEN worked up *Combretaceae* and *Flacourtiaceae* (1919), H. J. LAM *Verbenacae* (1919), C. VAN STEENIS *Bignoniaceae* (1927). Researches on the Flora of the coal balls from the province of Limburg were carried out by R. G. KOOPMANS, in 1928. In 1923 J. BROUWER published Researches on the morphology and development of Platanaceae. Important investigations into the plant sociology of the Netherlands were made and published in 1925 till 1931 by D. M. DE VRIES, M. J. J. PEETERS and A. SCHEYGROND. In 1924—1927 C. VAN STEENIS published a number of articles on the flora of the Netherlands. In 1927—1933 M. A. DONK did mycological work on *Basidiomycetes,* F. VERDOORN Bryological work on *Frullaniaceae* in 1927—1934. An extensive monograph on the genus *Evolvulus* was written by S. J. VAN OOSTSTROOM in 1934, whilst J. LANJOUW published studies on the *Euphorbiaceae* of Surinam, P. EYMA on the *Polygonaceae, Guttiferae* and *Lecythidaceae,* and C. E. B. BREMEKAMP on the *Rubiaceae* of this country.

In 1928 the Institute also began to occupy itself with the study of the fossils and sub-fossils of the pleistocene and holo-

Cantonspark at Baarn.

cene of the Netherlands, in which F. FLORSCHÜTZ took a leading part. He himself and a great number of younger students occupied themselves with pollen analytical research of the peat

deposits in the Netherlands. This research is still being continued and has partly been published in „Mededeelingen van het Botanisch Museum en Herbarium van de Rijks-Universiteit te Utrecht", twenty-two numbers of which have been published in all since 1932. This periodical also contains a number of smaller communications on the Flora of Surinam and further taxonomical work on various families, inter alia on the *Cyperaceae* by H. UITTIEN and on *Moraceae* and *Euphorbiaceae* by J. LANJOUW.

In 1932, under the guidance of A. PULLE, the publication was begun of a detailed Flora of Surinam in four volumes, 1000 pages of which have now been published, dealing with various families, for the greater part worked up by the staff of the Institute, partly by outsiders, Netherlands as well as foreign botanists. The compilation and publication of this extensive South-American Flora will for many years continue to be the principal task of the scientific staff. This staff consists at present of a curator, an assistant, acting university lecturer in an honorary capacity, and two assistants.

Cantonspark at Baarn.

Besides the old botanical garden belonging to the Botanical Laboratory, Utrecht University owns another one at Baarn, 13 miles from the city of Utrecht. This garden, which is much larger than the Utrecht Botanical Gardens (about 8 acres) is situated in splendid rural surroundings, and was presented to the University in 1920. It was laid out in 1905 by Mr. A. JANSSEN, who lived at Baarn at Canton-Hall, and who in the neighbourhood of his mansion bought a plot, on which he had conservatories and a gardener's lodge and laid out ornamental gardens with pinetum, a kitchengarden and orchard. When Mr. JANSSEN died in 1918 the garden, which has retained the name of „Cantonspark", came to the family of JANSSEN, who, in 1920, offered the entire property to the State of the Netherlands, to be used in the botanical course of instruction in Utrecht University. The professor of taxonomy, Dr. A. PULLE, was appointed director, which position he continues to hold at the present moment. Under his management the plantations were made suitable to botanical instruction. A considerable part was fitted up as systematic department, the pinetum was considerably enlarged, a great number of new trees were planted, and less important groups of shrubs were replaced by species of more importance for instruction. The conservatories also underwent important alterations. The former kitchengarden and the orchard are used for instruction in phytopathology by Prof. WESTERDYK. The rest of the garden is entirely set apart for the instruction in

taxonomy by Prof. A. PULLE, who in summer delivers part of his lectures in a small laboratory, built in the botanical gardens in 1929.

The botanical gardens are situated on the eastern border of the village of Baarn on the last spurs of the diluvial hills, and slope from here to the valley of the river Eem. They have ornamental waters with running water, near which a moorland has been laid out. In summer especially the gardens attract crowds of visitors. Since 1924 a seed-catalogue has been published annually.

THE UNIVERSITY OF AMSTERDAM

THE BOTANICAL LABORATORY (BOTANISCH LABORATORIUM)

The Botanical Garden at Amsterdam is older than its University and probably dates from 1618. At first it was situated on the eastside of the river Amstel near the centre of the city, afterwards, since 1630, near the crossing-point of the Utrechtschestraat and the Keizersgracht. In 1682, when the University celebrated its fiftieth birthday, the present garden was founded, and the famous plantlover JOAN COMMELIN may be said to be the founder. In those days, until the year 1877, the Botanical Garden had nothing to do with the University. Of course, there were Professors of Botany at Amsterdam, who lectured in the garden, but the latter was managed by a Board of administration.

The first botanist of the Amsterdam University was JOHANNES SNIPPENDAL, lecturer in botany during the years 1646—1656. He published a catalogue of the garden, of which one copy still exists, namely in the library of the British Museum. Between 1660 and 1731 botany was treated by the medical professors G. L. BLASIUS and FR. RUYSCH, since 1706 also by the first real professor of botany of the University C. COMMELIN Jr. The latter published a supplement, called „Flora Malabarica" to the famous work „Hortus indicus malabaricus" of his uncle JOAN COMMELIN, further a second volume of the work „Horti botanici Amstelaedamensis plantae rariores", also started by his uncle, and a new catalogue of the garden.

Then came the period of the BURMANS, father and son. J. BURMAN was professor of botany between 1731 and 1777 and is known for several works on taxonomy, inter alia the publication of RUMPHIUS' „Amboinsch Kruidboek", his „Thesaurus

Zeylanicus" and „Decades decem rariarum plantarum Africanarum", a translation of Weinmanns wellknown book, the article „Wachendorfia" and a new edition of the catalogue of the garden. His son, N. L. BURMAN, who died in 1793, was far less important in the history of the garden, and the same holds true to his successor N. BONDT, who died already in 1796.

G. VROLIK (1796—1842) taught botany together with several other sciences. He published numerous smaller articles on physiology, teratology etc. Wellknown are his descriptions of a prolification in white lilies, still present in the collection of the Institute, and of the peloric race of *Digitalis purpurea,* ever since cultivated in the garden. At his side was nominated in 1834, W. H. DE VRIESE, who became his successor in botany in 1842, but already went to Leyden in 1845, a man, known by taxonomical studies, inter alia an essay on the genus *Rafflesia,* a monograph of the *Marattiaceae,* etc. After him came the famous F. A. W. MIQUEL, who stayed here until the year 1859, when he went to Utrecht, very well known by numerous taxonomical publications of great value, inter alia a Flora of the Netherlands East Indies, descriptions of the *Piperaceae, Chloranthaceae, Urticinae, Primulaceae, Myrsinaceae, Diospyrinae* in the Flora brasiliensis etc.

With C. A. J. A. OUDEMANS (1859—1896), the newer history of the Institute begins. He too was a lover of taxonomy, and especially made a study of the flora of Holland. We owe to him that the fungus flora of Holland is pretty well known. Together with HUGO DE VRIES he published a textbook on botany, which until the present time, is in use in Netherlands Universities.

HUGO DE VRIES was called to his side, to teach plantphysiology in the important year 1877, when the Botanical Garden of Amsterdam became, simply, the garden of the botanical institute of the University. When OUDEMANS retired, DE VRIES became director of the Institute and Garden, and it was decided, that in future, the new functionary ED. VERSCHAFFELT would treat plantphysiology and pharmacognosy, DE VRIES himself anatomy, morphology and taxonomy. Not necessary, of course, to mention anything about the scientific results of DE VRIES who remained true to his University until the year 1918, when he reached the age of 70. TH. J. STOMPS became his successor, having been called already to the position of an extraoridinary professor of cytology as far back as 1910. VERSCHAFFELT died in 1923 and was followed by the present professor of plantphysiology and pharmacognosy TH. WEEVERS.

The main building of the Botanical Institute dates from 1915

and has been erected on the place of the old palmhouse of 1682. A new palmhouse had been built before in the southeastern corner of the garden. A big tropical house and a succulenthouse have been presented to the garden by the City of Amsterdam in the year 1932 on the occasion of the tercentenary of the University.

THE LABORATORY FOR PLANT PHYSIOLOGY (LABORATORIUM VOOR PLANTENPHYSIOLOGIE)

The separate laboratory of Plant Physiology owes its existence to the fact that in 1897 Dr. ED. VERSCHAFFELT was appointed Professor of Chemical Plant Physiology and Pharmacognosy, while Dr. HUGO DE VRIES, who until then had taught Anatomy and Physiology, more especially concentrated on Anatomy and Systematical Botany.

When in 1915 the Botanical Laboratory was rebuilt, one wing was assigned to Plant Physiology, the other to Anatomy and Systematics, while the centre of the building, containing the lecture room and the library, was to be shared by the two departments.

The Laboratory of Plant Physiology partly consists of rooms, that belonged to the old building, partly of a new wing, built in 1915 with a more modern equipment, rooms of constant temperature, hothouses for research in plant physiology (on the roof of the building) and a garden for experimental work.

After the death of Dr. ED. VERSCHAFFELT in 1923 Dr. TH. WEEVERS was appointed professor of Plant Physiology and Head of the Laboratory in 1924. Under his direction, research is carried on mainly along the following lines:

1° Chemical Physiology. Nitrogenmetabolism is the central problem here. On the one hand, the influence of various factors on protein metabolism in general is investigated, e.g. in *„Untersuchungen über den N-Stoffwechsel bei Helianthus annuus"* by Dr. C. A. GOUWENTAK, while, on the other, the connection between protein metabolism and the so-called secondary plant products is studied. From this point of view Dr. N. J. STEKELENBURG considered the formation and function of cyanogenetic glycosides, while Dr. TH. WEEVERS and some collaborators are studying the formation and significance of alkaloids. The results are set forth in a number of publications, the provisional summary of which was given in *Die Funktion der Xanthinderivate im Pflanzenstoffwechsel* (Archives Neerlandaises 1930) and in *Die Pflanzenalkaloide phytochemisch*

und physiologisch betrachtet (Recueil des Travaux botaniques Neerlandais 1932/3).

The idea underlying these investigations is as follows: In connection with the oxydation-reduction potentials in the tissues, the products of protein degradation, which occur in every plant, are variously transformed, methylated or dehydrogenated and linked, to which processes the secondary plant products, in this case the alkaloids, which are specific to certain sections of the vegetable kingdom, owe their existence. This theory is then further elaborated, e.g. with respect to the formation of aromatic compounds and terpenes in protoplasm degradation, and of other combinations, generated out of these.

In addition, the formation and function of the various carbohydrates was investigated by Dr. M. C. KEULEMANS, the significance of anthocyanines in metabolism by Dr. L. W. KUILMAN.

On the subject of oxydative breakdown, two physiologists, attached to the laboratory, Mr. L. W. VAN HERK and Mr. N. P. BADENHUIZEN, are engaged in investigations into the nature of the processes in the Sauromatum spadix. The former of these investigators is also studying the influence exercised on respiration and carbohydrate metabolism by compounds subject to revertible oxydation and reduction.

In the field of mineral metabolism there is on the one hand Dr. C. H. VAN HARREVELD-LAKO's research on *Water cultures with Clay Suspensions and with Nutrient Solutions,* on the other hand Mr. M. C. VAN EIJK's investigation into the influence of NaCl on the development and composition of halophytes. In connection with this, the department has also undertaken an inquiry into the possibility of surrender of mineral products, inorganic salts through the cuticle, whilst the alimentary conditions of European Orchids are also being studied.

Besides these chemical-physiological investigations the problem of translocation forms an object of research. Concerning the transport of organic combinations several publications by Dr. TH. WEEVERS and collaborators have been published.

With regard to the chapter on transpiration, investigators in the Department are mainly studying stomatal transpiration by means of the porometer, in which an automatic porometer constructed by Dr. M. PINKHOF may prove very useful.

The various publications of the Department appeared mainly in: Proceedings Koninklijke Akademie van Wetenschappen te Amsterdam and in: Recueil des Travaux Botaniques Néerlandais.

THE UNIVERSITY COLLEGE OF TECHNOLOGY AT DELFT

THE LABORATORY FOR TECHNICAL BOTANY AND THE BOTANICAL GARDENS FOR TECHNICAL PLANTS (LABORATORIUM VOOR TECHNISCHE BOTANIE)

Although the Laboratory of Technical Botany in its present state dates from 1916, the chair for this subject was established in 1907 under the name of Microscopical Anatomy.

Instruction in this department includes the study of various plant products such as wood, cork, starch, albumens, etherical and fatty oils and many others, especially in the last years cellulose, pectin, lignin, chitin, etc., which products have great significance in various industries (paper-, jam manufacture, etc.). Many other products are studied which, although not technically used or prepared, are of importance to mankind, viz: various foodstuffs and condiments. These materials are studied here anatomically and also chemically in courses specially arranged for this purpose. Among important theses on these subjects are the following:

W. DE VISSER, Het kalandereffect en het Krimpeffect van ongevulcaniseerde rubber (1925).
Calander grain and Shrinkage effect of unvulcanised rubber.

H. W. HOFSTEDE, Het Pandanblad als grondstof voor de Pandanhoeden industrie op Java (1925).
The Pandan leaf as raw material for the Pandan hat industry in Java.

A. C. SLOEP, Onderzoekingen over Pectinestoffen en haar enzymatische ontleding (1928).
Investigations on Pectinous materials and their enzymatic dissociation.

H. FRANKEN, Voorkomen, bereiding en eigenschappen van in in de natuur aangetroffen uronzuren en enkele aanverwante zuren (1934).
Presence, preparation and properties of uronic- and a few related acids found in nature.

R. HOUWINK, Physikalische Eigenschaften und Feinbau von Natur- und Kunstharze (1934).
Physical properties and Micro-structure of natural and artificial resins.

In the machine-room of the laboratory there is ample opportunity for the study of the methods of preparation of different botanical products. There are available extraction apparatus, an oil press, a large and a small vacuum dryer (Passburg system), a drying centrifuge and a super centrifuge, a Krause drying apparatus (loaned by Dr Krause), an autoclave, an experimental hollander, a kollergang, ordinary and vacuum distillation boilers. As a gift from several manufacturers there has been available for a few years, a complete installation for paper-making on a small scale, including a long web paper-machine with a width of 30 cm, pulping and bleaching hollanders, strainers and a calandar.

The laboratory also offers opportunity for pure scientific botanical research on cytological as well as on physiological problems, of which some theses have been the result during the last years.

It is not so well known that, besides botanical products, those of zoological origin have been a point of research in the laboratory, especially animal fibres such as wool and other kinds of technical hair. Problems such as the drying of milk and blood and the preparation of chemical substances from animal tissues have also been studied repeatedly.

Instruction is further assisted by an herbarium, in which technical or economically important plants, mainly, are represented, together with an extensive collection of botanical and zoological raw materials.

Twice a week lectures are given on biochemical as well as on pure botanical subjects (both morphological and physiological), while the cultivation of various technical or economically important plants and subjects of statistical analysis are also treated.

Besides the daily laboratory work of the students, three six-weeks courses are given each year; in the first course, plant anatomy is treated, in the second systematics is dealt with, while in the third course either the anatomy of wood, the testing of food stuffs and condiments, microchemistry or the testing of fibrous materials is given. During these courses, each student has the use of a complete microscope equipment.

The botanical garden with its hothouses covers an area of 3.5 hectare and serves partly as arboretum, partly for the cultivation of those technically important plants (on a larger scale) which may be investigated in the laboratory. It is self-evident, that, in the hothouses, mainly tropical and sub-tropical technical or economical important plants are cultivated regularly.

THE LABORATORY FOR MICROBIOLOGY (LABORATORIUM VOOR MICROBIOLOGIE)

The Microbiological Laboratory of the University College of Technology at Delft was founded in 1895, with the idea of affording suitable accomodation for the continuation of the researches of M. W. BEIJERINCK. At that time the discoveries made by this investigator in the field of general microbiology had aroused as great interest in Holland as abroad, and the Dutch Government had the good sense to profit by this state of affairs by establishing a chair for general and applied microbiology at Delft and by inviting BEIJERINCK to be the first occupant of this chair.

From 1895 till 1921, when he reached the age of 70 years and had to retire, according to the requirements of the law, BEIJERINCK was director of the institute. During this period he performed an enormous amount of highly important work, dealing with the most varied subjects of general microbiology. The discovery of *Azotobacter chroococcum* should be especially mentioned here; for the rest, reference may be made to the „Verzamelde Geschriften" („Collected papers"), published in 1921 (5 Vol. oct.).

Several collaborators with BEIJERINCK, chiefly VAN DELDEN, VAN ITERSON, JACOBSEN and SÖHNGEN, also made important contributions to our knowledge of the microbe world.

In 1921 BEIJERINCK was succeeded by A. J. KLUYVER, who is still in charge of the institute to this day. From this time on, special stress has been laid on the study of the chemical activities of micro-organisms. The metabolism of representatives of various groups of bacteria has been studied in detail. The biochemistry of acetic acid bacteria has been dealt with in publications by DE LEEUW and VISSER 'T HOOFT, whilst the fermentation processes of butyric acid and butyl alcohol bacteria were investigated by DONKER and by VAN DER LEK, those of the bacteria of the colon group by BRAAK and by SCHEFFER. VAN NIEL published an extensive monograph on the propionic acid bacteria. Yeast metabolism was studied by STRUYK, and, as far as the interrelation of respiration and fermentation is concerned, recently by HOOGERHEIDE.

In later years, special attention has been given to the measurement of oxidation-reduction potentials in suspensions of bacteria and yeasts, and to the study of the relations of these potentials and the metabolic processes of these organisms. In this

connection, the fundamental work of ELEMA should be especially mentioned.

Studies on the metabolism of the purple bacteria, begun by VAN NIEL, were continued by MULLER and by ROELOFSEN. MULLER investigated the metabolism of the purple sulphur bacteria in organic media, whilst ROELOFSEN carried out a closer investigation of the remarkable type of photosynthesis, found with these bacteria.

The chemo-autotrophic nitrifying bacteria were studied in detail by KINGMA BOLTJES, who showed inter alia the beneficial influence of some organic compounds on the development of these bacteria.

The results of these various investigations have led to the publication of a series of more theoretical studies on the fundamental principles of biochemistry.

Besides this work of a more general character, studies in the field of applied microbiology (fermentation industries, dairy industry, wood preservation etc.) have also been made.

It should be mentioned that the Yeast Division of the „Centraalbureau voor Schimmelcultures" (cf. p. 58) is housed in the institute. The collection of this division includes about 750 pure cultures of various yeast species. Extensive investigations of the organisms in question from the standpoint of taxonomy have been carried out, as a result of which monographs by STELLING-DEKKER (sporogenous yeasts) and by LODDER (asporogenous yeasts) have been published.

In accordance with the character of the work outlined above, the equipment of the institute is especially adapted to the study of bacterial metabolic processes and of the physiology of unicellular organisms in general.

THE UNIVERSITY COLLEGE OF AGRICULTURE AT WAGENINGEN

THE BOTANICAL LABORATORY (LABORATORIUM VOOR PLANTKUNDE)

Up to October 1934 this institute (Present Director: Prof. Dr. E. REINDERS) only disposed of some rooms for lectures and for plant anatomical classwork; since then a new building (Arboretumlaan 4) offers modest accomodation for physiological investigation too.

THE LABORATORY FOR PLANT TAXONOMY AND THE ARBORETUM (LABORATORIUM VOOR PLANTENSYSTEMATIEK)

In 1896 alumni of the Secundary School for Agriculture, Horticulture and Sylviculture at Wageningen were sent to Leyden to hear lectures about and to do practical work in Tropical Botany, especially the trees, interesting for forestry in the tropics. Dr. J. VALCKENIER SURINGAR was charged with this teaching work. In 1899 he was called to Wageningen as a docent for Dendrology and Systematics applied to Horticulture and Sylviculture.

He placed his teaching on such a high standard that when in 1918 this Secundary school was reformed into the University College of Agriculture he had nearly nothing to alter in his part of the programme. VALCKENIER SURINGAR was nominated a professor in applied Systematical Botany and Phytogeography. In 1924 he retired and died in 1932.

He was succeeded in 1925 by Dr. J. JESWIET, former chief of the Department for Sugar Cane breeding of the Experiment Station in Pasoeroean, Java. The laboratory c.a., till that moment in the main building of the College was transferred to the building of the former School for Horticulture, which partly had to be rebuilt for that purpose. A lecture-room, laboratory-rooms, library and flats for herbarium have been built and in 1926 all was ready. The building stands in the Arboretum. The latter was started in 1896 and was planned by the garden architect L. A. SPRINGER and planted by Dr. VALCKENIER SURINGAR. Originally it covered a surface of 1 H.A. In 1913 it was enlarged with a new part for *Coniferae* and *Ericaceae* and a nursery, so that the new surface was about $1/1_2$ H.A. In 1922 a new nursery was acquired and in 1925 all the grounds, formerly in use by several departments of the College were added to the arboretum; also the hothouses. The whole surface covered till now is $\pm$ 6 H.A. and will probably be extended at the end of this year. The arboretum contains a collection of trees and shrubs systematically arranged after the system of VALCKENIER SURINGAR, being a combination of Benthams and Hookers and Engler and Prantls system. Every year a seed catalogue is published for changing material with other institutions. A catalogue of the collection is still wanting, but will be published as soon as the new part of the arboretum will be ready.

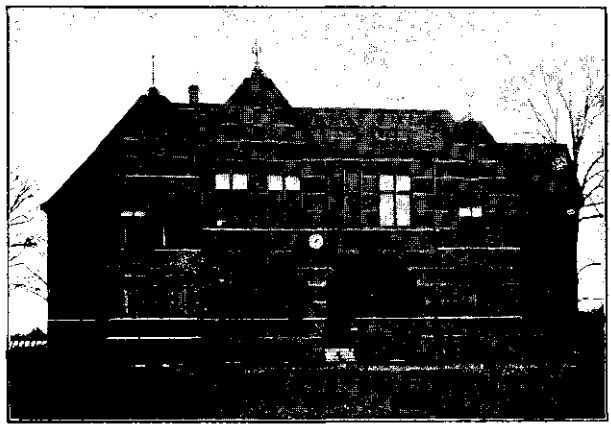
The arboretum serves in the first place as a study-collection for the students and also for garden-architects, dendrologists and nurserymen. Seeds, cuttings and plants are sent out to other

institutions and to the nurseries. The Arboretum links the laboratories with the Netherlands Dendrological Society, which has its seat in Wageningen.

The herbarium is a rather rich one, containing a general herbarium, a tropical herbarium and special ones for dendrological purposes.

Lectures are given about Morphology and Systematics, about Phytogeography and Dendrology. In connection to these students do practical work in the laboratory and excursions are made for field work.

From 1918 till now the following theses appeared:
J. G. B. BEUMÉE: Onderzoekingen der korte flora van de djatiplantsoenen; J. T. P. BIJHOUWER: Geobotanische studie van de



Laboratory for Plant Taxonomy, Wageningen.

Berger duinen; I. RIETSEMA: Kersenvormen; F. H. ENDERT: Geslachtstabellen voor Ned. Indische Boomsoorten naar vegetatieve kenmerken; B. K. BOOM: Botanisch-serologische onderzoekingen.

Further researches: Floral successions in the new soils of the North West Polder (Zuiderzee); Sociology of the forests of the eastern provinces; Climax-association and the influence of anthropological factors; Development of the flora in post-glacial periods; Phytosociological studies of forest types in Germany; Taxonomical work, etc.

On the latter many articles came out in the Yearbook of the Netherl. Dendrological Society, which is published under an editorial staff of which the Director of the Arboretum is the president. Most of the taxonomical work till 1932 was from the

hand of Prof. Dr. J. VALCKENIER SURINGAR, in the latter years this part was taken by Dr. H. J. VENEMA, assistant of the Staff.

The Staff consists of:

Prof. Dr. J. JESWIET for Systematics, Phytogeography and Dendrology, Director of the Arboretum.

Dr. H. J. VENEMA, Assistant.

H. W. RENKEMA, Technical Officer.

See further: Chronica Botanica Vol. I, 1935, page 220.

THE LABORATORY FOR PLANTPHYSIOLOGICAL RESEARCH (LABORATORIUM VOOR PLANTENPHYSIOLOGISCH ONDERZOEK)

The general purpose of this laboratory is to investigate the influences of outward conditions on plants, especially on horticultural plants as they are grown in the different nurseries in the Netherlands: the bulbdistrict, Aalsmeer, Boskoop, and the fruitdistricts etc. More especially we have to increase the botanical knowledge of these horticultural plants and to investigate the influence on them, of the factors of growth, to find the most effective circumstances (temperature, light, humidity etc.) for cultivation in the field or in greenhouses.

Before this laboratory was founded in 1918 hardly any scientific research work had been done. All that was known, was private knowledge of individual growers, gained by experience. Therefore we started at once with researches on periodical development, in order to determine first of all the time of flower- and leaf-formation in the buds of different kinds of horticultural plants. These morphological studies included the life-cycle of these plants during at least a whole year. The method which was found to be best was to study the development of the buds, fixed with alcohol under a binocular microscope staining with JJK. Provided with a large number of illustrations (made by Mr B. J. van Tongeren, draughtsman of the Laboratory) a great number of investigations on the periodic development of different kinds of plants have now been published. Among these plants are the most important of the bulb-district (hyacinth, tulip, lily of the valley, daffodil, iris, hippeastrum), numbers of fruit-trees (apple, pear, cherry, plum) and some of the most important flowering trees and shrubs (lilac, rhododendron, azalea).

These morphological investigations served as a basis for experimental work which also began in 1918, and was extended, after the building and furnishing of the new laboratory, finished in 1921, an example of Modern Architecture in the Netherlands.

This laboratory has special arrangements for producing and maintaining constant temperatures (maximal deviation 0.2° C) from — 20° C till + 45° C. Most temperatures can also be combined with day-light in specially constructed greenhouses.

So it is possible to investigate with many temperatures, mounting by 2 centigrades, in the same year and to work with a wide scale of temperatures in order to settle minimum, optimum and maximum for different periods of the life-cycle, e.g. on the flower-formation, on root development.

In the course of these years we have already found, there is a great difference between various species with respect to the time of flower-formation, its optimal temperature and its rapidity. As

Laboratory for Plantphysiological Research, Wageningen.

to the roots, we found that their formation and development were greatly influenced by temperature and humidity. In order to study the growth of roots in most natural conditions a root-house has been built with different boxes with constant and without water-levels. The growth of the roots can be controlled by means of glass windows. In connection with this it may be mentioned that all research-bulbs are planted with the optimal constant water-level, kept up automatically.

In this way we have been able to find the best treatment for the fieldculture of hyacinths, tulips, irises (flowering, increase in weight, production of new bulbs); a new method of rapid flowering, based on the application of low temperature in a certain period which now is widely accepted in practice (9° C for

tulips, daffodils and irises; 13 ° C for hyacinths) and the possibility of sending tulips, hyacinths, daffodils, irises to all parts of the world, especially to the southern Hemisphere with its climate and periodicity shifted for half a year.

It is clear that vegetative reproduction is also a part of our work. As yet, we have only studied the vegetative reproduction of Hippeastrum hybridum and found it is possible to multiply these bulbs very easily by using the correct temperature and humidity. The method has been followed in this country as well as in America.

To study the influence of outward conditions on the growth of plants principally, a single cell of Phycomyces nitens is used. These investigations are to be considered as a continuation of the research-work done by BLAAUW since 1908. The influence of Radium-radiation has been studied, as well as that of light and darkness. In connection herewith, we also refer to the work done on the influence of Röntgen-rays on tulip-bulbs, in which the effects on the vegetationpoints and on the flowers are noteworthy.

A list of the communications (Nos. 1—45) is obtainable at the laboratory.

Present Staff: Director Prof. Dr A. H. BLAAUW; Botanists Miss IDA LUYTEN and Miss Dr ANNIE HARTSEMA.

THE LABORATORY FOR MICROBIOLOGY (LABORATORIUM VOOR MICROBIOLOGIE)

The building was erected in 1920—1922.

It has been organised to serve educational as well as research purposes. Third year students follow a practical course in microbiology for 5 or 6 weeks every afternoon. During the course, microorganisms of different groups are isolated, using selective culture methods (yeasts, lactic-acid bacteria, colon-aerogenes group, nitrifying- and nitrogen fixing microorganisms, fat-, amylum-, protein and urea hydrolysing bacteria). The influence of the acidity of the soil on some of these processes is studied. The laboratory is situated in a garden, where the students find soils of different acidity and manuring. During their 4th and 5th years students work on special subjects of soil- and dairy-microbiology and of enzymology. Other subjects of research during latter years have been bacteriophagy, mitogenetic rays, oligodynamic action of metals, coagulation of casein by rennet.

Prof. Dr. Ir. N. L. SÖHNGEN the founder of this laboratory was born 4th of March 1878 and died on 24th of December 1934. Publications by him are:

N. L. SÖHNGEN, Sur les bactéries, qui emploient le méthane comme nourriture carbonée et comme source d'énergie. (Arch. Néerl. des sciences exactes et nat. Serie II, T. XI, p. 307).

——, Het ontstaan en verdwijnen van methaan en waterstof onder den invloed van het organische leven. (Diss. Delft 1904).

——, Over ureumsplitsing bij afwezigheid der eiwitten (Kon. Akad. v. Wet. Amsterdam 1908).

——, Ueber Fettspaltende Mikroben und deren Einfluss auf Molkereiprodukte und Margarine.

——, en Prof. Dr. G. v. ITERSON, Rapport over onderzoekingen verricht omtrent geconstateerde aantasting van het z.g. marbarklak. (De Ingenieur 1911).

——, Oxidation of petroleum, paraffin, paraffin oil and benzine by microbes (Kon. Akad. v. Wetensch. Amsterdam, Proc. 1913).

——, Einfluss von Kolloiden auf mikrobiologische Prozesse (Centralbl. f. Bakt. II Bd. 38, 1913).

——, Ueber reduzierende Eigenschaften der Essigbakterien (Folia Mikrobiologica III 1914).

——, and J. G. FOL, Die Zersetzung des Kautschucks durch Mikroben (Centralbl. f. Bakt. II Bd. 1914).

——, Kolloidaal opgeloste en gelatineuse koolstof (Chem. Weekbl. 1914).

——, Verslag over het onderzoek naar de oorzaken van het ontstaan van den stank der Haagsche Grachten. ('s Gravenhage, Gebr. Belinfante 1914).

——, Umwandlungen von Manganverbindungen unter dem Einfluss mikrobiologischer Prozesse (Centralbl. f. Bakt. II Bd. 40, 1914).

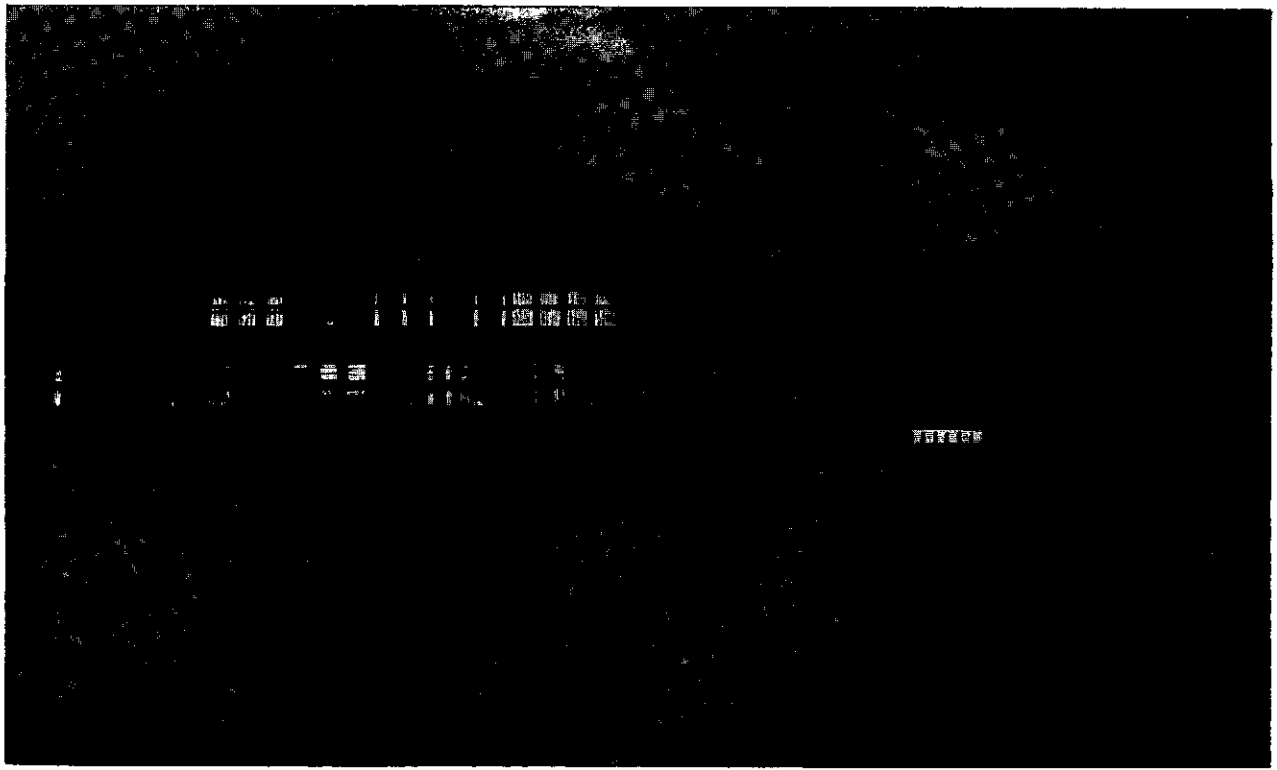
——, A. KNETEMANN en K. T. WIERINGA, Bepaling van het gehalte aan vrije en gebonden humus in zand- en veengronden (Versl. van Landbouwk. Onderzoekingen der Rijkslandb. Proefst. 1917).

——, und P. E. VERKADE, Die Angreifbarkeit von cis-trans-isomeren ungesättigten Säuren durch Pilze (Centralbl. f. Bakt. II Bd. 50, 1922).

——, und C. COOLHAAS, Die Galactosegärung durch *Saccharomyces cerevisiae* (Centralbl. f. Bakt. II Bd. 66).

——, F. C. GERRETSEN, A. GRIJNS und J. SACK, Das Vorkommen eines Bakteriophagen in den Wurzelknöllchen der Leguminosen. (Centralbl. f. Bakt. II Bd. 60, 1923).

——, en W. S. SMITH, De invloed van de temperatuur op



Laboratory for Microbiology, Wageningen

de ontleding van waterstofsuperoxyde door persgist. (Tijdschr. v. Vergelijkende Geneesk. Dl. X, 1923).

——, und C. COOLHAAS, Der Einflusz ultravioletten Lichts auf die Alkoholgährung (Wochenschr. f. Brauerei XL).

——, and A. GRIJNS, On the disinfection of the bacteriophagus of *Bac. Danicus* (Kon. Akad. v. Wetensch. Proc. XXIX).

——, Heterobacteriolyse en bacteriophagie (Kon. Akad. v. Wet. Dl. XXXVI).

In his last years SÖHNGEN was specially interested in the researches on mitogenetic rays. In his laboratory, many experiments were carried out on this subject. The results of these experiments were not convincing as to the existence of a mitogenetic effect. His last researches on the disappearance of hydrogen under the influence of microorganisms are being carried on.

THE LABORATORY FOR GENETICS (LABORATORIUM VOOR ERFELIJKHEIDSLEER)

Genetics as a separate branch of instruction at the Agricultural College has been taught since 1921, as a basic science for plant-breeding, horticulture, cattle-breeding, tropical agriculture and forestry. The laboratory building and the greenhouses date from 1929.

Staff: Prof. Dr. J. A. HONING; Dr. R. PRAKKEN, assistant.

The experimental garden, of an area of nearly 2 hectares, contains species or types (different every year) of *Antirrhinum, Canna, Matthiola, Nicotiana, Oenothera* and *Pisum* as material for experimental work by the students, often also some of the following genera: *Datura, Mirabilis, Phaseolus* and *Zea Mays.*

Thanks to the co-operation of Ir. G. TUKKER, director of the Poultry Experiment station in Beekbergen (alas, 42 K.M. from Wageningen) the students in cattle-breeding have an opportunity of experimenting with animals.

Publications of the results with beans, *Canna* and *Nicotiana* appeared in the „Mededeelingen van de Landbouwhoogeschool", „Genetica" and „Proceedings of the Koninklijke Akademie van Wetenschappen te Amsterdam".

As to cytology, it is treated as an auxiliary science.

THE LABORATORY FOR MYCOLOGY AND POTATO-RESEARCH (LABORATORIUM VOOR MYCOLOGIE EN AARDAPPELENONDERZOEK)

The first director of the Institute for Phytopathology was the Zoölogist RITZEMA BOS, known through his investigations on plant parasitic nemas. When he retired the Institute was reorganised: the Phytopathological Service became independent, whereas research and teaching remained the work of the Institute, consisting now of three laboratories, each directed by a professor of the Landbouwhoogeschool. One of these is the Laboratory for mycology and potato research, under the direction of QUANJER. It was opened in 1923 during the International Conference of phytopathology and economic entomology. At present virus diseases, diseases caused by fungi and nemas, and non-parasitic diseases are being studied and taught in the laboratory. A complete list of its research papers, which are issued in periodicals, and reprints of which are exchanged, is to be found on each of these reprints.

VIRUS DISEASES. The first work on tobacco mosaic had been done fifty years ago in the chemical department of the „Landbouwschool" by ADOLF MAYER and continued in the botanical department by BEIJERINCK. In 1913 QUANJER differentiated leafroll from other potato diseases, with which it was confounded, by describing its internal symptom „phloemnecrosis", and in 1914 he gave proof of its transmissibility by grafting, and grouped it with the virus-diseases. In 1916 OORTWIJN BOTJES detected its field transmissibility and in 1920 he was the first to prove its transmission by the peach-aphid. In 1923 QUANJER showed that the disease, transmitted to other plants (tomato, tobacco, etc.), may remain latent, these plants behaving as symptomless carriers. In the same year ATANASOFF, working in the laboratory, recognised stipple-streak of potato as a virus-disease. In 1927 ELZE was the first to detect certain relations between the insect mentioned and the leafroll virus, a.o. that the virus has an incubation period in the aphid. In 1928 THUNG supplied evidence that starch accumulation in the leafrolling plants is not due to abnormal enzymic action but to disturbed translocation. In 1929 QUANJER and OORTWIJN BOTJES detected two types of viruses, of which different potato-varieties are tolerant, and in 1930 QUANJER classified these viruses according to their histological effect on non-tolerant varieties; his differentiation between viruses causing top necrosis and acropetal necrosis agrees with K. M. SMITH's differen-

tiation between X- and Y-viruses. Also, a virus causing internal spotting of potato-tubers was differentiated by him. In 1933 OORTWIJN BOTJES described a case of what he regards as attenuation of a topnecrosis-virus and of acquired immunity. In the meantime a great deal of experimenting on the influence of environment on the spread of potato-viruses has been undertaken at the laboratory, part of it in coöperation with laboratories in other European countries (BLATTNY, GÄUMANN). In conclusion mention may be made of the differentiation of the „yellowing disease" of the beet from other beet-diseases, with which it was confounded. This has been made by QUANJER (1934) on the same lines as the differentiation of potato leafroll.

DISEASES CAUSED BY FUNGI, arranged according to the systematic position of the causing organism:

Olpidium: infection experiments on cauliflower (VAN DER MEER, 1926).

Pythium: cause of European flax wilt, „brûlure du lin". (VAN DER MEER, 1928).

Phytophthora: Saprophytic life in soil (DE BRUYN, 1923); *Ph. syringae* (same, 1924); Overwintering of *Ph. infestans* (same, 1926).

Peronospora: on *Brassica* (THUNG, 1926); Sexuality (DE BRUYN, 1935).

Rhabdocline: on *Pseudotsuga* (VAN VLOTEN, 1932).

Nectria cinnabarina (VAN VLOTEN, 1932).

Ophiobolus: on wheat (VAN DE LAAR, 1931, OORT, in progress).

Puccinia triticina: Specialization (WELLENSIEK, 1930).

Ustilago tritici: New method of combating (OORT, 1934).

Armillaria mellea: (VAN VLOTEN, in progress).

Phoma: Synergetic forms on celeriac (GOOSSENS, 1928).

Dothichiza populea on Populus (VAN VLOTEN, in progress).

Colletotrichum and *Gloeosporium:* Specialization and variation (MULLER, 1926); on clover (WELLENSIEK, 1926).

Cercosporella: on wheat (OORT, in progress).

Verticillium: (VAN DER LEK, 1919; VAN DER MEER, 1925).

Rhizoctonia violacea: (VAN DER LEK, 1917).

Actinomyces: on potato (DE BRUYN, in progress).

DISEASES BY NEMAS.

Tylenchus: in wild meadowplants and potato (QUANJER, 1927).

NON-PARASITIC DISEASES.

Premature tuber formation and physiology of tuber formation of potato (WELLENSIEK, 1924—1930).

Blue discoloration of potato, in relation to nitrogen and potassium (DE BRUYN, 1929).

Physiological spotting, „marsh spot", of pea seed, in relation to nitrogen and potassium (DE BRUYN, 1933).

Boron deficiency in Solanaceous plants (VAN SCHREVEN, 1934 and '35).

Calcium deficiency as cause of medullary necrosis of potato (VAN SCHREVEN, 1934).

MISCELLANEOUS.

Influence of jarowization on wheat diseases (OORT, in progress).

THE LABORATORY FOR HORTICULTURAL RESEARCH (LABORATORIUM VOOR TUINBOUW-PLANTENTEELT)

This Laboratory (Director Prof. Ir A. M. SPRENGER) was founded in 1918 with a double purpose:

(1) for the training of the students in Horticulture,

(2) for research work on horticultural problems.

Naturally these two functions are closely connected in their performance. Thus the senior students participate in research work, either by assisting the members of the staff or by working out a problem on their own, while apart from the regular college courses, given by the director, lectures are given by members of the staff from time to time, mostly on investigations, going on in the institution. This research work may be divided as follows:

A. Applied botany
B. Fruit growing
C. Vegetable growing
D. Cold storage
E. Application of electricity in horticulture
F. Preparation of wines and fruit-juices.

Results are published in the „Mededeelingen van de Landbouwhoogeschool", in „Gartenbauwissenschaft", in certain other Netherland journals or as separate papers. They are subsequently issued in one complete series viz.: „Mededeelingen van het Laboratorium voor Tuinbouwplantenteelt" of which twenty-three numbers have appeared between 1925 and 1935.

A. Applied Botany.

Anatomical and anatomical-physiological research on vegetative propagations of woody plants. The starting-point of this

work was given by the very different rooting capacity, shown by different types of fruit stocks in vegetative propagation.

In order to give this investigation a broad botanical base, it has been extended to include other species of trees and shrubs. The results are published in No. 1 of the above-mentioned series: H. A. A. VAN DER LEK „Over de wortelvorming van houtvormige stekken (on the rooting of woody cuttings), 1925.

Not only the result of anatomical investigations, but also physiological observations, especially on correlations between the formation of shoot and root in cuttings, were published in this paper.

These investigations have been continued along two main lines of research:

(1) Comparative anatomical investigations and descriptions of a great number of varieties of quince and doucin stocks, with special reference to the presence of root-initials (number, development etc.), in relation to smaller or greater capacity for rooting (results not yet published).

(2) Investigations on the correlations which, in vegetative propagation, govern the root formation of cuttings, and on the influence of external factors on this process: influence of buds and leaves on root-formation in relation to modern theories of root-forming substances (rhizocaline) and metabolic processes in trees. The first results of these investigations were published in: Mededeeling No 18 (from the Labor. Hort. Research) H. A. A. VAN DER LEK, Versuche über den Einfluss von niedrigen Temperaturen auf die Wurzelbildung von Stecklingen (published in Gartenbauwissenschaft, 1933) and Med. 23 (Labor. Hort. Res.) Over den invloed der knoppen op de wortelvorming van stekken; „On the influence of the buds on root-development in cuttings," 1934.

B. Fruit Growing.

Attention is paid to the following subjects:

Influence of the level of the subsoil water on the productivity of pears, apples and currants; experiments on pruning apples and pears; stock and scion problems. For the last mentioned investigation, experimental orchards have been laid out in several parts of Holland. Further, the classification of fruit stocks, the growth and selection of new types of stocks and the selection of different varieties of fruit in relation to productivity, fitness for storage, etc. The influence of climatic conditions on flowering and fruit formation in apples, pears and plums is being investigated in collaboration with a number of observers all over the country: The control for frost damage, etc.

Other problems are studied by senior students under the direction of the members of the staff. Publications, pertaining to fruit culture and occurring in the „Mededeelingen van het Laboratorium voor Tuinbouwplantenteelt" are: No 4. A. M. SPRENGER and A. K. ZWEEDE, Zelfsteriliteit en kruisbestuiving van eenige kersensoorten in Zeeland, I, 1927 and No 7. A. M. SPRENGER and A. K. ZWEEDE, Steriliteit en kruisbestuiving van eenige kersensoorten in Zeeland, II, 1928.

Further, two extensive reviews of literature may be noted: one (No 12) dealing with the problem of senility in relation to vegetative propagation, and the other (No 22) with the causes of insufficient fruit-formation in fruit trees.

C. Vegetable Growing.

The main work here lies in crossing and selection. In addition, the following problems are being studied: The relation of hard seeds in beans to the technique of drying; vernalization of asparagus and garden-succory, description of vegetable varieties, investigations on fruit formation and periodicity of certain strawberry varieties, etc. Certain other problems are being worked out in this division by senior students.

Publications on vegetables appearing in the series of the Laboratorium voor Tuinbouwplantenteelt are as follows:

No 3. J. H. L. JOOSTEN, Een onderzoek naar het kenmerk der „Draadloosheid" bij verschillende boonenrassen. 1927.

No 8. R. MULDER, L. J. M. OELMEYER en A. M. SPRENGER. Proeven over den invloed van bepaalde factoren op de rijping van eenige tuinbouwproducten.

I. De invloed van de temperatuur op de narijping van Mangga Gedong.

II. De invloed van aethyleen en temperatuur op de narijping van tomaten en andere tuinbouwproducten. 1929.

No 11. A. K. ZWEEDE. Beoordeeling van de variatie in vroegrijpheid en productie en daarmee gepaard gaande selectie van de „Vroege Wagenaarboon". 1930.

No 13. A. M. SPRENGER. Selectie van aardbeien. Voordracht gehouden ter gelegenheid van de Landbouwweek te Wageningen van 30 Juni—4 Juli 1930 voor de Ned. Pomologische Vereeniging. 1930.

In addition, two papers were issued on phytopathological subjects.

D. Cold Storage.

Experiments on the fitness of fruit- and vegetable varieties

for cold storage; physiological research on the forms of breakdown and diseases, which appear in cold storage.

Here investigations are in progress on the possibility of shipping fresh fruit over long distances, such as the export of fruit from the East- and West Indian colonies to Holland. This division was founded in 1929. Publications in the series of the Laboratorium are:

No 16. R. MULDER and A. M. SPRENGER. Proeven met het bewaren van tomaten bij lage temperatuur. 1932.

No. 20. W. F. VAN HELL. Voorloopige mededeeling omtrent het ontstaan en den bouw van z.g. stomatavlekken bij bananen. 1934.

No 21. O. BANGA. Het „steelrot" van appels. 1934.

E. Application of electricity.

These investigations which are subsidized by several electricity departments as well as by the firm „N.V. Gloeilampenfabriek" (Eindhoven), may be divided into two groups:

a. Heating.

Experiments (started in 1931) on the use of electricity for heating the soil in glasshouses and garden frames in the growth of several fruits and vegetables.

b. Lighting.

Experimental work (started in 1928) on the application of different systems and types of artificial lighting in floriculture and fruitculture.

Publications in „Mededeelingen van het Laboratorium voor Tuinbouwplantenteelt":

No 14. J. ROODENBURG. Kunstlichtcultuur. 1930.

No 17. J. ROODENBURG. Kunstlichtcultuur II. 1932.

F. Preparation of fruit wines and juices.

This department resulted from the need for finding new outlets for fruit growing in Holland, especially economic outlets for second grade fruit, and was formed in June 1932. Financial support was forthcoming from several growers and societies. The work includes investigations on the preparation of fruit juices and wines from several kinds of fruit, on clarifying juices by gelatine, on the influence of carbonic acid on sterility of juice, etc.

Naturally these investigations are mainly of a practical nature, hence mere directions for preparing several kinds of fruit juice are issued and no articles have been published.

THE INSTITUTE FOR PLANTBREEDING (INSTITUUT VOOR PLANTENVEREDELING)

GENERAL SCHEME.

A Education of students and scientific cooperators.

B Scientific research.
- 1. Agricultural (Director Prof. Ir. C. BROEKEMA, Ir. J. K. GROENEWOLT, Ir. R. P. DOJES).
- 2. Genetic (Dr. M. J. SIRKS).
- 3. Cytological (Dr. H. DE HAAN).
- 4. Physiological (Dr. A. E. H. R. BOONSTRA).

C Extension work.
- 5. Breeding
- 6. Assistance to breeders and propagation of superior varieties.
  - a. Supply of advice, material and literature.
  - b. Variety investigations (experimental fields, race collections, observation stations, correspondents, breeding competitions).
  - c. Public information (annual list of races).
- 7. Organising work (Breeders association etc.).

This institute is one of the 25 laboratoria of the University College of Agriculture. It was opened in 1912 under the direction of Prof. Dr. Otto PITSCH. Since 1923 Prof. C. BROEKEMA l.i. has been in charge.

The institute has at Wageningen some 100 acres of very heavy clay soil at its disposal, including about 45 acres of arable land, and some acres of sandy soil.

Apart from its share in the education of students, the work of the institute is to do scientific investigation in the interest of plant breeding and also to do actual plant breeding and propagation of the best possible races.

B. The scientific research is to be divided in 4 sections, viz.:

1. The agricultural investigations are partly connected with the extension work to be mentioned later. For the rest they touch subjects of varied character, e.g. at present the study of heterosis (rye, beets), census and yield analysis, the value of mixtures compared with pure strains etc. Questions in close relation with the extension work include trials with malting barley and with silage crops.

2. The aim of the section for genetic analysis is to study the genetic composition of agricultural plants, and special questions in connection with breeding, e.g. sterility. Work is done, inter alia, with rye, wheat, flax and beans.

3. The cytological research section studies questions like

species crossing and the mutationlike phenomena, which result from the application of abnormal conditions or influences during cell division (X-rays, high and low temperatures, chemical treatments).

4. Physiological research tries to gauge the causes of differences in productivity of varieties. The investigation includes differences in rootfunctions, differences in water requirement, in assimilation and respiraton capacity. It is obvious that in future, physiological analysis of the process of production can give fundamental insight into the increase of productivity which is the main aim of agricultural plantbreeding.

C. The extension work of the institute may be classified under two headings.

5. Actual breedingwork.

6. and 7. Measures in the interest of propagation of superior varieties (including organising work).

5. Actual breeding. Although it is not the intention to concentrate the greater part of the capacity of the institute on this detail work, — the priority being given to scientific research and the organising task mentioned sub 6 and 7 — breedingwork in the institute has considerable extent.

The institute continues the work of Prof. Dr. L. BROEKEMA, Prof. Dr. Otto PITSCH and other breeders of the previous generation, and it has some important races of its own, e.g. Wilhelmina wheat, Imperial IIa wheat, Algebra wheat, Emma wheat, Juliana wheat, Prins Hendrik wheat, Vindicat winterbarley, Texala flax, Minister Ruys spring barley. In addition, breeding work is done with rye, brewing barley, oats, spring wheat, forage plants and mangolds. During the last years, a considerable number of crossings have been made with exotic material (such as cereals from Central Asia, Japan, Italy, Poland, Russia, North Africa, Middle America) in the hope of discovering greater possibilities than seem to remain in combining West European strains.

An extending collection of exotic material for the purpose of new crossings is being made now.

6. In the interest of plant breeding and propagation of the best races, the institute cooperates on a large scale with other organizations and institutes. More and more the Netherland measures in this matter are being coordinated. According to circumstances, the institute has a larger or a smaller part in the general cooperation. It is impossible to give a complete scheme of present cooperation. Consequently only a few principal questions will be mentioned here, in which the role of the institute is of some importance.

a. Direct aid to breeders. Netherland breeders can apply for

aid from the institute whenever they want it. They obtain not only advice and instruction, but also material, e.g. new crossings, literature a.o.

In connection with this it may be mentioned that the institute has a library of some 160 periodicals and about 7600 volumes, reprints and a systematic catalogue of literature. Apart from scientific publications, the institute endeavours, by means of the agricultural press, to spread reports on interesting facts and discoveries in the dominion of plantbreeding. There are more institutions, which support breeders in their line, and with which the institute works in close relation, such as the N.A.K. (Neth. General Inspection Service, p. 79), the Seed Testing Station (p. 77), the Institute for Phytopathology (p. 41), the Phytopathological Service (p. 74) and the Netherlands Genetic Association.

b. Experimental fields and farms. It is intended to put all field experimental work in the Netherlands under the direction of an executive committee, which started work in 1929 and has already taken charge of the field experiments with rye, wheat, barley, oats, potatoes, flax and peas. The Institute for Plantbreeding retrained provisional control (in cooperation with various people and organisations) of the field experiments with brewing barley, grasses, beans, canary seed, caraway, mangolds, lucerne, serradella, onions, turnips, swedes and carrots (in all, some 700 experimental fields, spread over the whole country). The seven lastmentioned crops and, partly, maize, form objects of continual matches among their breeders. For the analyses of samples, the institute enjoys the aid of the station for the investigation of cattle fodder at Wageningen.

Experiments with sugarbeets are carried out by the Institute for Sugarbeetgrowing at Bergen op Zoom (Director Dr. P. J. H. VAN GINNEKEN cf. p. 61), which has been erected with the aid of the Institute for Plantbreeding.

c. Public information. Since 1923 the Institute has published annually a descriptive list of races (home and imported), in which all available results of experimental work as well as practical experience are compiled. A chapter is added on statistics of varieties.

The races are classified as: A: recommended races, B: races worthy of a trial, N: new breeds and D: rejected breeds. From the races A-N a description is given, verbal as well as in figures. In 1935 the list contains descriptions of 223 varieties and the names of 100 rejected breeds.

In order to be continually in touch with practical observation, the institute has a staff of 400 correspondents, spread over the country, and some 100 observation Stations for special crops;

which are of special importance in forming an opinion quickly on the value of new breeds.

It should be mentioned that collections of seeds are supplied annually to numerous agricultural schools and to private students to be grown in their gardens, partly for demonstration, partly for observation purposes. This is one way of giving interesting new breeds a start. In 1935 400 of these collections were grown, several of them abroad.

In late years, attempts have been made to carry out exact research on the development of races with the aid of private people, chiefly young farmers and farmer's sons.

7. Organising work. The managing director and his staff are members of the boards and executive committees of nearly every organisation connected with plantbreeding in the Netherlands. Moreover they succeeded in uniting the Dutch plant breeders in an association which forms part of the International federation (Fédération internationale des sélectionneurs de plantes de grande culture at Paris). The Netherland Breeders Association fosters the interests of Netherland plantbreeders and aims at giving information and encouraging whereever it is possible.

During the last few years, this institute has been the centre of investigations on forage growing (Nat. Committee for forage culture and silage). In addition a National Committee for Brewing Barley research has been founded, and this committee is directed by the Institute.

THE LABORATORY FOR AGRICULTURAL CROPS (LABORATORIUM VOOR LANDBOUWPLANTENTEELT)

When in 1918 the University College of Agriculture was founded, the separation between the section for the culture of agricultural crops (Afdeeling Landbouwplantenteelt) and the Institute for Plantbreeding (Instituut voor Plantenveredeling) which already existed (the latter since 1912) was not yet accomplished. The teaching in farm-crop-production for the temperate zones (consequently excepting the tropical, however including the plantbreeding for temperate zones) was until the retirement of Professor Dr O. PITSCH, divided between two professors. Hereafter it was temporarily assigned with the leadership of the above-mentioned Institute, of which PITSCH was the first director, to Prof. Ir H. MAYER GMELIN. This state of affairs lasted until 1923, when Prof. Ir C. BROEKEMA was appointed director of the Plantbreeding Institute, and a reasonable division of teaching was arranged, by which the latter

became responsible for plantbreeding, while the culture was preserved for the first-mentioned, who at the same time remained in charge of the laboratory for the culture of agricultural crops and the experiment gardens (at the moment comprising nearly $2^1/_2$ hectares, about 6 acres) belonging to the section. These plots are used chiefly to give practical examples of the theories expounded. First and foremost they enable students to make a study of crops and races. These grounds are also used for scientific work by the professor and his assistant. No periodical publications are issued by the laboratory. In late years several publications of the laboratory for agricultural crops appeared in the periodical „Landbouwkundig Tijdschrift", which is the periodical of the Netherlands Society for Agricultural Science. Among the subjects, which are particularly studied, are the following: The flora of useful meadow-grasses, in particular for the purpose of getting in future the disposition of the varieties of grasses, considered better in practice than the present commercial seed; experiments on inbreeding with rye and red clover; experiments on crossing with different crops; experiments on jarovisation; experiments with races of Phaseolus vulgaris, obtained from spontaneous cross-fertilized plants, to get these races free from mosaic disease etc.

THE SECTION FOR FORESTRY (AFDEELING BOSCHBOUW)

The University College of Agriculture offers a five years graduate course, leading to the degree of Master of Science in Forestry (Forest Engineer).

The Department of forest- and wood-technology of this college, directed by Prof. A. TE WECHEL, is steadily building up a collection of wood samples of woods in different parts of the world, with emphasis of tropical woods, in particular those in the Netherlands colonies in East and West India. The Department studies the macroscopic and microscopic investigation and identification of woods of the whole world.

Dr J. R. BEVERSLUIS, of the Department, developed a method of microscopic description of Angiosperm woods, based on a systematic prompter, representing a micrographic key for identification, which can be extended to an unlimited degree (vide his work: „De micrografische identificatie van hout", (The micrographic identification of wood), publ. by H. Veenman en Zonen, Wageningen, 1925). A similar method for macrographic identification of Angiosperm woods was published by him in a contribution to the „Congrès international du bois", at Paris, 1932.

THE LABORATORY FOR BULB-RESEARCHES AT LISSE (LABORATORIUM VOOR BLOEMBOLLENONDERZOEK TE LISSE)

The Laboratory for the research of flower-bulbs at Lisse belongs to the University College of Agriculture at Wageningen, and, together with the Laboratory for Mycology and the Laboratory for Entomology it forms: „The Institute for Phytopathology".

The leader of the Laboratory, Prof. Dr. E. VAN SLOGTEREN,

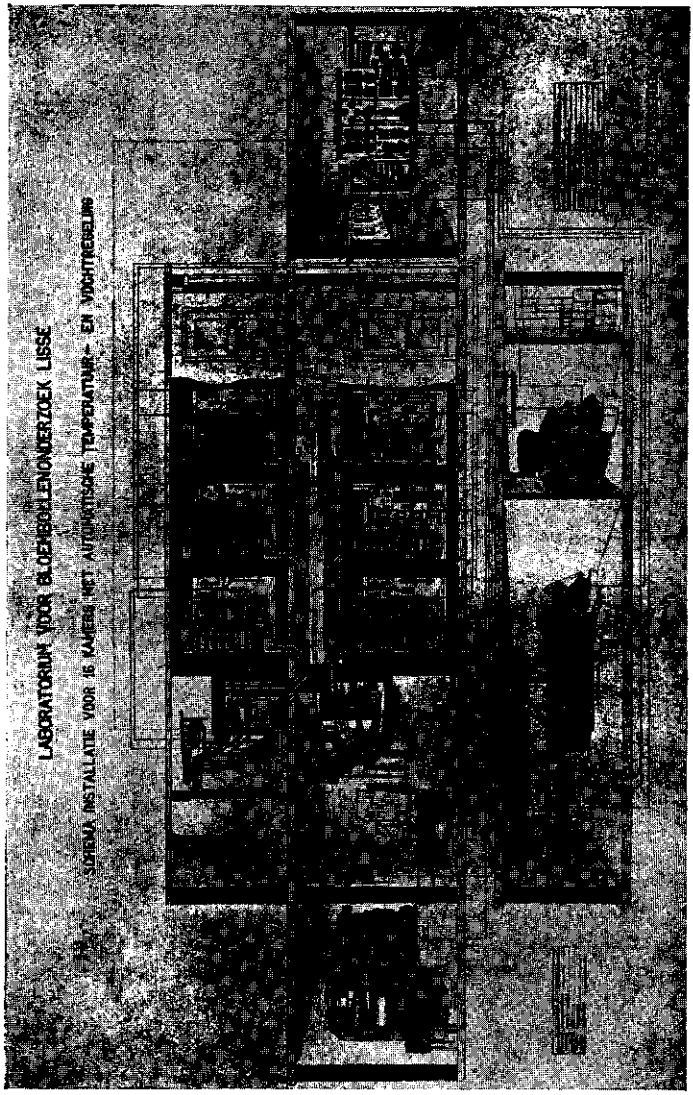
Laboratory for bulb-research at Lisse.

began his researches in 1917, as phytopathologist for the bulb-district in connection with the appearance of „The Eelworm-disease" of *Narcissi*.

For this research, and with an eye to other problems of bulb-culture, the laboratory was built in the years 1921/1922. The bulbgrowers have always recognized the importance of scientific research for the benefit of their culture, and materially contributed to the finishing and improving of the installations. After having been destroyed by fire in 1928, the laboratory was

rebuilt and enlarged, again with the vigorous assistance of the bulbgrowers.

It is impossible to draw a sharp line between a sound bulb



Scheme of the installations for constant temperature and humidity in the Laboratory for bulb-research at Lisse.

and a diseased one. Neither are the problems of the diseases to be separated from those of the culture of sound bulbs. There-

fore the laboratory has been named: „Laboratory for bulb-research".

Only a thorough knowledge of sound bulbs and their vital functions can give us an insight into the causes of abnormalities, and the methods for fighting parasitical as well as physiological diseases *can* and sometimes even *must* influence the capacity for growing and flowering, in other words the trade-value of the bulbs, to such a degree, that all the problems can only be studied in close connection with each other.

This makes heavy demands, not only upon the staff, but also and especially upon the organization of the laboratory and its installations, which must be adapted for anatomical-, morphological- as well as for physiological-, mycological- phytopathological-, and chemical researches.

We may particulary mention the installations, consisting of 16 rooms of constant temperature, in which, besides the temperature, the degree of moisture of the air and the ventilation may also be automatically regulated and registered.

The investigations of the Laboratory for bulb-research have especially concerned: the nematode-diseases of bulbs, the Yellow disease of hyacinths, (*Pseudomonas hyacinthi*), and the fight against these two diseases, against which effective methods have been found (the hot-water treatment against the Nematodes and the hot-air treatment against the Yellow-disease of hyacinths) — the respiration of hyacinths — the preparative methods for an early flowering of hyacinths, tulips and narcissi and the chemical processes connected with these —, the influences of shipping-conditions and the climate on the flowering-capacity of bulbs, and, in connection with this, the importance of various fungi or other organisms as primary or secondary parasites —, the sterilization of the soil by means of steam —, and, further, the biological strains and their importance for the principle of plant-quarantine and the phyto-sanitary measures, taken against our bulbs in various countries. Part of the results of these researches have been set down in about 50 publications.

For these researches and the results obtained, the situation of the laboratory, in the very centre of the bulbgrowing district, has been of vital importance. Only by this fact, was a close contact with the often very complex problems made possible; and this contact is essential for the analysis of the problem for the research, as well as for a correct interpretation of the results obtained.

In 1935 the staff of the laboratory consists of:

Prof. Dr. E. VAN SLOGTEREN, Director; Dr. J. J. BEIJER, Botanist; Miss Dr. A. S. TIMMERMANS, Mycologist; Dr. L. ALGERA, Physiologist; Dr. E. COLLINS, Chemist.

III. AUTONOMOUS OFFICIAL AND SEMI-OFFICIAL INSTITUTIONS

THE NETHERLANDS HEATH SOCIETY (NEDERLANDSCHE HEIDEMAATSCHAPPIJ) ARNHEM

The Nederlandsche Heidemaatschappij is a society, founded in 1888, whose members pay a small annual subscription. A branch is formed if at least 20 members live in any specified district. There are also Departments dealing with the special interests of the Society, closely connected to it, such as Fruit-farming, Fishery work and Re-Allotment of lands. These departments have members and branches in the same way, spread all over the country. Branch representatives elect the heads of the Society and its departments.

The object of the Nederlandsche Heidemaatschappy is to increase the value of cultivation of Dutch soil in the broadest sense. Advice is given and reports drawn up on all matters that are connected with soil productivity, and such work is also undertaken for the members.

At present the Government makes great use of the experience of the Nederlandsche Heidemaatschappij in providing work for the Unemployed. Some tens of thousands are engaged by or under control of the Society. Works are carried out at cost price. At the present time some thousands of large and small jobs are carried out annually; reclamation, planting, fruit-farming, re-allotment and fishery work. Thus in the broadest sense, covering almost the whole problem of soil cultivation.

Through the Nederlandsche Heidemaatschappy the members can buy seeds, fertilisers and other necessary items, and can sell all kinds of farm, forestry and fishery produce.

Propaganda is prepared for the aims of the Society, and information given to the public of the work covered, by holding exhibitions, giving courses and lectures, publishing a periodical and other press notices, and by keeping a library and museum.

For all this work the Nederlandsche Heidemaatschappij has some hundreds of technical and office employees.

In the Museum of the Nederlandsche Heidemaatschappij, a great number of exhibits are to be found, of interest to Botanists. Some of these are on show in the Exhibition attached to the 6th International Congress. Sufficient only to name here the pieces of trunks of our various trees; also trees and cultivated plants affected by harmful fungi. The fight against plant diseases, both from animal and vegetable origin, plays a prominent part in present-day farming.

For the rest, the Nederlandsche Heidemaatschappij continually comes in contact with botanical questions. The wild vegetation on waste land greatly helps to decide if the land is suitable for cultivation, while in the planning of forest lay-outs, it is important to obtain a satisfactory association between the trees used. This depends upon the botanical characteristics such as rate of growth, growth-form, the ability to tolerate shade, and humus-formation. The native vegetation, again, gives indications as to whether, in our forests, humus-formation is proceeding in the desired direction. Besides these, there are many other botanical questions, which are of great importance for the reclaimer, the forester, and, indeed, for everyone, interested in primary production.

THE PHYTOPATHOLOGICAL LABORATORY „WILLIE COMMELIN SCHOLTEN" (PHYTOPATHOLOGISCH LABORATORIUM „WILLIE COMMELIN SCHOLTEN") BAARN

The Phytopathological Laboratory „Willie Commelin Scholten" is an institute, founded in 1894 by Mr. and Mrs. SCHOLTEN-COMMELIN, in memory of their son „Willie" a student of biology who died at the age of 26 in 1894. This institute originally had a threefold purpose:

1. to give information in the practice of agriculture, horticulture and forestry about diseases and their prevention.
2. to increase knowledge of plant-diseases by research-work
3. to promote the interests in instruction in phytopathology.

Prof. Hugo DE VRIES gave his cooperation as president of the Board till 1899.

The laboratory was established in Amsterdam, and Dr. J. RITZEMA BOS became the first director. The entomological as well as the mycological side of phytopathology was investigated; the foundation for the Phytopathological Service of the Nether-

lands was laid by him in 1899, and practical horticulture, agriculture and forestry obtained a great deal of support and advice from this institution.

The director was at the same time professor at the University of Amsterdam. In 1899 Prof. WENT became president of the Board, and acted in this capacity until 1935. Mr. E. H. KRELAGE has been secretary since 1895. Publications appeared in „Tijdschrift over Plantenziekten".

In 1905 the Government removed the Phytopathological Service to Wageningen and at the same time appointed Dr. RITZEMA BOS Professor and Director of the new Government-institute for Phytopathology at Wageningen.

As a result one of the main purposes of the institute fell into disuse; namely, the work of giving advice and drawing up legal regulations. Monetary support was no longer received from the Government, and the professorship in Amsterdam was cancelled. In 1906 Dr. Johanna WESTERDIJK was appointed director, and the work was restricted to investigations on phytopathological (mostly mycological) subjects. In 1907 the Central Bureau for Fungus-cultures was established in the Laboratory. The investigations were published in the „Mededeelingen van het Phytopathologisch Laboratorium Willie Commelin Scholten".

For the next 10 years, undergraduates from the University of Amsterdam and foreigners worked at odd times in the laboratory, but no actual instruction was given, until in 1917 the director was appointed Professor of phytopathology at the University of Utrecht. It soon became apparent, that to meet the needs of the Utrecht undergraduates in practical work, there was not room enough in the laboratory in Amsterdam. As luck would have it, in 1920 a gift was presented to the Botanical Department of the University of Utrecht. The brothers and sisters of the late August Janssen at Baarn made a present of the „Cantonspark" at Baarn, part of which was destined to be used in phytopathological activities. By another happy chance, the Board of the „Willie Commelin Scholten Institute" were able to purchase a country-house with grounds, in the immediate neighbourhood of Cantonspark. The laboratory was removed from Amsterdam to Baarn in 1920, and practical work for students from the Universities now developed freely in the building and the gardens at Baarn. Connection with the University of Amsterdam became closer again, by the appointment of the director as professor in Amsterdam in 1930. At present, graduates from the University of Leiden also regularly come to work in the laboratory, and, now and then, an undergraduate from the University of Groningen. So the laboratory has become

the centre of phytopathological studies for the Universities. Lectures are given at Utrecht and Amsterdam, not in the institution at Baarn.

By the presence of the collection of the Central Bureau for fungus-cultures in the laboratory and the experimenting-grounds round the building and in Cantonspark, an all-round training in phytopathology has been guaranteed.

As a result of the collaboration of the Universities and the support of other institutions, the Board of the institute now consists of representatives from the Universities of Amsterdam and Utrecht, from horticultural and forestry institutes and from the colonies (President Prof. Th. WEEVERS).

The staff consists of the director and one permanent collaborator Mr. A. VAN LUYK, and one demonstrator for practical courses. Investigations on parasitic and physiological diseases and on variation and physiology of fungi have been carried out by the staff and also by young workers for publication as theses for their Doctorates. Studies about the elm-disease (*Ceratostomella*), about root-rots of grasses and other plants, willow bacterial disease, cankers, bulb-diseases, concerning boron deficiency and injury by sodium-chloride, about immunity and virulence have been issued. Investigations on Antagonism between fungi are at hand.

For the „Committee for the Investigation and Control of the „Elm-disease" (president E. VAN DISSEL, secretary Ir. N. VAN POETEREN) the investigations on the fungus *Ceratostomella,* the pathology of the host-plant and the susceptibility of the species and on variation and physiology of fungi have been carried out by Dr. C. J. BUISMAN. Specimens of resistant and susceptible types of elms are grown in the gardens.

The laboratory contains an extensive library on phytopathological and mycological subjects; herbarium material however is not carried. Material of various plant-diseases is present in the experimental grounds.

The institute of Mr. and Mrs. SCHOLTEN-COMMELIN has made it possible for different institutions to work together in one building and under the same management in the interests of phytopathology.

THE CENTRAL BUREAU FOR FUNGUS CULTURES (CENTRAALBUREAU VOOR SCHIMMELCULTURES) BAARN

„The Central Bureau for fungus cultures" is an institute,

which aims at getting together and maintaining a collection of pure cultures of fungi, and making these available for all those who are interested.

This collection has been allotted a place in the laboratory of the „Willie Commelin Scholten" institute at Baarn.

The history of it is, briefly, as follows: in 1905 the „Association internationale des Botanistes" decided to bring together a collection of pure cultures of fungi: Prof. F. A. F. C. WENT at Utrecht undertook to execute this plan. In 1907, however, this collection came under the charge of Dr. Johanna WESTERDIJK, director of the Phytopathological Laboratory „Willie Commelin Scholten", then in Amsterdam. During the great war the Association ceased to exist. As a financial basis was then lacking, several Dutch scientific societies temporarily came to the rescue, until in 1918 the Royal Academy of Sciences in Amsterdam succeeded in obtaining a regular grant of money from the Government for the Central Bureau; the Academy itself was also a great support to the Bureau inter alia by issuing its publications and publishing the annual „List of Fungi".

The Phytopathological Laboratory „W. C. Scholten" supports the bureau by permanently housing the collection. The space available in course of time however became too small. The former President of the Tea-experiment Station in Java, Mr. Odo VAN VLOTEN, who had been already supporting the bureau for some years, in 1929 presented a sum of money to the Phytopathological Laboratory „W. C. Scholten" to enlarge the building, more especially to provide greater space for the collection of fungus cultures.

The Bureau is also supported by a contribution from the Section botanique of the „Union internationale des Sciences biologiques", which, in a way, may be considered as a continuation of the Association internationale des Botanistes. The support given by institutions from the Dutch colonies has been very much reduced.

In addition to this, the Central Bureau has to raise the funds necessary for maintaining and extending the collection from the sale of cultures.

In order to give full justice to the collaboration of these different institutions the Bureau in 1934 became an Institute under the management of a Board, which comprises two members of the Royal Academy of Sciences, two members of the Institute „W. C. Scholten", one member of the Section botanique of the Union internationale des Sciences biologiques and a representative of Mrs. van Vloten, the widow of the donor of the funds mentioned above.

The present director of the collection is at the same time secretary-treasurer of the Board.

During the development of the Bureau, it was found, that the right place for the yeasts would be in the Microbiological Institute of the University College of Technology at Delft, where special interest is given to these groups of organisms. The director, Prof. A. J. KLUYVER has taken this department under his care. The collection however remains part of the Central Bureau.

At present, a staff of 4 scientific workers is engaged in maintaining and extending the collection: one of them is constantly transferring and inserting newly obtained fungi: the other three have specialised in various groups. New species are regularly being published either as information (Mededeeling) from the Central Bureau (publication from the Royal Academy of Sciences) or in the Zentralblatt für Bakteriologie (VAN BEYMA THOE KINGMA, DIDDENS). More especially the yeasts and related groups are being treated monographically [1]).

When in 1907 Prof. WENT transferred the collection to the present direction, the collection contained 90 species; it has now increased to over 5000. Every year an increase of 400 to 500 units can be recorded.

The strains have been obtained from requests to investigators, who issue publications on certain species or describe new species.

We regret to state that as a general rule, new specimens are not sent to the Bureau, spontaneously: but, happily, more and more presentations of this kind are received. Several strains of one species are accepted if they are of special interest, e.g. in phytopathology the biological and local races, in technology strains with certain biochemical characters or strains, about the identity of which doubts have been expressed in literature, etc. etc. It stands to reason, however, that this extension can only go as far as there are workers to carry it out.

Though the Bureau in many respects, financially as well as scientifically, finds a great deal of support, international cooperation might be much greater. It proves to be impossible, on the present financial basis, to maintain the collection on the same footing, and to meet the further activities that arise from its unavoidable growth.

The purchase of cultures must, as a result of the present problems of exchange be extremely difficult for many countries. However, as interest in all the branches of mycology is in-

1) Die Hefesammlung des „Centraalbureau voor Schimmelcultures". Teil I. „Die Sporogenen Hefen" by N. M. Stelling—Dekker. Teil II. „Die Anaskosporogenen Hefen" by J. Lodder. Erste Hälfte.

creasing, it should surely be possible to ensure the maintenance of this collection in view of the fact that there are more than 4000 institutes of pure and applied botany, all of which must, from time to time be in need of cultures.

INSTITUTE FOR SUGAR-BEET CULTURE (INSTITUUT VOOR SUIKERBIETENTEELT) BERGEN OP ZOOM

The „Instituut voor Suikerbietenteelt" (Institute for sugar-beet culture) (Director Dr. P. J. H. VAN GINNEKEN) was founded in 1930 by the Netherlands beet-sugar industry. It succeeded a Commission which confined its work especially to experiments in order to determine the comparative merit of various brands of commercial sugar-beet seed. The Institute took over the task of the Commission and expanded its work all over the domain of the research concerning sugar-beet culture. The special object of the Institute is to raise the yield per hectare in tonnage and sugar production. This object is pursued principally by scientific means. Science however is but a means to an end, the final object being an economical one. — The Institute has its own laboratory so that field experiments may be done in close association with laboratory investigations. Up to now the subjects of the work of the Institute have been among other things: the study of various sugar-beet strains, the study of the growth of sugar-beets during the whole growing period, the influence of manuring, the production of carbonic acid by the soil and also the study of the influence of various elements on the growth of the beets such as boron and manganese. The influence of various insect enemies has also been studied, particularly the beet-fly. — A special working method in order to study the growth of the beets and the factors which influence the growth has developed itself in the last years by an inquiry of a great number of fields. The results of this inquiry have been worked up statistically. The investigations of the Institute are published in the „Mededeelingen van het Instituut voor Suikerbietenteelt".

THE NETHERLANDS GOVERNMENT RUBBER INSTITUTE (RIJKSVOORLICHTINGSDIENST TEN BEHOEVE VAN RUBBERHANDEL EN RUBBERNIJVERHEID) DELFT

On the 14th May 1935, the Netherlands Government Rubber

Institute celebrated its twenty-fifth anniversary. From 1910—1916 the Institute was placed under the guidance of Prof. Dr. G. VAN ITERSON Jr; in 1916 it was definitely organised. Originally housed in one room, it now occupies a full wing of the Laboratory of Technical Botany of the University College of Technology at Delft. There are specious chemical laboratories and a library on the first floor; the ground floor consists of a vulcanisation room, mechanical testing laboratory and the Director's room.

The Institute is to be regarded as a centre of rubber information and research. A considerable variety of work is carried out for three branches of the industry, i.e. the rubberproducing companies, united in the International Association for the Rubber Cultivation in the Netherlands Indies, the rubber manufacturers and the consumers of rubber articles. This work is partly of informative character; it includes testing a large variety of rubber articles, and technical investigations of a varied nature. During a number of years research work was carried out for a number of co-operating rubber manufacturers, but unfortunately this work had to be abandoned owing to the critical times.

Apart from this requested work, research work for its own sake in relation to rubber problems is carried out at various times, e.g. on rubber latex, on the quality of raw rubber, on the problems in relation to the vulcanisation process, on the oxidation and the ageing of vulcanised rubber.

The Institute works in close contact with the Technical Department of the International Association for the Rubber Cultivation in the Netherlands Indies, whose chemists are working most of the time at the Institute. There is also close co-operation with the Central Office of the Society of Directors of Electrical Plants in the Netherlands, and the situation of this Institute in one of the buildings of the University College of Technology guarantees a close harmony with this educational body.

Copies of a list of publications of the Institute are forwarded on application.

THE LABORATORY OF THE GOVERNMENT FIBRE INSTITUTE (RIJKSVOORLICHTINGSDIENST VOOR DEN VEZELHANDEL EN DE VEZELNIJVERHEID) DELFT

Owing to the ever-increasing competition in industry, research on the properties of raw materials, products in various stages of completion, and of finished articles, is of extreme importance. It

is for this reason that, in late years, industry as well as trade is constantly making more use of scientific methods of investigation of fibres and fibrous products. The „Rijksvoorlichtingsdienst ten behoeve van den vezelhandel en de vezelnijverheid" (The Government Institute for the fibre trade and the fibre industry) at Delft, Netherlands, which maintains a scientifically trained staff, offers ample opportunity to those interested to have the necessary investigations made.

It is needless to add that this institute has at its disposal a well-equipped laboratory to fulfil its task as it should. To determine the various physical and chemical properties, there are available a great number of instruments, some of which are very costly. Furthermore, use may be made of the equiment in the many laboratories of the University College of Technology at Delft.

Of the most important apparatus we mention the Ball's cotton-sorter, with the aid of which the length of cotton fibres may be determined, the Krais apparatus, wherewith the strength of thinner and shorter cotton fibres may be determined, and Schopper's conditioning apparatus, for determining the moisture content.

Moreover, various fibrous materials may be investigated microscopically, and a micro-projection apparatus of Leitz makes possible the preparation of micro-photos and drawings.

Threads and fabrics, as such, can also be studied; in this work use is made of the Lea-test dynamometer of Goodbrand to determine the strength of leas, and of the dynamometer of Schopper to gauge that of fabrics. Not only the strength of threads and fabrics is studied, but also their fastness to light, which quality is of special importance in various sorts of paper.

Since the chemical properties of fibres and textiles are also of great practical importance, the institute contains a well-equipped chemical laboratory, where the percentage of ash, the wool and cotton percentage, fastness of colour in washable fabrics, the extractable percentage of flax threads, paper sizing etc. are being constantly determined.

The use of the services of the institute is open to large institutions and factories as well as to dealers and individuals, at a rate of payment, which covers the costs incurred.

The Governmental Fibre Institute, with its director, is under the jurisdiction of the Department of Economics. An advisory committee continually reports to the minister of economics and keeps in touch with the various branches of the industry.

THE GOVERNMENT EXPERIMENT STATION FOR ARABLE AND GRASSLAND (RIJKSLANDBOUWPROEFSTATION VOOR DEN AKKER- EN WEIDEBOUW) GRONINGEN

The Experiment Station at Groningen, established in 1889, has, since its reorganisation in 1913, a general aim, covering all subjects of importance concerning arable and grassland, except those that are treated by specialised institutes. As far as botanical work goes, plant breeding is provided for by the Instituut voor Plantenveredeling (see page 47) while diseases and pests are the concern of the Plantenziektenkundige Dienst (p. 74) and the Laboratorium voor Mycologie en Aardappelonderzoek (p. 41). Some work is done for horticulture and for sylviculture, but only occasionally and as far as other occupations allow.

In accordance with its general character, the Station is divided into four sections, and the scientific staff is at present:

Prof. Dr. O. DE VRIES, General Director.

Agricultural Division: Ir. P. G. MEIJERS, Director; C. MEIJER, Dr. Ir. H. J. FRANKENA, Ir. F. DECHERING, Ir. W. C. VISSER, Agriculturists;

Chemical Division: Ir. J. G. MASCHHAUPT, Director; Dr. C. W. G. HETTERSCHIJ, Drs. P. BRUIN, Dr. Th. B. VAN ITALLIE, Chemists;

Botanical Division: Dr. K. ZIJLSTRA, Director; Dr. M. A. J. GOEDEWAAGEN, Dr. D. M. DE VRIES, Botanists;

Microbiological Division: Dr. Ir. F. C. GERRETSEN, Director; Dr. J. SACK, Bacteriologist.

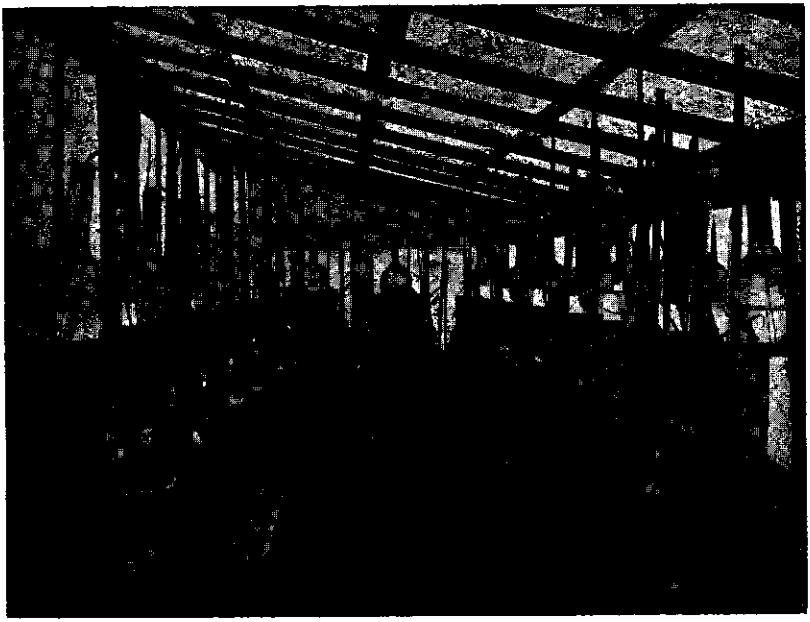
Hospitality is extended to several workers in the same field; at present these are Ir. S. D. RISPENS (working on problems of crop rotation), Ir. W. FEEKES (wheat, principally baking quality) and Dr. F. v. d. PAAUW (phosphoric acid and potassium supply).

The original building having become too small, the Station is at present accommodated in two buildings, one (v. Hallstraat 3) containing the headquarters, the agricultural and the chemical division, and the other (Eemskanaal 1) the botanical and microbiological division. Both buildings have adjoining small experimental gardens; the Station further carries out about one hundred field experiments, mostly in the province of Groningen, and about thirty of which are conducted on three experimental farms.

The *Botanical Division* spends a great deal of its time in the study of the botanical composition of grassland and the influence

of various factors thereon, such as grazing, mowing, manuring, soil reaction, level of groundwater. Investigations are also proceeding on the laying out of land as permanent grassland, by using various seed mixtures, especially in the new Zuiderzee-polders, where one has to reckon with an initial salt content of the soil. Seed mixtures, suitable for the new sea-dykes, are also studied.

An extensive investigation is carried out on the botanical com-



At the Agricultural Experiment Station, Groningen, special attention is paid to thesterile culture of higher plants, for the investigation of problems corcerning the influence of microbes on plant life.

position of first-rate old pastures, in order to learn to understand the importance of the various sorts of grasses for different regions.

In connection with these investigations, much attention has been devoted to the improvement of the methods of sampling and investigation, and the determination of their reliability.

A detailed study is being made of the development of the roots of agricultural plants under the influence of varying distribution of fertilizers in the soil, as well as under the influence of other factors, such as moisture content and aeration of the soil.

In addition, investigations are made on the weed flora of

arable land, to discover in how far this flora may be an indicator of the soil type, manuring, water economy and soil structure.

A further subject of study is the influence of the salt concentration in culture solutions upon the growth of agricultural plants, particularly in connection with the measures to be taken for the setting under cultivation of the new Zuiderzee-polders, where, in the beginning, the salt concentration of the soil is rather high.

Another subject of investigation is the power of resistance of winter wheat and winter barley against frost. This resistance is determined by means of artificial freezing of young plants.

The significance of jarowisation or vernalization of winter cereals is under investigation, particularly concerning yield and quality of the crop harvested. A comparative morphological and anatomical study of the vernalized and non vernalized plants is included in this work.

Morphological and anatomical work is also done on agricultural plants of the new Zuiderzee-polders, in order to compare the crops harvested from soils with different salt content.

The transpiration of various sorts of grasses is determined and compared with the evaporation of the bare ground and of a free water surface.

The quality is determined of some agricultural products, for instance of caraway seeds (oil and carvon content) grown under the influence of different manures, different times of harvesting and different means of controlling the caraway moth pest.

The *Microbiological Division* is concerned with investigations on the activities of soil bacteria in relation to plant growth. A special technique has been developed for the cultivation of plants under sterile conditions. By means of this method it could be shown, that micro-organisms play an important rôle in bringing about the symptoms of grey speck disease in oats, as well as in making insoluble phosphates available for the plant.

The influence of nitrification upon pH changes is also being investigated; attention is further paid to different microbiological methods, in use for the determination of plants nutrients in the soil.

The changes in the redox-potential of the soil, as influenced by microbes, are being studied in relation to plant growth and the mobility of iron and phosphates in the soil.

Cultures of different root-nodule bacteria for inoculation of legumes are available for farmers and are asked for in increasing numbers. The question of optimal virulence in relation to the different varieties of the host plant (specially with regard to soja) is being studied.

The *Agricultural Division* is chiefly engaged in field experiments on manuring questions, cultivation and other measures, liming, tillage and similar subjects. The Station's own field experiments are of the more complicated type, containing sometimes as many plots as 285 or even 432; botanical and chemical investigations, such as may be desired, are carried out in close connection with the agricultural work. The Station further compiles data from the field experiments of the Local Advisory Service and issues summarising reviews upon separate subjects. Grassland experiments (both pastures and meadows) are a prominent feature of this field work. Statistical methods are studied and applied as the work demands.

The *Chemical Division* is chiefly engaged in work, dealing with soil; it collects data on the chemical composition of the principal crops under normal and under special experimental conditions, and a Table, giving figures for the average composition under local agricultural conditions, has been issued. Special attention is paid to the kation-ratio in connection with the base-status of the soil and with manuring; a further special subject is the effect of excess of potassium on the starch content and the starch production of potatoes.

Publications appear in the Verslagen van Landbouwkundige Onderzoekingen (Communications on Agricultural Investigations), issued by the Dept. of Economic Affairs at the Hague; these are in Dutch, with a summary in German or English. Occasionally scientific papers are published in foreign journals; smaller and popular papers appear in the local agricultural press.

THE GEOLOGICAL BUREAU FOR THE DUTCH MINING DISTRICT (GEOLOGISCH BUREAU VOOR HET NEDERLANDSCHE MIJNGEBIED) HEERLEN, LIMBURG

The *Geologisch Bureau, Heerlen* (Director Professor Dr. W. J. JONGMANS), an institute for the paleontological investigations of the Dutch Mining-district in Limburg, occupies a special position among the botanical institutes of this country. It was founded on January 1, 1908, as a branch of the „Rijks Opsporing van Delfstoffen", the government institute for geological researches in the Netherlands, especially in connection with the occurrence of coal and minerals. This branch-office was established as the young coal-industry had to make numerous researches by borings, and as a special knowledge of the geological composition of the Limburg soil would be of the greatest importance for the development of the colliery-work. Since January

1, 1924, it has ceased to be a government institute, but has been a foundation of the Dutch collieries. The Government contributes for general researches and for such special investigations as are necessary for the execution of official works.

An examination of the material obtained from borings and an examination of the underground workings on the occurrence and distribution of fossils were some of the first tasks of the institute. As plants form an important part of the material for stratigraphical researches, it was necessary to pay special attention to the flora of the carboniferous system in this country. Thanks to the support of the directors of the mines and the „Rijksopsporing" it has been possible to make systematic collections, in most of the collieries from the very beginning of their workings. In studying this material and comparing it with similar material from other countries of Western Europe, it became evident that the fossil flora was one of the most important and valuable bases for the study of the stratigraphy of the carboniferous in the different basins.

In this way the paleobotanical work of the Bureau at Heerlen grew larger and larger. The systematic methods in the collecting of the Dutch fossil flora enabled us to make up a complete review of the succession of the carboniferous floras in this country and to compare them with those in the other parts of W. Europe. These methods provided us with material not only from selected localities but from all succeeding beds. Another important result is that we did not collect only „museum-specimens", but that all our collectors tried to get a view on the different forms in which the same plant may occur. Our enormous material throws a new light on different species. We hope at some future date to publish full descriptions with many figures. This work will be of the highest importance to increase the knowledge of the carboniferous flora.

As at the same time our collectors paid attention to animals, not only from marine horizons but also from fresh water deposits, we obtained at Heerlen a general collection which could serve together with the flora as a base for the discussions at the Heerlen stratigraphical Congress, 1927.

This collection will also be of high value for comparison with other coalfields in the world, where similar formations, belonging to the Namurian and the Westfalian, are met with.

It is shown in a special museum at Heerlen. We try in our exhibits to give a general view on the different species and on the composition of the different formations as to both flora and fauna.

The collection not only contains Dutch specimens, but in-

cludes a large number of specimens from other coalfields of Europe, necessary for purposes of comparison. These specimens have been obtained by exchange, by presentations, and as the result of a number of excursions, among which the collections, made on the excursion in England preparatory to the Congress at Cambridge and at the international paleobotanical excursion after this Congress, take an important place. Other material has been collected on the later international excursions in France and in Germany, on special excursions in the Saar-basin and Lorraine, on several special excursions in the French, Swiss and Austrian alps and on many other occasions.

Our collections of floras from the Alps are, perhaps, excluding some *very specialized collections,* among the best and most complete in Europe.

A rich collection has been brought home from the U.S., where, during a trip after the International Geological Congress, Washington, our representative was able to visit the coalfields of several states; those of Pennsylvania, Virginia, W. Virginia, Illinois, Kansas. On this excursion, we found several new floras, and we collected material from different horizons, so far unknown in the american literature.

Another important collection is that from Sumatra, collected by Dr. Posthumus at my instigation. This material proves that this series of rocks still belongs to the Stefanian and that it cannot be classed with the so-called Permian. By the presence of Gigantopteris, the relation with other deposits in Eastern Asia is clearly proved. The figured specimens of this collection have to be sent to Bandoeng, but the collection of duplicates is so rich, that it gives a full idea of this interesting and important flora. I have great pleasure in thanking Dr. Posthumus for the work, done in Sumatra, which is of the highest value for paleogeographical studies in the far-East.

A great deal of our work is devoted to the study of the coal itself, to the different elements of which it is composed, and to the different structures, which can be detected in it by several methods. We use methods, which enable us to throw a new light on the different questions, connected with origin and composition of coal and with the significance of the different elements contained in it. This study will certainly prove to be of great importance for the collieries. But it is curious, how many details are discovered in coal which are or may prove to be of a special botanical interest.

Of course, so far these botanical results cannot yet be compared with those obtained by the study of the coal-balls, which have been found in our Dutch collieries in two horizons. The

lower is the same, from which in England the bulk of Williamson's and Scott's material has been collected. From this lower horizon we have a rich collection of Dutch, German, and British balls. The higher one, separating the middle and upper Westfalian, is of rare occurrence. In other countries only some isolated specimens have been found. We possess a rather good collection, from which samples can be seen in our show cases.

We also possess a rich tertiary flora, especially from the pliocene deposits in the neighbourhood of Heerlen. This collection has not yet been described, and we hope to find a Dutch student who can undertake this task. The study of the tertiary floras of Limburg, i.e. Tegelen, Swalmen, Brunssum, and the lignite mines, will provide us with a very important review on the succession of floras in Limburg during the younger part of the tertiary. This study is important from many standpoints, but not the least, because the glaciation did not reach this part of our country.

I may mention here, that the collection in Heerlen embraces not only these carboniferous floras and faunas and tertiary plants, but that they contain also a rich material of cretaceous and tertiary faunas, a material which for a great part is still undescribed.

We also possess a great number of rock specimens, among which I mention those collected from several deepborings. Some of these cores give an excellent idea of the way in which the sediments of the carboniferous have been deposited.

As a further treasure of the Heerlen collections I can mention the minerals collected in the Dutch mines. I do not know of one other collection of this kind in Europe.

Altogether the Heerlen institute has developed into a centre of paleontological and geological knowledge, and it is of the highest importance for a general study of this part of our country. Also it is of a high practical value. It enables us to answer many questions arising from the underground-workings of the collieries and has thrown a new light on many of the conditions we meet there. It also has taught us a great deal about surface geology, knowledge of which is of vital importance, in solving many technical problems (the provision of drinkwater, etc.).

A museum, such as we have in Heerlen, is also of high social interest. Visitors can learn here the origin of the coal, they can make the acquaintance of the floras and faunas which lived here in earlier periods, the formation of the rocks which build up our province of Limburg. It is a well-known fact, that one who is acquainted with the details, with the elements, with the

significance of his work, will do this work much better, because he understands more of it, than one who is doing his work as a daily task, which must be finished before he receives his salary, and who does not ask questions on the why and wherefore.

It is therefore to be hoped that, even under the present difficult conditions we can continue our work and that we will be able to add to our knowledge of, and to further the development of, the coal industry.

THE GOVERNMENT FOREST SERVICE (STAATSBOSCHBEHEER) UTRECHT

The State Forest Service in the Netherlands was established by Act of parliament on the 21st of July 1899, with a view to the conservation and exploitation of existing forests and the afforestation of waste lands.

In managing forests and grounds, the idea in mind is on the one hand the production of timber, and on the other hand the conservation of the natural beauty of the country, the fixation of dunes and drifting sands, and so on. In the afforestations as much as possible is being done for the protection of natural scenery. A number of grounds, which are particularly remarkable from a scientific or aesthetic point of view, are preserved in their original state. At present, the total surface of the grounds thus protected is about 7000 ha [1]). Besides extensive protected areas on the Frisian Islands, in the Kootwijk Sand, a small phreatic lake, called Gerritsflesch, with surrounding heath on the Veluwe, some larger or smaller parts of other State grounds are also being preserved as natural monuments. Various State forests may likewise be regarded in this light.

The afforestation of waste lands affords permanent employment, especially in winter, when farming requires little or no labour. This opportunity for employment can be expanded in times of economic depression, with a view to relief for the unemployed; this is being done at present on a large scale.

On the 1st of January 1934 the total area, administrated by the State Forest Service, amounted to 47822 ha (of which 20507 ha were under cultivation) divided into 8 forestry-districts, viz.: „Breda", „Kootwijk", „Haarlem", „Assen", „Emmen", „De Eilanden", „Nijmegen" and „Eindhoven".

The afforestation of municipal grounds with free advances

1) 1 ha = 2.47 acres.

and technical aid of the Government was regulated by Royal warrant of the 27th of July 1907. The Government provides interest-free loans, maturing in fifty years, which may reach a maximum of 80% of the initial cost of establishing the plantations during the first two years, but which in the aggregate must not exceed *f* 190.— per ha. On the 1st of January 1934, 61 municipalities and one society for general benefit were

MASTBOSCH NEAR BREDA.
Pine Forest underplanted with broad-leaved trees.

taking advantage of this means to afforestate their waste grounds, covering a total surface of 16517 ha, of which 11.776 ha had already been afforestated on that date.

The advisory service includes the rendering of permanent advice on matters, relative to forestry, to Government Departments, societies and institutions for general benefit, to municipalities and other public bodies, as well as the giving of individual advice. The State Forest Service, in general, does not provide technical advice for private owners.

Owing to the regulations of the Forest Act 1922, municipalities and other public bodies, as well as societies and institu-

tions for general benefit, are obliged to give written notice to the Director of the State Forest Service of any intention to fell or to thin their forests or other plantations. In this way the Forest Service comes in close touch with the management of forests and plantations of a great number of municipalities and other bodies, which are being assisted as much as possible by its technical advice.

The Forest Act also provides, that, to ensure protection of

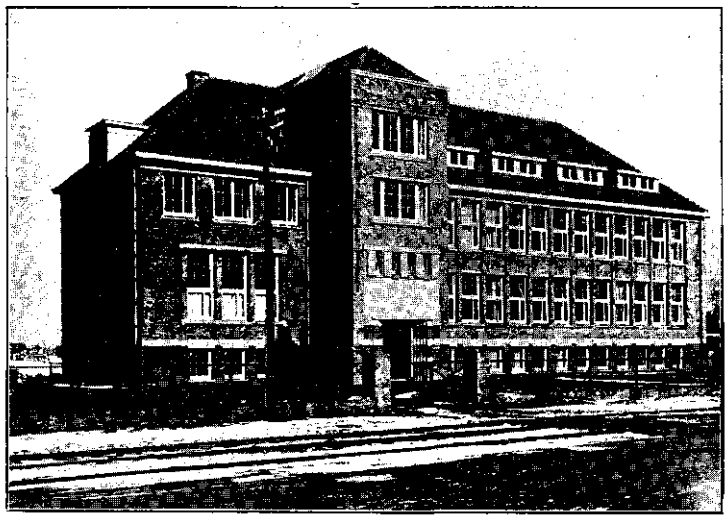
AFFORESTATION OF HEATH LAND.
A five year old mixed plantation of Picea excelsa, Pseudotsuga Douglasii and Alnus incana at Schoonlo (Drenthe).

landscape-beauty in the shape of forests and other plantations, contributions may be granted by the Government to public bodies and societies or institutions for general benefit.

The Natural Beauty Act 1928 contains provisions with regard to a reduction on some taxes, levied on those estates, the continued existence of which is deemed desirable for the beauty of the country. In this case, the owner must pledge himself to preserve his estate in its present state. It is the duty of the state Forest Service to see that this pledge is honoured. On the 1st of December 1934, as many as 288 estates with a total surface of

50.400 ha had been brought under the regulations of this Act.

The State Forest Service seeks to promote interest in forestry in the Netherlands by distributing posters and pamphlets, by showing a forestry film, by granting free admission to its museum at Utrecht and by participating in exhibitions. The Forest Service also takes an active part in arranging what are known as tree-planting days for school-children, both on State and municipal grounds.



Building of the Phytopathological Service, Wageningen.

THE GOVERNMENT PHYTOPATHOLOGICAL SERVICE (PLANTENZIEKTENKUNDIGE DIENST) WAGENINGEN

The Phytopathological Service has a double task:

I. Promoting the combating of plant-diseases and of animals noxious to plants, also increasing the animals that are useful for the culture, as extensively as possible, in order to contribute towards improving the crops quantitatively and qualitatively;

II. Carrying out inspections of agricultural and horticultural products and issuing certificates of health in order to promote the export of these products.

I. The combating of plant-diseases and of animals noxious to plants, is chiefly advanced by means of information on all points (extension work). It is given:

(1) by establishing for the public the causes of diseases in crops and by giving advice as to the best method of fighting them;

(a) at the head-office at Wageningen, where all the required laboratory examinations are made,

(b) by any of the technical Officers and inspectors at work in 30 different places.

(2) by publishing notices in agricultural and horticultural as well as in other papers (an average of 25 a year), in which advice is given about necessary measures to be taken (spraying, seed-disinfection) and warnings issued against the possible appearance of diseases or noxious animals.

(3) by issuing papers on phytopathological subjects:

(a) Verslagen en Mededeelingen (Bulletins) (up to July 1935 — 80 numbers),

(b) Vlugschriften (leaflets) (up to March 1935 — 47 numbers).

(4) by means of demonstrations in the field, both on the trial-ground at Wageningen and in the cultures, also by lectures.

(5) by putting at the disposal of agricultural and horticultural schools and courses:

(a) preparations of plant-diseases and insecticides and fungicides,

(b) photographic reproductions of these,

(c) lantern slides.

(6) by taking part in exhibitions.

(7) by linking to the Service as correspondents practical agriculturists and horticulturists and other people active in this domain (headmasters of agricultural and horticultural schools).

This information-work must be based on investigations and experiments, as the science of phytopathology is still steadily developing, and new causes of diseases are again and again being established, while the manufacture and application of fungicides and insecticides, and the working out of methods of control ever more increase the possibility of the combating and prevention of diseases.

For these purposes much use is made of the results of phytopathological investigations carried out in special laboratories at home and abroad, but in a number of cases complementary work must be done by the scientific staff of the Service. Experiments are made on a large scale, both at Wageningen and elsewhere, because the results of these particular experiments are of vital importance to the general knowledge.

The special work of the service includes:

(1) the examination of potato-varieties (and seedlings), as to their susceptibility to Black Scab,

(2) the determination of varieties of potatoes,

(3) the supervision of the constancy of the composition of recommended brands of fruittree carbolineum (tar destillate oil),

(4) the supervision of seed disinfection,

(5) the promotion of investigation in connection with the elm-disease,

(6) the working out and the application of phytopathological regulations for field inspection and certification of agricultural and horticultural crops,

(7) the increase of the natural enemies of noxious animals, such as the hymenopterous parasite Aphelinus mali in American blight.

The ornithological section is concerned with the study of birds, both as regards the damage they may cause (starlings, sparrows, rooks) and with regard to the increase of useful birds (titmice, woodpeckers, field birds). To a large extent the placing of nestboxes for useful birds is promoted, and so many ornithological data are collected, also by means of the so-called ring-investigation, feeding-experiments, examination of stomach-contents and spitballs. This section also pays full attention to the combating of rats and mice.

II. The work in connection with the carrying out of inspections of agricultural and horticultural products and the issuing of certificates of health, which are necessary to meet the requirements made for the import of these products in many countries, is very extensive. These inspections comprise: potatoes, bulbs, woody and herbaceous plants, seeds, fresh and dried fruit. They are carried out by the entire technical staff, consisting of 10 technical officers and 37 inspectors in permanent appointment, to whom are added at certain periods 10 interim inspectors and, further, about 160 local inspectors, exclusively for the inspection of potatoes. With the aid of this extensive staff, it is possible to carry out all the inspections in time before the packing and dispatching, and in the place where the packing is done.

The inspections are chiefly carried out, in order to satisfy the requirements made by the countries abroad for imports, partly too with regard to the Acts issued in our country for promoting the export of sound products, viz.:
the *Flowerbulb Act* and the *Seed potatoes Act*.

For information to trade a series of papers has been published: Regulations with regard to the import and export of plants and parts of plants, containing the very extensive phytosanitary

regulations to which many countries subject imports (embargo on import, certificates of health and origin, disinfection, packing, etc.).

THE GOVERNMENT SEED TESTING STATION (RIJKS-PROEFSTATION VOOR ZAADCONTROLE) WAGENINGEN

The station was established in 1877 as a division of the State Agricultural College. In 1898 the Government decided to create a self-governing Institute, fully equipped with modern requirements and directed by a well-qualified staff. After the establishment, new divisions were added; in 1919 for mycology, in 1921 for control culture and in 1925 a special laboratory for seed cleaning.

The first director Mr. F. F. Bruijning (1889—1921) was succeeded by Dr. Ir. W. J. Franck, who is still in charge.

The State Seed Testing Station is a practical-scientific institute, its principal object being to control the quality of seed samples by means of tests in the laboratory and on the field, with the further task of independent scientific research; the solution of problems, connected with the various qualities of seeds, or with the methods of seed-testing. Further activities, falling within its sphere, are: the supervision of the observance of the Netherland seed law, the State-sealing of seeds, and the pursuit of inquiries of all kinds concerning such questions, as may arise from circumstances.

It acts also as arbitrator in case of disputes to be settled between the parties concerned, regarding contract-cultivation of seeds; it supplies the seed-buyers with every kind of information or advice, in order to enable them to obtain absolutely reliable seed.

Further activities of the station include the assisting of field-crop inspections; the protection of seedbreeders; the annual proposing and fixing of norms, and the participation in international seed testing work (unification of rules, a.s.o.).

The station is divided into three laboratory-divisions, one for purity, one for germination and one for the determination of the health condition of the seed; moreover a division for field-control.

The first three laboratories have to carry out the examinations, applying to the seed itself. The laboratory for purity (identification of genuineness of species, determination of origin, moisture content, presence of dodder or other weed seeds,

weight, etc. included), contains specially constructed balance-tables, different balances, diaphanoscopes, a microtom, a miniature seed-cleaning apparatus, exactly imitating the cleaning of contract seeds in practice, a cupboard for drying seeds, hand-mills for grinding seeds, electric ovens for moisture tests, etc. There is also an extensive seed collection.

In the germination laboratory are various types of incubators, bell jar apparatus and thermostats with thermo-regulation, alarm arrangements and gas- or electric heating. In addition a seed counter, various soaking tables and cupboards for the containers of ground brick, used in the Hiltner method, a refrigerator with thermostats, where seeds germinate at 10—12° C, in order to eliminate the effects of after-ripening, etc.

As apparatus of the mycological division we mention: ordinary and binocular microscopes, special incubators, glass ware for disinfection, containers for soiltests, all of which are used either to determine the health condition of seeds, the presence of injurious micro-organisms, or to ascertain whether a certain seed sample has to be disinfected or not. A modern photographic installation and a dark room are included.

In the basement we find a small printing machine for sealing certificates and all kinds of other printed matter; also an installation for the growing of plants by means of electric light.

The field-control division has a small special laboratory for carrying out different investigations, registration of field-test results etc., standing in its own culture fields, where all samples are grown.

The staff of the Seed Testing Station at Wageningen consists (during the busy season) of about 37 workers, among whom are scientists, analysts, clerks and servants.

The annual reports and different publications of the station are printed in: „Verslagen en Mededeelingen van de Directie van den Landbouw", „Verslagen van Landbouwkundige Onderzoekingen der Rijkslandbouwproefstations" and in the agricultural and horticultural periodicals.

THE AGRICULTURAL EXPERIMENT FIELDS SERVICE (REGELINGSCOMMISSIE VOOR HET LANDBOUW-PROEFVELDWEZEN) WAGENINGEN

The examination of agricultural problems on experimental fields in the Netherlands is principally done by the agricultural advisers, each in charge of a department (18 departments in all) and are most wholly in the State's service. Most of these

experiments take place on ordinary agricultural farms, where the farmers provide the land needed at a small fee, and often do a great deal of the work on these experimental fields. At present there are in the Netherlands 6 experimental farms, that are wholly intended for field trials. On these farms experiments are carried out by the agricultural advisers as well as by various scientific institutions, which mostly have only small plots of their own at their disposal. In latter years agricultural advisers and institutes, have joined forces in experimental field work, under the aegis of an Organizing Committee for the agricultural experimental fields („Regelingscommissie voor het Landbouw-proefveldwezen").

As conditions in the different parts of the Netherlands vary greatly, both with regard to the types of soil and the methods of cultivations, the number of subjects which are tested on the experimental fields show the same diversity.

In 1934 the agricultural advisers took 1134 field trials, which were distributed over the different subjects as follows:

157 tests with nitrogenous fertilizers,
125 „ „ phosphoric „ ,
178 „ „ potash „ ,
109 „ „ chalk,
33 other fertilizing experiments,
504 variety experiments with 26 crops,
25 tillage- and reclamation experiments.

THE NETHERLANDS GENERAL INSPECTION SERVICE (NEDERLANDSCHE ALGEMEENE KEURINGSDIENST; N.A.K.) WAGENINGEN

In the course of years a system of control in producing excellent seeds and plants has developed in the Netherlands, a system that is now in general use and that gives all guarantees which reasonably can be submitted to approved seeds and plants.

This system of control is called: „Inspection of Crops".

As early as 1903 an inspection of crops came into existence. In 1932 an amalgamation took place of all existing inspection services, sothat now the inspections are carried out by or through the General Netherlands Inspection Service (N.A.K.) established at Wageningen, in cooperation with several scientific institutions and — as to the seed-potatoes — under the supervision of the Netherland Government.

The country is divided into 12 inspection-districts; in every district the inspection is carried out by the inspection service,

indicated by the N.A.K. and according to the „General rules for the inspection" laid down by the N.A.K., which rules must be confirmed by the Minister of Economic Affairs.

The inspection is confined to the races mentioned in the List of Varieties of the Institute for Plantbreeding (cf. p. 47).

In summer the plots, subject to supervision, are inspected by experts in the field, and, after harvest, the seeds and plants are examined in sample and in bulk.

Every bag of approved seeds must contain an official certificate, and each package must be closed by a leaden seal, carrying the stamp of the N.A.K.

The Netherland breeders have placed themselves all under the control of the N.A.K. For „original" seed a special certificate is used.

At first only agricultural seeds and seed potatoes were submitted to inspection, but in latter years, examination of horticultural specimens has gradually developed.

THE BIOLOGICAL STATION (BIOLOGISCH STATION) WIJSTER, DRENTHE

In 1927 this Institution came into existence by private enterprise, and in March 1933 it was united with the foundation „Het Nederlandsch Biologisch Station" („The Netherlands Biological Station". Pres.: Prof. Dr. Th. Weevers, Amsterdam; Secr.: Prof. Dr. L. G. M. Baas Becking, Botanic Laboratory, Leiden).

The modest laboratory at Wijster is situated amidst the most extensive heath- and moorland district of the Netherlands. A short time ago this territory was not yet cultivated, and even now it still contains many extensive heaths, soft water ponds and peat complexes. In the laboratory, there are four workplaces for students, who are given introductory courses in Hydrobiology and on other subjects of Field-biology.

Research on the distribution and the periodicity of freshwater algae, Sphagnum, peat-formation is going on, as well as investigations on a more floristic and faunistic nature. At present, a special study of Calluna vulgaris (L.) Salisb. is being made. More than fifty forms and varieties of this surprisingly polymorphic plant are cultivated here. Forms from England, Germany and the Netherlands are being more closely studied. Several „reserves", belonging to the State of the Netherlands, as well as those belonging to the Society „Vereeniging tot behoud van Natuurmonumenten in Nederland" (Society for the Preservation

of Natural-Monuments in the Netherlands) afford a wide field of future research.

Of these Reservations the principal are: the Heath at Dwingeloo (Geusinger Veld), area ± 2000 acres (800 H.A.); the „Vennen" (softwater ponds) near the Gamekeeper's dwelling of the State Forestry at Dwingeloo; the „Hooge Stoep" near Gees and the „Brandeveen" near Uffelte.

Besides its programme of research, the Station provides Universities with biological materials and gives information and advice. Its publications are marked: „Mededeelingen van het Biologisch Station te Wijster" (Reports of the Biological Station at Wijster).

IV. SOCIETIES

THE NETHERLANDS BOTANICAL SOCIETY (NEDERLANDSCHE BOTANISCHE VEREENIGING)

The Netherlands Botanical Society (President Professor Dr. Th. Weevers, Hon. First Secretary Dr. M. J. Sirks) was founded on August 15th., 1845 by a circle of friends, among whom R. B. VAN DEN BOSCH, C. M. VAN DE SANDE LACOSTE, F. DOZY and J. H. MOLKENBOER deserve special mention. At first the Society's chief attention was directed to the study of the Netherlands Flora and the establishment of a Herbarium of plants growing wild in this country. In connection herewith, the Society at the time of its foundation was called „Society for the Netherlands Flora"; a few years later (1851) this name was changed into „Society for the Flora of the Netherlands and their Oversea Territories", while in 1867 it was resolved to include general botany in the Society's activities and to change the name into „Netherlands Botanical Society". The Society began its existence with a modest number of members (21); during a long range of years it limited its membership to a small circle of botanists (in 1904 its members numbered to 75). However, notwithstanding this relatively small number of members, the Society had developed already a strong activity while it had an important share in fostering the study of botany in the Netherlands. Since 1904 the number of members has increased rapidly; in 1927 it exceeded 400 and at present there are about 420 members, of whom very few are foreign. This numerical increase is chiefly due to the important extension of the sphere of action in botany; at present every branch of botany, pure and applied, morphological, physiological, pathological, taxonomical, ecological, geographical and genetic is represented in the Society.

The aboriginal floristic character of the Society was shown in its first publications. Within five years of its foundation the Society published the first part of the „Prodromus Florae Batavae" (1850—1866, 2 volumes in 4 parts) which appeared

in 1893 as a second edition. To this the „Nederlandsch Kruidkundig Archief" was added, a periodical which was started in 1846 as a successor to the „Tijdschrift voor Natuurlijke Geschiedenis en Physiologie" (12 volumes, 1834—1845), which was discontinued in the previous year. W. H. DE VRIESE, F. DOZY and J. H. MOLKENBOER, and later W. F. R. SURINGAR and F. KNUTTEL acted as its editors. The first series of this new periodical (5 volumes in 20 parts, 1846—1870) may be considered as the Society's semi-official publication, as from the beginning, its annual reports have been published therein. In 1867 the Society resolved to undertake entire charge of this periodical. A second series (6 volumes in 24 parts) followed in 1874—1895; a third series (2 volumes in 8 parts) in 1899—1903, while from 1904 on, annual volumes have been published (volume 14, 1904—volume 45, 1935). Besides the reports of the Society and those of its Committees, the Nederlandsch Kruidkundig Archief contains, chiefly, contributions of a floristic, taxonomical or geobotanical character on the Flora of the Netherlands, among which the Communications of the „Zuiderzee-Committee" deserve special mention.

A second periodical was added to this in 1904: the „Recueil des Travaux botaniques néerlandais", in which studies on physiology and morphology and on the taxonomy of plants outside the Netherlands are collected (volume 1, 1904—volume 32, 1935). The articles in this periodical are written in English, French or German. The publication of the „Recueil" is strongly supported by the Botanical Laboratories of the Universities, which avail themselves of the opportunity to publish therein their most important contributions to Botany.

The Society's development necessitated the establishment of three administrative committees: two Editorial Committees for the periodicals, and a special Committee to supervise the library and the herbarium. The work of this latter Committee is very important: the Society's Library, housed in the Colonial Institute at Amsterdam, contains a fine collection of periodicals and botanical works, while the Herbarium, which forms a part of the National Herbarium at Leyden, is of great historical and documental value. Both collections are at the permanent disposal of the Society's members. Besides this, the development of botanical science has led to the establishment of a few research committees: the Committee for the Study of the Netherlands Flora and its Subcommittee for the Study of the Zuiderzee; the Committee for Protecting rare wild plants; the Committee for Phytopathology and the Committee for Biosociology and the Study of Moorlands.

The firstnamed committee (established in 1908) aims especially at promoting the initial studies of the Society, since 1930 in collaboration with the I.V.O.N. (cf. p. 85). In the Subcommittee for the study of the Zuiderzee (founded in 1927) it has enlarged its activities in a direction, which is very important from a general botanical point of view: a study of the changes, to which the flora within and around the former „Zuiderzee" (now Yselmeer) are submitted as a result of the reclamation, and a study of the plant successions, that follow each other on the newly-reclaimed soils. Twenty-five articles have thusfar been published; the results obtained show most explicitly the far-reaching importance of these researches. The Committee for the Protection of Wild Flora (established in 1927) has collected all available data regarding the localities in this country, where rare plants are found; its records have developed into the function of an adviser for all those who are interested in the preservation of those precious members of the Netherlands Flora. In a number of cases this Committee's action has been crowned with success; special mention should be made of the fact that the plant Wahlenbergia hederacea has been recently found again in this country (the last mention of it was in 1820) on a field, which has now been rented by the Netherlands Botanical Society. The remaining two committees aim at a closer contact between those members who specialize in one of these branches of botany. Each of these committees holds special meetings once or twice a year, which meetings are open to all the members of the Society and on the whole are attended by large numbers of people.

Notwithstanding the differentiation among its members according to their special lines, we state that this differentiation does not mean a division in any sense. Thanks to the relatively short distances in this country, it is possible for a large number of the members living in the Netherlands (about 25% live in the Oversea Territories) to attend the four or five general meetings which are held each year by the Netherlands Botanical Society, by which they are able to keep in touch with all other Dutch botanists. Most of these general meetings are held in Utrecht or in Amsterdam; in the summer, a meeting is organized elsewhere, while it is then connected with an excursion of botanical interest. Thanks to its sound organization, the Netherlands Botanical Society successfully continues to perform the function that was assigned to it from the first days of its existence: to assemble all those in the Netherlands and the Oversea Territories, who are interested in Botany in its widest sense.

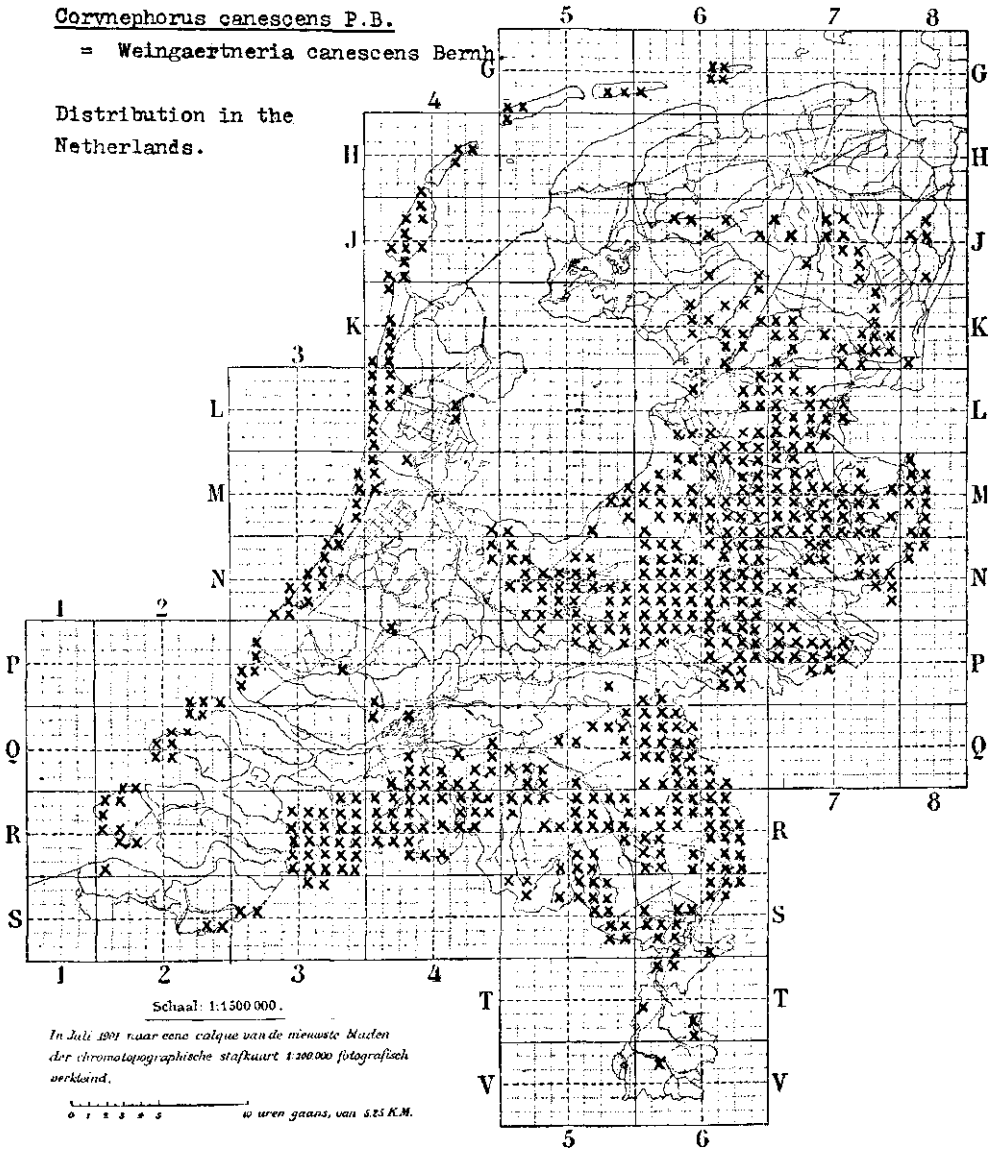
THE INSTITUTE FOR THE INVESTIGATION OF THE VEGETATION IN THE NETHERLANDS (INSTITUUT VOOR HET VEGETATIE-ONDERZOEK VAN NEDERLAND, I.V.O.N.)

The above Institute cannot boast as yet of a ripe old age: it was founded by Dr. J. W. C. GOETHART and Dr. W. J. JONGMANS, the rules of association being signed on Feb. 23, 1930. The original committee consisted of Dr. J. W. C. GOETHART (chairman), Dr. W. C. DE LEEUW (former secretary), Dr. J. Th. HENRARD, Prof. Dr. J. JESWIET, Jan G. SLOFF (present secretary) and Ir. J. L. VAN SOEST. Present chairman is Ir. A. W. KLOOS, additional members Prof. Dr. H. J. LAM and Prof. Dr. Th. WEEVERS.

The activities of the Institute have so far been confined to the preparation of data for the „Plant-maps for the Netherlands", which had been accumulating since 1902. For in that year GOETHART and JONGMANS had started the publication of a number of maps, showing the distribution of phanerogams, drawn to a scale of 1 : 1,500,000, on which maps all the stations known up till then have been marked. Fascicules of this work have been published down to the end of the year 1908.

The method adopted in marking these maps is, briefly as follows: the ordnance-map of the Netherlands, according to a system previously agreed upon by Goethart and Jongmans, is divided into squares, the sides of which roughly correspond to the distance covered during an hour's walk, so-called „Hour-squares". These are subdivided into smaller areas, so-called „Quarter-hour-squares". Of the latter the Netherlands contain about 26,000. The botanical inventory of each of these quarter-hour-squares is tabulated on a form, giving the abbreviated names of about 1500 plants. The results are then indicated on small maps (scale 1 : 200,000) each of which represents on a reduced scale a particular portion of the map of the Netherlands. The maps thus obtained are put together to form albums, 55 in all; consequently each album covers 1/55 part of the whole country. These albums, brought up to date (1934), may be inspected at the National Herbarium at Leyden.

In addition to these maps there has been issued an abridged edition 1 : 1,500,000 which covers the whole of the Netherlands. These maps are slightly flattering, because they show, not each quarter-hour-square but each hour-square in which the plant may be found. This map too has been brought up to date (1934) and is being kept up to date, enabling the user to see at a glance



Sample of the distribution-maps as made by the Institute for the Investigation of the Vegetation of the Netherlands (Scale 1 : 2.000.000)

the area of distribution of all kinds of phanerogams and cryptogams. This work is kept at the house of the secretary of the I.V.O.N.

The preparations of these albums has occupied all the time of the members of the council and the collaborators of the I.V.O.N., particulary owing to the fact that, in summer, unknown districts had to be examined thoroughly and the results tabulated. Thus it has been found impossible to compare the maps with one another and with the European plant-maps included in the literature, though in 1935 the publication of a number of the maps was begun viz those of a number of plants which are termed „atlantic" in the literature on the subject. (Part I to be issued on occasion of the VIth I.B.C.).

The committee for the Protection of Wild Plants under the auspices of the Botanical Society of the Netherlands regularly used the data concerning the distribution of plants thus obtained, while several members of the governing council utilize the material collected for some regional description.

The I.V.O.N. was also interested in plant-sociology. In 1930 its then secretary, Dr. W. C. DE LEEUW, issued the Dutch translation of the „Phytosociological Nomenclature" by BRAUN-BLANQUET and PAVILLARD. The tremendous amount of time involved in keeping the Plant-maps up to date rendered further work on sociological lines as yet impossible.

THE NETHERLANDS MYCOLOGICAL SOCIETY (NEDERLANDSCHE MYCOLOGISCHE VEREENIGING)

The Netherlands Mycological Society was founded in 1908. Like the Société Mycologique de France and the British Mycological Society, it aims at attracting all people interested in Mycology, both scientists and amateurs. Consequently in this country too, the centre of the society is formed by a relatively small number of scientific botanists, mycologists, phytopathologists, chemists, etc. For the rest the members are amateurs, who, by joining the Society, aim at increasing their knowledge of higher Fungi by visiting the meetings, exhibitions and excursions of the Society, by studying its publications and by using its well-furnished library. Naturally these amateurs vary from the simple mushroom-eaters, content with their knowledge of the most important eatable and poisonous toadstools, to those people, who have acquired a fair knowledge of the Fungus flora of the Netherlands.

Here also practice showed that this union of scientists and laymen is in many respects a very succesful one. Soon after its

foundation, the Society started a standard-collection of Dutch fungi, in the „Rijks-Herbarium" at Leiden. In this institution several important mycological collections were at that time already to be found, e.g. the „Herbarium Persoon". These collections increased rapidly through the activity of some members of the Society, who worked here as official custodians of the Society, and with the cooperation of several members, living in different parts of the country, who sent in interesting specimens for determination and preservation. At the same time our knowledge of the Dutch fungus-flora increased considerably. It is true, long before the founding of our Society, important work in this field had already been done. The whole knowledge acquired by the florists of the 19th century is embodied in the works of OUDEMANS, especially in his Catalogue raisonnée (1905). A number of excellent pictures were already published in the illustrated standard-work „The Flora Batava". Yet, when a new generation of enthusiastic mycologists set to work, it soon became evident, that our knowledge of the fungus-flora of Holland was still far from complete. As a matter of fact, during the 25 years existence of our Society this knowledge has been greatly enlarged. Apart from the starting of a standard-collection and the determination of material sent in by the members, this extension of our knowledge is mainly due to two other things: 1) The exhibitions. During the first years of the Society's existence an annual exhibition was, as a rule, held, every time in a different part of the country. These exhibitions were important for purpose of propaganda, but at the same time they were very instructive, because a great number of species from one special region were collected there. 2) The excursions organised by the Society, especially those, in which a limited number of members took part for some days, have perhaps contributed even more to increasing our knowledge of the fungus-flora. As a result of all these activities we may say that the number of fungi known in our country has become about twice as large since the work of OUDEMANS. Moreover, several errors have been corrected. Finally it is worth mentioning that although, in consequence of the work of the Mycological Society, the use of toadstools as food had greatly increased, cases of poisoning are extremely rare in this country.

The publications of the Society are:

A. The „Mededeelingen van de Nederlandsche Mycologische Vereeniging". From 1908—1933 21 numbers of this series appeared. The whole history of the Society, the official reports of meetings, lectures, exhibitions, excursions etc. is to be found here, and also the reports of the conservator, which reflect the

growth of our knowledge. Moreover they contain a number of publications by the members of the Society, monographical treatments, floristical and biological notes, etc.

B. „Fungus". This periodical was founded in 1929 with a view to establishing a more regular bond between the members. It is now the official organ of the Society, appearing about six times a year. The „Mededeelingen", appearing at irregular intervals, are now reserved for more extensive and purely scientific publications.

THE NETHERLANDS PHYTOPATHOLOGICAL SOCIETY (NEDERLANDSCHE PLANTENZIEKTENKUNDIGE VEREENIGING)

At the International Agricultural Congress, held at Vienna in 1890, an International Phytopathological Committee was established with the task of combating pests and diseases of cultivated plants in every country. As members for the Netherlands, Prof. J. RITZEMA BOS and Prof. Hugo DE VRIES joined this Committee.

In most countries, the efforts of the Committee had little or no results; in this country, however, the Netherlands Phytopathological Society was founded in 1891, forming a section of the International Committee. The first president was Prof. Dr. J. RITZEMA BOS, who remained in office until his death in 1928. The present Honorary Member, Dr. H. J. CALKOEN, acted as its secretary-treasurer. According to its regulations, the Society adopted as its aim the improvement of Agriculture, Horticulture and Forestry in the Netherlands by studying and fighting the diseases and enemies of cultivated plants and the spreading of knowledge of phytopathology. The Society had also to stimulate research work, to give information free of charge and to encourage employment of Phytopathologists and the organisation of Phytopathological Experiment Stations.

Very soon the lack of a periodical was felt. So, in 1895, the „Tijdschrift over Plantenziekten" was started, during the first years in collaboration with the „Kruidkundig Genootschap Dodonaea" at Gent, Belgium. Also meetings were held and lectures were given by the members in different parts of the country.

Meanwhile, Prof. Dr. RITZEMA BOS had been appointed Director of the Phytopathological Laboratory „Willie Commelin Scholten" at Amsterdam. In 1906, the Institute for Phytopathology at Wageningen was founded by the Gouvernment, under his Direction. In 1918, the Phytopathological Service, which

had grown under the Institute, became established as an independent institution. In this way, the original task of the Society was partly taken over by others. However, the Society and its journal remained intact and vigorous. A supplementary task was adopted, viz. to stimulate cooperation between persons interested in or working on plant diseases or pests. In spite of the economic world depression, the Society, in its fortyfifth year, is still flourishing and its Journal is spread over the whole world. Many valuable papers, both phytopathological and entomological, have appeared in the „Tijdschrift". At present, the President is Prof. Dr. W. ROEPKE, Chief of the Entomological Laboratory, Wageningen. The actual number of members and contributors amounts to about 400.

THE NETHERLANDS PHENOLOGICAL SOCIETY (NEDERLANDSCHE PHAENOLOGISCHE VEREENIGING)

The Society was founded in 1921 on the initiative of the late Dr H. BOS of Wageningen, who had made observations there since 1893 and, besides, had assembled other observers in the Netherlands, whose results he published annually. Dr BOS was president of the Society from 1921 to 1932, then, up to his death in August 1933, at the age of 76 years, he was honorary president. At present this office is held by Dr M. PINKHOF of Amsterdam.

The observations of the Society concern 4 subjects, viz. the phenology of a) higher plants, b) toadstools, c) birds, d) insects. At the present moment there is no one in charge of sections b and d. The leader of section c) is Mr G. WOLDA, retired ornithologist of the State Phytopathological Service at Wageningen.

In this paper, section a) is of more immediate importance. Its leader during the period 1921—1933 was Dr BOS, who was succeeded by Dr PINKHOF. The annual reports, edited by Dr BOS (report 1931 to 1934 by Mr J. D. VIS) have been published as follows:

1893—1913 in: Tijdschrift van het Kon. Aardrijkskundig Genootschap (Journal of the Royal Geographical Society);
1914—1916 in: Tijdschrift voor Tuinbouw (Journal of Horticulture).
1917—1921 in: „Cultura".
1922—1934 in: Landbouwkundig Tijdschrift (Agricultural Journal).

Further, several papers on phenological subjects, by Dr Bos and others, have appeared in the „Landbouwkundig Tijdschrift" and, since 1931, in „Acta Phaenologica" and elsewhere.

The observations of the Society concern budding, flowering and regular autumn-colouring of trees and shrubs; in general, the wellknown list of Hoffman-Ihne is followed. In 1934 Dr PINKHOF simplified the list and added a list of herbaceous plants, motivating their applicability to phenological aims.

Agricultural phenology, already studied by Dr Bos (winter-rye) has been extended by the new leader Mr J. D. KOESLAG of Wageningen.

In cases of abnormal phenomena, the Society organizes inquiries with the aid of the daily press. Great success attended one such inquiry in December 1934, which showed that, owing to the mild weather in the autumn, and on account of the exceptionally high temperature in December, 110 species of wild plants were in flower in the open air in the Netherlands on Dec. 15 th. 1934, and as many cultivated plants. An exhibition of the flowering plants was held in the Amsterdam Botanical Laboratory on Dec. 18th and 19th.

The foregoing information shows that there is a growing interest in phenology in this country.

The Netherlands have also become, to some extent, a centre of international phenology, owing to the initiative taken by Dr Bos, who founded in 1930 an international phenological journal. Encouraged by the interest, shown by phenologists all over the world, the Society in 1931 resolved to edit a journal of this kind. It is named „Acta Phenologica" and published at the Hague by Martinus Nijhoff.

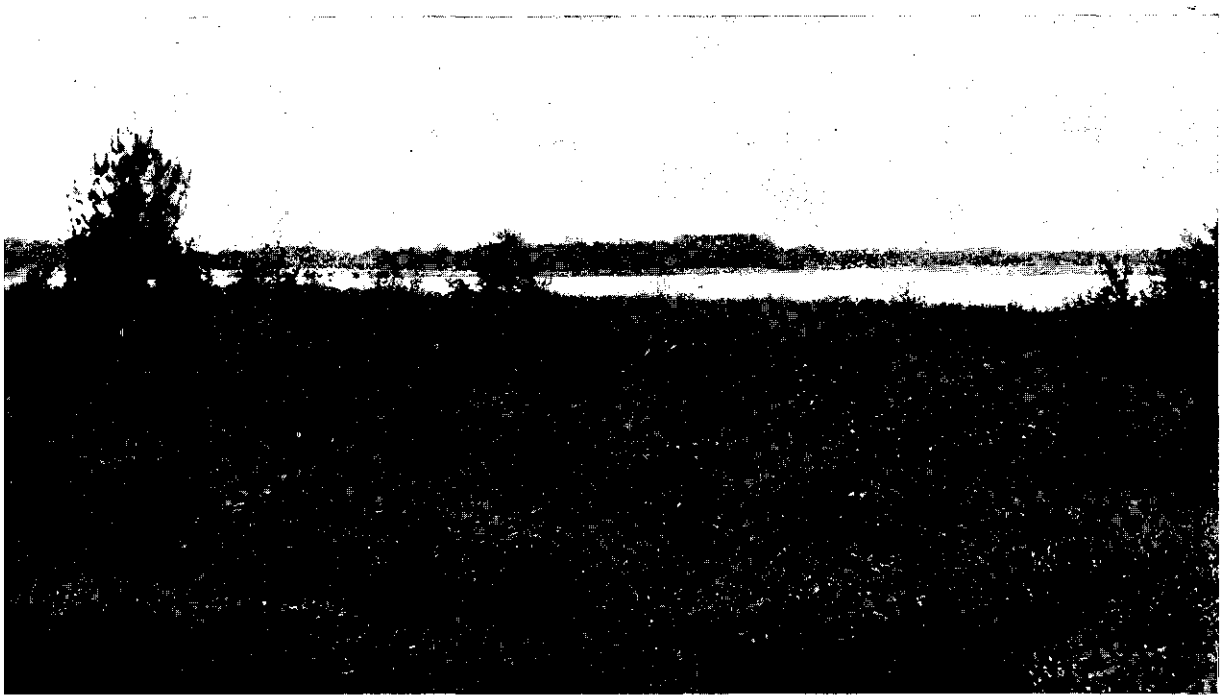
Three volumes have appeared up to the present, containing papers from many European countries; its subscribers live in all parts of the World. Yet the continuance of the journal under the present unfavourable economic conditions can be assured only, if countries, larger than the small Netherlands, give it their moral and financial support.

For information it may be mentioned, that the subscription is *f* 6.— per volume.

THE SOCIETIES FOR NATURE PROTECTION (VEREENIGING TOT BEHOUD VAN NATUURMONUMENTEN, E.A.)

Nature Protection in the Netherlands is taken care of by

a. The Society for the Preservation of Natural Monuments.



I. Eriophorum in the „Korenburgerveen".

(Vereeniging tot Behoud van Natuurmonumenten in Nederland). (The offices are at Amsterdam, Heerengracht 540, where any information about this and the other organisations can be obtained).

b. Several affiliated regional organisations.
c. The Government Forest Service. (Utrecht, Museumlaan 2; cf. p. 71).
d. Some Provinces and Municipalities.

The Corporations sub *a* and *b* work by contributions from their members, by gifts and bequests.

As yet the Vereeniging tot Behoud van Natuurmonumenten, founded in 1905 has obtained in different parts of the Kingdom a grand total of about 12000 h.a. consisting of landscapes of every description. The most important for the botanist are:

1. The Naardermeer (750 h.a.) near Amsterdam, of great faunistic importance as a breeding ground for Spoonbills, Purple Herons, Bearded Tits, Savi's Warbler etc. but at the same time offering a complete succession of hydrophytic and helophytic associations from open water to Alnetum-betuletum and sphagnetum-ericetum. Large tracts are left wholly undisturbed.

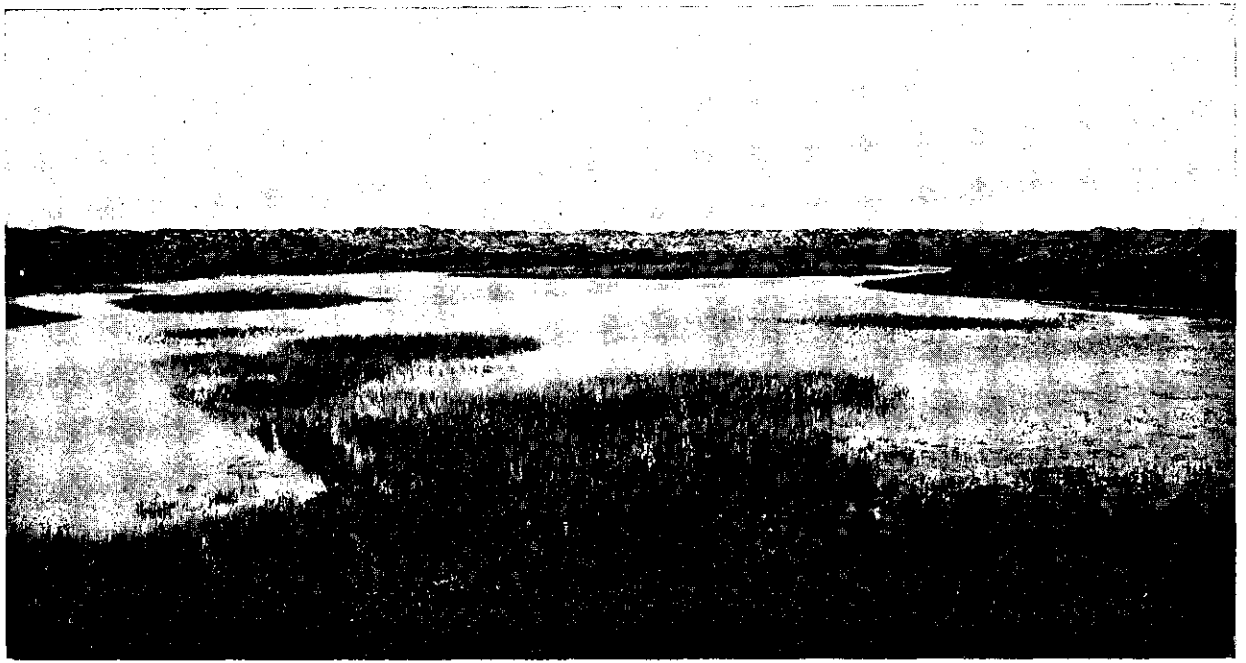
2. The small uninhabited island of Griend (23 h.a. at high water) near Terschelling with the complete flora of sandspit and saltmarsh and with a breeding colony of some 10000 pairs of Sandwich Tern, with its dependent flora.

3. A heath near Dwingelo in Drente safely situated on the water-divide, a Callunetum-ericetum with interesting oligotrophic meres containing a remarkable algal flora. In the neighbourhoud is the Laboratory of the Dutch Biological Station (cf. p. 80).

4. The Balinger Zand in Drente, the Sands of Hulshorst in Guelderland, the Dunes of Drunen and Loon op Zand in Noordbrabant and the Buurser Zand in Overijsel, all of them erstwhile moving sands (partly still now) and gradually being covered by forests of Pine and *Juniperus*.

5. The Korenburgerveen in Guelderland, a sphagnum peat moor, partly dug out a century ago and now in different stages of regeneration.

6. The National Park „Veluwezoom" near Arnhem 2500 h.a.



II. Fens in the province Noord-Brabant.

of beech, oak, birch and pine woods and large tracts of heather and gorse.

7. The meres and woods of Oisterwijk in Noordbrabant, partly woods, partly heath and interspersed with some dozens of larger and smaller meres of different origin, some oligotrophic, others mesotrophic, and the whole with every association of the wet and the dry heaths.

8. The dunes of the island of Voorne with the dune meres of the Breede Water and the Quackjes Water (715 h.a.), one of the finest and most interesting dune- and beach landscapes.

The allotted space does not permit further enumeration, but still we must mention one of the smaller possessions viz. a plot of *Cornus suecica* near Jipsinghuizen in Groningen, one of the southernmost habitats of this interesting boreal plant.

With very few exceptions, all the species of the flora of the Netherlands are to be found within the area preserved by the Vereeniging tot Behoud van Natuurmonumenten.

The regional organisations have succeeded in preserving certain woods and mansions in Utrecht and Guelderland, and the Frisian Society „It Fryske Gea" acquired the „Prinsenhof", a most interesting landscape of marsh and mere in the centre of the Province.

The State reserves are administered by the Forest Service, advised by a small committee of scientists. Of absorbing interest are those in the islands of Texel, Vlieland and Terschelling (together over 2000 h.a.) containing extensive sandflats, beaches and dunes from the tiniest embryonic ones to hills and vales covered with heather. The helophytic flora is well represented in some beautiful and extensive valleys with fresh water meres. In the State reserves of Terschelling, *Euphorbia Paralias* attains its northernmost station on the Atlantic board.

Under guidance of the Forest Department numerous improvement-works have been undertaken as relief-work for the unemployed. Assisted by the aforesaid Committee, the Forest Service takes good care that those works do not cause the loss of any landscape of important scientific or even scenic interest, and so very fine reserves were obtained in Drente, Guelderland and Brabant.

III. The „Meeuwenduinen" (Gull-Dunes) on the Island of Vlieland.

The Province of Noordholland together with the municipalities of Amsterdam, Naarden, Bussum, Hilversum, Laren, Blaricum and Huizen have created together the foundation „het Gooisch Natuurreservaat" which preserves about 1800 h.a. of woods and heath of great recreational value and of some botanical geological and archaeological interest.

The great and ever-increasing menace to the natural beauties of the country have led to the collaboration of the aforesaid organisations with those in the departments of science, art, touring etc. in a kind of Committee of Defence called the „Contact commissie", which is ever watchful and has a semi-official standing with the Government.

Lately another Committee is trying to find measures to instil the concept of nature-preservation into the schools and the general education (commissie ter bevordering van de heemschutgedachte onder de jeugd).

And so we may conclude that in summa the effort is adequate to the danger.

The principal literature on the subject of nature-preservation in the Netherlands is to the found in the annual reports of the Vereeniging tot Behoud van Natuurmonumenten. (Jaarboeken van de Vereeniging tot Behoud van Natuurmonumenten 1910—1928).

THE NETHERLANDS SOCIETY FOR THE STUDY OF NATURAL HISTORY (NEDERLANDSCHE NATUURHISTORISCHE VEREENIGING)

The Netherlands Society for the Study of Natural History (abbreviated N.N.V., President Dr J. H. VAN BURKOM) was founded on December 27th 1901, and numbers 30 local branches.

In accordance with the regulations of the Society its objects are twofold, viz.:

(1) It propagates the study of Natural History,

(2) It aims at preserving those districts that are of importance from the point of view of Natural History.

When the Naarden Lake, famous in this country as the place where the Common Spoonbill breeds, was in danger of disappearing, it was clear to the General Committee of the Society that firm efforts must be made to preserve this spot for posterity.

Its action resulted in the founding of another Society, which is in a flourishing condition at present; it is called Society for the Preservation of Natural Reserves.

The N.N.V. still remains active, preserving beauty-spots in this country. It contributes to the sums of money that are required to buy interesting grounds, and, whenever necessary, it lodges protests with the authorities concerned, when a beauty-spot is in danger of being destroyed or impoverished.

The branches of the Society attend to matters of local importance. Monthly meetings and excursions are held to stimulate and increase the knowledge of the members about

An Excursion in the Southern Part of the Province of Limburg.

the plants and the animals of a particular district. These excursions are conducted by experts. In the course of them the members not only learn the names of the various plants and animals, and their mutual relations, but their attention is also directed to the natural beauties of the landscape they are visiting. In this way they are made to realize that what gives man his purest joy in life must not be defaced, but should be handed down to posterity in an inviolate condition.

Famous scientists, such as Professor Hugo DE VRIES, who was an honorary member, have always displayed a lively interest in the work of the Society, and this interest is ever-growing.

The members are taught the science of Natural History in a semi-popular form, so that their own knowledge is not only in-

creased, but the interest of the general public is awakened for the work done in the Universities. In this way the appreciation of the results obtained there is widened.

Once a year (if possible alternately at Whitsuntide and the second part of August) a congress is held for the members of all the branches. These congresses take place in different towns of this country, and there are lectures and excursions in connection with them. The object is to study that particular district from the point of view of Natural History, and also to strengthen the ties between the branches and the members individually.

The Society publishes a monthly periodical, entitled „Natura",

After Returning to the Camp.

which is sent to every member. In addition to reports from the various branches it contains popular articles on subjects taken from the whole range of Natural History. Apart from the ordinary numbers (containing 16 pages) there are occasionally double numbers, which are entirely devoted to a special subject or a special district.

The Society also publishes a series of booklets:

(1) Gallenboekje („On Galls") by A. JOMAN.
(2) De Hondsrug („The Hondsrug Hills") by Dr. J. BOTKE.
(3) De Land- en Zoetwatermollusken van Nederland („The Land and Fresh Water Molluscs of Holland") by D. DORSMAN and Ir. A. J. DE WILDE.

(4) De vorming van de Nederlandsche duinkust („The formation of the Netherlands dune-coast") by Dr. P. TESCH.

Another publication is entitled: Het Woordenboek der Nederlandsche Volksnamen van Planten („Dictionary of Dutch Popular Plant Names") by H. HEUKELS.

Both the Society and the branches organize exhibitions, through which it is sought to engage the interest of the general public outside the Society.

Some years ago the N.N.V. extended its work by organizing Leaders' Camps for the study of Nature. In these camps leaders of young people's societies and teachers meet one another, the object being that those who move among boys and girls either as a hobby or professionally are enabled to increase their knowledge of Natural History. For this purpose they attend an eight days' course in the open air.

As it is desirable to study as many districts as possible, the camp is held in a different spot every year. The object of these camps is to enable the participants to transmit the knowledge they have obtained, and especially their increased interest and appreciation of Nature, to the young people entrusted to their care.

THE NETHERLANDS SOCIETY FOR AGRICULTURAL SCIENCE (NEDERLANDSCH GENOOTSCHAP VOOR LANDBOUWWETENSCHAP)

Soon after the foundation of the Agricultural College at Wageningen, which was destined to become nearly fifty years afterwards the University College of Agriculture, the need was felt for an union of old-pupils of that school, who partly had became farmers themselves and partly governmental advisers in agriculture; very soon this society published a monthly periodical, practically the first one in Holland in which papers on scientific agriculture were published. After several changes in name and organization this old Wageningen-pupils Union became in 1916 the „Nederlandsch Genootschap voor Landbouwwetenschap", and the monthly became the „Landbouwkundig Tijdschrift" (Journal of Agricultural Science) which both still exist.

The membership of the Society can nowadays be acquired by everybody, who is working to further the practice of agricultural science, provided that by his training or sphere of activity he may be expected to do credit to the society. To make sure of this one can only become a member by invitation after being proposed by a member.

The publishing of the „Landbouwkundig Tijdschrift", which covers more than a thousand pages a year, is one of the foremost activities of the Society. It contains original papers as well as summaries of other Dutch and foreign publications on scientific agriculture.

Yearly the Society organizes at Wageningen a „Nederlandsche" and an „Indische landbouwweek" (Dutch and Indian agricultural week). During the first of these conferences important problems on agriculture in its broadest sense are being introduced by men, who may be considered experts on their subject of discussion; demonstrations on experimental-fields are often added. The Indian week has for purpose to bring together for a few days the managers and assistants and government-advisers, working in the Netherlands East Indies in private and governmental agriculture, and at that moment on leave in Holland, in order to put them up to the status of agricultural science, which during their stay in the tropics was impossible.

Although not strictly a botanical society, the „Nederlandsch Genootschap voor Landbouwwetenschap", acknowledging botany as one of the fundamental sciences for agricultural science, has gratefully accepted the offered opportunity to tell something of its aim and activities to the members of the Sixth Botanical Congress.

THE ROYAL NETHERLANDS HORTICULTURAL AND BOTANIC SOCIETY (KONINKLIJKE NEDERLANDSCHE MAATSCHAPPIJ VOOR TUINBOUW EN PLANTKUNDE)

As in all countries, where horticulture is intensively conducted, the Netherlands have their leading societies, where scientists, technical experts and amateurs in matters of plants and flowers, of fruit and vegetables, of gardening and architecture or floral decoration meet to try to raise the art of cultivation to the highest possible standard.

One of them is the Royal Netherlands Horticultural and Botanical Society (President Jhr. G. F. VAN TETS). The seat of this society is Amsterdam, but its headquarters are at Aalsmeer. An executive committee consisting of a Chairman, a Secretary and 10 members, is chosen by the sections at the annual meeting. These sections are divided all over the country, their present number being 48. Their work is mostly local, but they can suggest propositions on general meetings of the society. They arrange local exhibitions and excursions, they hold courses

of instruction for young gardeners, they give advice in matters of park-planning etc. etc.

The committee meets every month at Amsterdam to examine the proposals, brought to its notice by the government or the sections or by anyone who desires its criticism of his views or of the ideas suggested by him. It arranges monthly examinations of plants by esteemed specialists, and the awards given at those meetings, are highly thought of by the nursery-men and growers.

The society has been working for over sixty years and has been largely instrumental in raising horticulture in Holland to the standard, which it has attained. It is a great compliment to the foresight of the first president and founder of the society, the late Mr. J. H. KRELAGE, that many of his methods of organisation are practised after these years.

In the year 1873 the society was founded, and in 1923 her golden jubilee was celebrated by the organisation of the first international horticultural congress after the war. Scientists of universal reputation were happy to be able to shake hands again. After the congress, the Royal Netherlands Society conceived the idea of forming an international committee to organise succeeding congresses, as regulation was necessary, to prevent confusion. With the help of the Netherlands Ministes of Foreign affairs it was accomplished, and so far has done good service in several matters at the congresses in Vienna, London and Paris.

At present the Society is able to continue its work. Economic organisations claim more attention nowadays than those, which deal with cultural matters. But when the world regains its sanity, and nations are wise enough to understand each other better, cultural work will — let us hope — return to favour, and then societies of this kind will surely have the renewed interest of many a man, born an idealist, who through force of circumstances has now become a materialist.

THE NETHERLANDS SOCIETY FOR GARDENS FOR MEDICINAL PLANTS (NEDERLANDSCHE VEREENIGING VOOR GENEESKRUIDTUINEN)

The Netherlands Society for Gardens of medicinal plants, founded in 1914 on the initiative of Dr. SIKKEL, Doctor of Medicine at the Hague, can look back on an existence of more than 20 years.

The aim of the Society is to promote the study, the cultivation and the use of medicinal-, aromatical- and similar plants; it deals with economics, as well as scientific questions.

To attain this goal, meetings are regularly held, at which different problems are introduced and discussed. Also subjects are proposed for prize-competitions concerning the work of the society. A journal is published at irregular intervals, in which are set down the transactions of the Society; reports are given on national and international meetings, as well as on the activities on the experiment-gardens, placed at its disposal.

The Society has arranged, on its own initiative and entirely at its own expense, an experiment-garden (at „Dolder", in the neighbourhood of Utrecht) for the study of medicinal plants and their culture, particularly as regards cultivation in the Netherlands.

Up to a short time ago the Government granted the Society an annual subsidy. In consequence the Society was able freely to pursue the objects it had in view, and to discharge its international obligations, as it joined the „Fédération internationale pour le développement de la production, de l'utilisation et du commerce des plantes médicinales, aromatiques et similaires" as representative of our country. (Seat at Rom „Institut international d'agriculture").

As this country was one of the oldest centres in Europe for growing drug plants (Noordwijk), in different parts of Holland there were still plantations of that kind of herb, even if on a very modest scale. Not that Holland took an important place in the international trade of medicinal and cosmetic herbs; yet the culture of the caraway-, mustard-, and blue poppy-seeds is important, on account of the first-rate quality of the merchandise, which is of international reputation. On the special range of medicinal plants this country has never produced important quantities, it does not even supply the local needs.

The chief items of research of the Society, carried out on the experiment-garden since 1928, are the following: Manuring experiments with Datura stramonium (1928, 29 and 30), Valeriana officinalis (1930), Foeniculum vulgare (1930 and 31), Coriandrum sativum (1930), Anethum graveolens (1930), Mentha piperita (1930, 31 and 32). This research concerns the study of influence of nitrogenous manure (calcium nitrate and lime nitrogen) on the quantity and quality of active components. The influence proved to be of little or no importance on the percentage of alkaloids and volatile oils. The quantity of those products per unit of area, however, was always modified in a favourable sense.

The possibilities of cultivation of different herbs were also studied; e.g. different kinds of Digitalis, i.a. D. purpurea, D. ambigua, D. lutea and D. lanata. It appeared that not only

the kind mentioned could be cultivated in this country, but that they disclose at the same time a regular activity. A value, according to Focke, was determined at respectively 7, 5, 6 and 20.

As the object in view ought to be the production of first class qualities of drugs it was thought necessary to normalise this prime quality. This aim is of international interest, because with friendly co-operation, there is a hope of composing a drug-codex. An effort was made to attain this object for different kinds of fruits of the Umbelliferae. Several schemes were composed, also *Mentha piperita* was taken up in the experiments.

Besides the culture-experiments of *Digitalis,* the possibility of growing exotic plants in this country was examined. For the present, *Rheum palmatum, Lobelia inflata, Hydrastis canadensis, Lavendula vera* and other herbs were studied. Selection-experiments were undertaken with *Foeniculum vulgare,* with the intention of obtaining an early flowering and early fructiferous plant, which could be gathered before the period of the night-frost, which commences in Holland in September.

These experiments have proved that *Valeriana officinalis* as well as *Mentha piperita* can be grown with success in Holland. The last-mentioned herb produces, in every respect, good proceeds of etherical oils of good quality. The experiment-gardens send, at a small charge, seeds and herbs to people interested (a register for seeds is published annually) and are willing to undertake research on drugs for the trade. It may be proved that the experiment-gardens seek seriously to promote and assist the aims of the Society. The gardens are under the direction of Prof. Dr. W. C. DE GRAAFF, who is pleased to acknowledge the valuable assistance of Messrs. P. J. JANSEN, F. C. HOEK and Dr. H. VELTHORST, and the members of the board of the Society. In conclusion, it may be mentioned that in co-operation with the „Open-Air Museum of Holland" at Arnhem, a botanical-garden in the old style has been established and maintained, where old popular medicinal plants and those plants, which are used nowadays, are exhibited, with the intention of giving a clear idea of those herbs, which have played such an important part in folklore. In the course of years this botanical-garden has grown so remarkably that it is now of outstanding importance.

V. THE OVERSEAS TERRITORIES

EAST INDIES

THE BOTANICAL GARDEN AT BUITENZORG ('s LANDS PLANTENTUIN TE BUITENZORG)

The Government Botanic Gardens ('s Lands Plantentuin) at Buitenzorg, Java, were founded in 1817, to promote the research of cultivated plants and the study of the original flora of the Netherlands Indies. It has become a centre of botanical study in this territory. In the beginning, this work was almost entirely of a taxonomic nature, and especially the first director of the gardens, C. L. BLUME, described a great many plants, new to science. The chief gardener J. E. TEIJSMANN and his helpers developed the gardens in various directions, and many valuable cultivated plants were imported from abroad. Later, the institutions for applied research work, the experimental stations, spread over Java and Sumatra, and the economic gardens in Buitenzorg, founded by the second director of the botanic gardens R. H. C. C. SCHEFFER, took over this part of the work. As a result, the Buitenzorg garden is an institution for almost purely scientific work. The present director is Dr. K. W. DAMMERMAN.

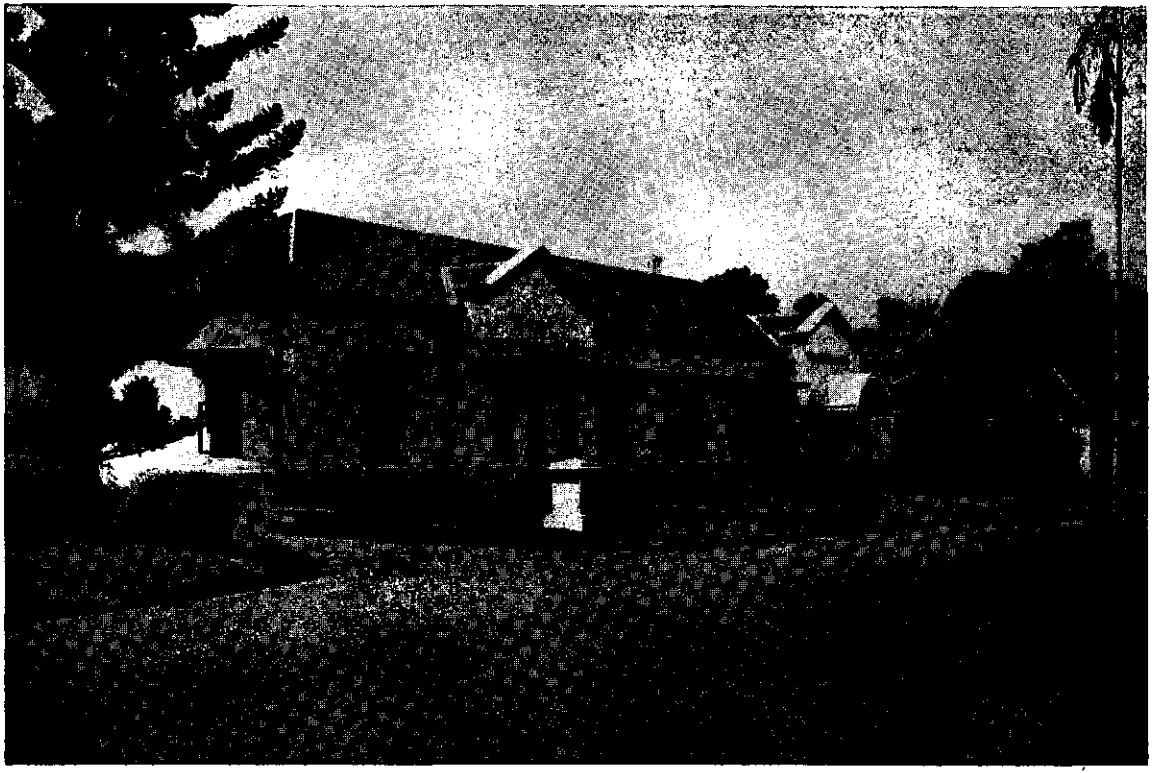
Before 1880 the institution consisted of a garden in Buitenzorg, and some smaller gardens against the slopes of Mt. Gedeh, of which the mountain gardens at Tjibodas, situated at about 1400 m above sea-level, and the forest reserve, annexed to it, reaching from the gardens up to the summits of Mts. Gedeh and Pangrango (3000 m above sea-level), have become world famous as a centre for the study of life in its virginal state. In 1880 M. TREUB came to Buitenzorg and, during the 25 years of his management, the gardens developed into a scientific institution of considerable extent and importance. Besides the herbarium, that was founded by J. E. TEIJSMANN, various institutions of applied and purely scientific research

work were added to the gardens, and in the beginning of this century the old botanic gardens came to be known as the Department of Agriculture. Some years later the scientific institutions of this Department merced into one section, named 's Lands Plantentuin. This section, under the leadership of J. C. KONINGSBERGER, contained the following sub-divisions: a. the gardens at Buitenzorg, about 85 H.A.; b. the gardens at Tjibodas, about 30 H.A. with the virgin forest of approximately 1200 H.A. annexed to it; c. the Treub-laboratory, founded solely for the use of visiting scientists; d. the Herbarium; e. the Phytochemical

The Mountain Laboratory at Tjibodas.

Laboratory; f. the Zoological Museum; and g. the Laboratory for Marine Research.

Besides his various official and administrative duties M. TREUB found time for his botanical research-work; his studies on the development of *Lycopodiaceae,* on the embryology of higher plants, and on the new flora of Krakatau may be mentioned here. The first volumes of the Annales du Jardin Botanique de Buitenzorg consisted almost entirely of his publications. These turned the attention of the botanical world to Buitenzorg,



Treub Laboratory in the Botanical Garden at Buitenzorg.

and in the following years an ever-increasing number of visiting botanists arrived, and the gardens became the centre of tropical botanical research work: research not only in a taxonomic direction, but also chiefly into the life of plants, especially the relations between the structure of the plants and the conditions under which they live in a tropical climate. Numerous investigators studied morphological problems, with which M. TREUB commenced activities in Buitenzorg. Moreover, the life of forest-plants, of epiphytes, of mangrove-plants, and of crater-plants were investigated by the Buitenzorg and by foreign botanists.

M. TREUBS successor, J. C. KONINGSBERGER, studied the economical insects, and published books on the birds and the mammals of Java; moreover, he is the author of the work, „Java; zoological, biological", which is the result of many years field-work. In the laboratory for marine research economic fishes were studied, and the methods of native fishery. It had been always an ardent wish of M. TREUB to appoint a physiologist as leader of the laboratory for foreigners. Shortly after his death, and in honour of his memory a new laboratory, called the Treub-laboratory, was founded in Buitenzorg, and F. C. VON FABER was appointed director. His work consisted in giving advice to the visitors and, further, in studying physiological objects. His attention was drawn to crater-plants, mangrove-plants, and he made also researches on the life of the plants of the virgin-forest [1]).

W. M. DOCTERS VAN LEEUWEN who succeeded J. C. KONINGSBERGER, continued his work on the galls of the Netherlands Indies, and studied the relations of plants and animals from a general biological view-point, i.e. antplants, Loranthaceae and their pollination and dispersal, and the life-history of plants and animals on the volcano-tops. Moreover, he visited regularly the islands of the Krakatau-group. The curator of the gardens, P. M. W. DAKKUS published a new catalogue of plants, cultivated in the gardens at Buitenzorg, Tjibodas and Batavia. The scientific staff of the Herbarium made an extensive study of various plant-families, especially those which contain plants of economic value; the results were published in the Bulletin du Jardin Botanique de Buitenzorg by J. J. SMITH, R. C. BAKHUIZEN VAN DEN BRINK, B. H. DANSER, H. J. LAM, D. F. VAN SLOOTEN, and C. G. G. J. VAN STEENIS. J. VAN

1) Von Faber was succeeded by F. W. Went, who continued his studies on the action of growthsubstances in rootformation; after Went left for the U.S.A., H. J. Lam took this position until 1933.

OVEREEM and, after his death, K. BOEDIJN devoted their attention to the rich fungus-flora of the Indies. In the Phytochemical Laboratory various objects of interest were studied, but in 1932 this laboratory was transferred to another division of the Department of Agriculture, i.e. to that of Industry.

The zoological institutions of the gardens developed new activities, but as these do not come under the heading of botanical science, further mention of them in this article is unnecessary.

Before 1932 the institutions of the botanic gardens were in full growth and a vivid scientific life was in existence, but, during the last three years the staff has been greatly reduced; the few survivors of the economic crisis are still working on the old lines.

In this short survey only the activities of the staff of the gardens are mentioned; it is impossible to incorporate herein the valuable research-work of the foreign visitors.

THE GENERAL AGRICULTURAL EXPERIMENT STATION (ALGEMEEN PROEFSTATION VOOR DEN LANDBOUW) BUITENZORG, JAVA

In 1918 the General Agricultural Experiment Station (Present Director Dr. J. G. B. BEUMÉE) was founded by putting under one direction several laboratories of the Department of Agriculture, Industry and Commerce (now Department of Economic Affairs) which formerly were independent and insufficiently coordinated. In the course of years the Sections for Breeding Annual and Perennial Crops, the Institute for Plant-Diseases and the Experimental Gardens of the Horticultural Service were incorporated. In 1926 an Agricultural Section was added, especially for coordinating the many field trials laid out every year by the Extension Services; in 1930 a special station for the study of the coconut was established at Menado (Celebes) in the centre of the most important copra-district of the Netherlands Indies.

At the present the organisation comprises all the scientific institutions of the Department of Economic Affairs, that work for the advancement of agriculture; besides some minor crops only those of the natives are studied. Formerly, when the private experiment stations for the estate-crops were not yet established or only just started, many investigations concerning rubber, tea, coffee etc. were made, several results of which proved to be of much value.

The General Agricultural Experiment Station consists of a

Division of Laboratories — of which by retrenchment only the Botanical Laboratory is left —, three institutes, viz: the Pedological Institute, the Institute of Plant-Diseases — with a Zoological and a Mycological Section and the Quarantine Service — and the Agricultural Institute — subdivided in an Agricultural Section and Sections for Breeding of Annual and Perennial Crops —, the Coconut Experiment Station at Menado, and some horticultural experiment gardens.

Botanical research is done at several sections, sometimes directly in connection with the praxis, mostly however to further the progress of other work.

The Botanical Laboratory, with its two botanists: Dr. TOXOPEUS and Dr. KUILMAN, is to a certain extent the continuation of the botanical section of the Experiment Station for Rice, founded in 1905. At that station VAN BREDA DE HAAN studied the anatomy of the riceplant and VAN DER ELST made investigations on the so called „mentek"-disease, which was supposed to be connected with a strong reduction of the soil. Many experiments were made to study the influence of tillage, manuring and time of planting on the disease. During several years circumstances prevented him to do much botanical work in that line. From 1922 till 1926 experiments on the mineral nutrition of rice were made, as a result of which the benificial effect of manuring the seedbeds with phosphate was found. HEIDE studied the flower biology and the fruitsetting of several crops.

In 1928 TOXOPEUS started his investigations on the gum-disease of *Citrus sinensis,* caused by *Phytophthora parasitica.* As the gum-disease showed a distinct periodicity, a study was made on the influence of temperature and humidity on *Phytophthora parasitica.* In connection with the cross-breeding to find a stock immune to gum-disease, the polyembryony of *Citrus* was studied. From many species and varieties the percentage of „vegetative seedlings" was stated and directions could be given for selecting the seedlings of vegetative origin on the nurseries all of which were quite identical with the mother-plant. On many of the hybrid stocks *Citrus sinensis* could not be grown as a scion. The causes of this failure were studied and it appeared, that the scion produces substances that are toxic for the rootstock.

In aid of the selection and breeding of the kapoktree (*Ceiba pentandra*) investigations on the biology of the flower and on the factors that controll the fruit-setting were started in 1930. Crossings with pollen of related species and genera were made to induce diploid pseudogamy, that would be very useful for the breeding of perennial crops in general. Some results are obtained, but at the present they are not yet conclusive.

As the soybean at the present is planted on an ever increasing acreage and thus this crop often occurs on soils, that never bore it before, investigations on *Rhizobium japonicum,* the root-nodule bacterium of the soybean, are started. The relation of this *Rhizobium* to other leguminosae is studied and experiments with native strains and with the best ones from Wisconsin, to determine the effect of inoculation on the yield are in progress. In connection with these experiments the frequency of *Rhizobium japonicum* in the soil during the crop rotation is being studied.

KUILMAN, who started his experiments in the end of 1930, studies the mineral nutrition of rice in connection with manuring and with the „mentek"-disease. At first many difficulties arose with the breeding of rice in watercultures. Excellent results are obtained with the solution of zinzadze. Much attention was paid to the reduction of the soil as a probable cause of the disease. It appeared however, that padi grows very well in strongly reduced soil and stands in watercultures very well doses of ferro-salts and nitrites that are harmful for other cereals.

Lack of nitrogen in the solution results in the characteristic yellow-orange color of the leaves of „mentek"-plants. Therefore at the present the proteinmetabolism is being studied. The disease especially attacks padi, that is planted in the middle of the wet monsoon. It is supposed, as VAN DER ELST already did, that the rootsystem is only weakly developed during that period deficient in sunshine. In the second half of the vegetation-period, when there is much more sunshine, possibly the deficient root-system can not afford all the nitrogen, that is needed for the formation of proteins, equivalent to the increased carbo-hydrate assimilation.

At the Mycological Section of the Institute for Plant-Diseases, studies have been made on cancer and brown bark disease of rubber, on several diseases of the bananas, on the slime disease of the peanut, and on quite a lot of minor diseases of numerous crops. A prominent result of still increasing practical value was the selection of a pure line of *Arachis hypogaea,* immune to slime-disease, by Miss SCHWARZ in collaboration with the Section for Breeding Annual Crops.

At the present two phytopathologists are working at this section, Dr. MULLER and Dr. KARTHAUS. MULLER started his investigations on the die-back disease of *Coffea robusta* in 1928 and found a *Rhizoctonia*-species to be the cause. This fungus enters the plant through the leaves and after a careful study of the initial symptoms, a method of pruning was established in order to save the tree in the first stage of the disease. Breeding-

work to find the perfect stage of the fungus is still in progress.

In 1930 the investigations on the footrot disease of pepper were commenced. A *Phytophthora*-species was found to be the causal agent. With the assistance of the Pedological Institute the effect of soil and climate on the spreading of the disease was thoroughly studied. In the plantations of the natives a highly resistant clone was found, which is much planted now.

Furtheron a pod-rot of *Arachis hypogaea,* which in the neighbourhood of Cheribon causes great losses, was studied. From the pods *Aspergillus niger* and *Penicillium glaucum* could always be isolated; inoculation experiments with these fungi produced the symptoms of the disease. They attack the pods and besides some products of their metabolism in the soil seem to check the growth of the plants, which is in accordance with the occurrence mainly on poorly drained soils as was stated in collaboration with the Pedological Institute. An extensive series of pure lines, provided by the Section for Breeding Annual Crops, was tested but no resistance of any importance was found.

In aid of the Forestry-Service, the mycorrhiza of *Pinus Merkusii* without which the seedlings do not grow, is studied. The isolation of the fungus, *Boletus bovinus* succeeded very well and the mycelium could be cultivated in bulk on artifical media. The inoculation of the seedbeds for the praxis is being tried now.

KARTHAUS is studying the slime-disease of the potato, caused by *Bacillus solanacearum.* Much attention is paid to the selection of resistant clones, as controll measures are very difficult and moreover too expensive for the native growers. In the clones of European origin no resistance of any importance could be found. Therefore now species from South America are tested and some clones of *Solanum andigenum* appeared to be resistant. The testing of other species is still in progress.

As recent Japanese investigations on *Sclerospora graminicola* eludicated the conditions controlling infection of the hostplant, it seemed worth while to investigate once more the „omo iyer"-disease of maize, caused by *Sclerospora javanica.* Formerly this disease has been studied intensively by PALM. As infections now can be produced artificially the susceptibility of maize strains can be tested.

At the Section for Selection of Annual Crops, VAN DER STOK was the first one to do genetical work on rice (1905). Much attention was paid by him and later on by KOCH to the pure-line selection of this crop, and to the importation of varieties from other countries. VAN DER MEULEN, who is working on rice now, made crosses as a basis for further breeding work. It appeared, that in the F_6-generation of a cross pure-line selec-

tion is already possible. In connection with the inbreeding of his crosses and with questions that arise when new varieties are propagated, the natural crossing in some varieties of rice under different conditions is rather intensively studied. So far the frequency of natural crossing proved to be very different according to the variety.

The selection of cassave, the peanut and the soybean was started by KOCH. Some high producing lines of soybean from seeds, imported from Formosa, selected by him, are planted by the natives on an ever increasing acreage. BOLHUIS who is continuing this work, studies the flower-biology and the natural crossing of the two latter crops, in connection with the inbreeding of artificial crosses.

At the Section for Breeding Perennial Crops much work has been done on vegetative propagation by CRAMER and VAN HELTEN; the first buddings of *Hevea* were made there. CRAMER very intensively studied coffee and imported many new varieties. Some important crops as *Hevea brasiliensis* and *Elaeis guinensis* (the oilpalm) originally were imported by this section, then still a subsection of the Botanical Gardens. From the latter period ought to be mentioned the importation and propagating of nearly all the outstanding green manuring crops now in use. At the present Dr HUITEMA, who is in charge of this section, pays much attention to the breeding of *Ceiba pentandra* (kapok), *Derris elliptica* and *Aleurites*.

Preliminary work on the fruiting and the variability of the coconut was done by BOLDINGH and VAN DER ELST. Dr TAMMES, the botanist of the Coconut Experiment Station studied the flower-biology and the factors that controll the fruiting of the tree. He succeeded in finding several high producing trees, which were used by him in making crosses with the kingcoconut especially to combine the high production of the ordinary coconut with the precocity of the dwarfvariety. The differences in production of coconut-trees chiefly are caused by the number of nuts produced.

THE DELI EXPERIMENT STATION (DELI PROEFSTATION) MEDAN, DELI, SUMATRA

It was a phytopathological question that established the so-called 8th Division of „'s Lands Plantentuin" at Buitenzorg as an institute for the study of Sumatra tobacco. *Phytophthora Nicotianae,* which made large devastations in tobacco on Suma-

tra's Eastcoast, compelled the planters to call for information at the gate of science at Buitenzorg.

J. VAN BREDA DE HAAN was the first botanist who came to Sumatra and studied the disease in question. As a result of his investigations he advised the use of „Bordeaux mixture" to fight the disease (1896).

Since that time, phytopathological problems have always been on the first plan of research of this division of the Buitenzorg institute as well as of the independent Deli Proefstation, which was founded in July 1906.

All botanists at this experiment station have concentrated on that destructive tobacco disease which still occurs to a large extent: the slime sickness caused by *Bact. Solanacearum.* The above-mentioned VAN BREDA DE HAAN was the first botanist who worked on this disease and reported on it from Sumatra (1897).

J. A. HONING came to Deli at the end of 1909 and immediately commenced his wellknown investigations on that bacterial wilt. We owe to his investigations a great deal of our knowledge of this disease, especially the purely botanical part of the huge phytopathological problem concerning this sickness, of such a large economic importance to Sumatra tobacco culture. HONING studied morphologial and physiological properties in pure culture, time of virulence of the bacterium against different *Nicotiana*-species and varieties. He found many new host plants e. g. the important teak tree *(Tectona grandis).* Many experiments to combat the disease with chemical desinfectants were carried out by him. HONING demonstrated the vast importance of the use of healthy seedbeds to get a healthy fieldcrop, and good drainage (1910—1913).

Some years later B. T. PALM (1920) began propaganda for the use of the leguminous plant *Mimosa invisa* as a covercrop during the 7 years of fallowing of tobaccoland, to diminish the slime disease. He based this advice on the results of some experiments with coverplants and many observations of tobaccofields, which previously, more or less accidentally, had been overgrown by *Mimosa* for some years.

J. KUIJPER and S. C. J. JOCHEMS carried on this propaganda (1926), supported by new results of some valuable experiments, which many years ago had been undertaken from a more agricultural point of view e.g. to compare the effect of different trees and shrubs during fallow time on the tobacco crop. Yet *Mimosa invisa* has become the commonly-applied growth on slime-diseased estates.

With regard to sensibility to this disease, JOCHEMS made a

phytogeographical study of the wild *secondary* forests of tobacco-land (1928). He found a lot of new host plants, mentioned in publications from 1920—1930. He also experimented on sterilisation by steam of seedbeds. Later, MEURS continued these experiments.

J. VRIEND made large selection-experiments to get strains, not liable to wilt disease. He had some good results (1924), but is was very regrettable that the resistant strains had an inferior leaf quality. Hybridisation with first quality strains was not brought to a successful issue.

Miss J. H. H. VAN DER MEER, who spent some time on the Deli Proefstation as a Fellow of the Rockefeller Foundation (1927—1928) inquired into the influence of the degree of humidity of the soil on the wilt disease.

Besides slime sickness, virus diseases, e.g. the common mosaic disease, have been the subject of many botanical investigations. F. W. T. HUNGER was the first who worked on this disease and investigated the ways of transmission of the virus. He demonstrated clearly the coherence between soiltype and severity of mosaic (1903).

L. P. DE BUSSY, who had to work on general biological problems through the absence of a botanist during some years of his stay at the Deli Proefstation, started a selection of strains, resistant to the mosaic disease (1906). Though many other scientists after him have done the same in Sumatra and other worldcentres of tobacco culture, no one has succeeded as yet.

B. T. PALM studied the cytological nature of the virus of mosaic (1925) and looked for hostplants among the weedflora on the tobaccofields (1924).

S. C. J. JOCHEMS described some other virus diseases of Sumatra tobacco and continued the above-mentioned studies of HUNGER on the transmission and the origin of mosaic. Several of the regular cultural operations appeared to have a very important effect on the spread of this virus (1931—1934). Experiments are proceeding, to omit these, or to replace them by other methods.

Concerning other diseases, we mention a study of HONING on black rust, a minor bacterial leafspotdisease, which seldom causes economic loss (1906).

J. KUIJPER controlled the disease called „topziekte" by applying a very diluted solution of boric acid in water.

S. C. J. JOCHEMS studied the rather severe stemburning of the transplanted seedlings, caused by several *Pythium*-species and *Rhizoctonia* (1927 and 1926). An outbreak of *Cercospora*-leafspot induced him to investigate this disease under Sumatra-

conditions, especially of the remarkable form occurring on the curing leaves in the dryingsheds (1931). A. MEURS experimented on the control thereof with chemical desinfectants of the soil seedbeds, and by spraying the leaves of seedlings and field-tobacco (1932).

In 1932 MEURS started taking an annual census of all diseases occurring in the Sumatra-tobacco-district, which since then has been continued by a botanist of the Deli Proefstation (JOCHEMS, VAN DER WEY).

MEURS introduced the water- and sandcultures of tobacco, to study the mingling of leafspotdiseases of unknown origin. G. VAN DER WEY, who is the only botanist at the Deli Proefstation at present, has continued these experiments successfully.

Besides Phytopathology Genetics, including selection and studies on seedtreatment, have always been subjects in the programme of the botanical division. DE BUSSY demonstrated the fact that Sumatra-tobacco was mainly a mixture of pure strains. HONING continued this study and selected many strains (1914—1920), some of which are still grown on a large scale. A hybrid of two of the best strains made by HONING, has also become an important type.

After HONING's departure (1920) JOCHEMS continued his work of selection. Though many new strains were isolated, none of them were shown to have better qualities than those which were selected out of the old mixture in the first years of the introduction of scientific breeding in Deli.

In 1924 the practice of breeding was handed over to breeders of the large tobacco-companies under the superintendence of the botanist of the Deli Proefstation.

THE EXPERIMENT STATION FOR VORSTENLANDEN TOBACCO (PROEFSTATION VOOR VORSTENLANDSCHE TABAK) KLATEN, JAVA

This Research Station was founded in 1912 by fusing two research-services, which both aimed at solving agricultural difficulties of the tobacco-culture in the Vorstenlanden (Principalities). The older of these services began its researches already in 1898, with the study of the *Phytophthora*-disease by RACIBORSKI, originally part of the scientific work under the direction of the Director of the Government Botanical Garden in Buitenzorg.

At present the costs of the Research Station are entirely

defrayed by all the private tobacco-plantations together in the Principalities.

The research-work is concerned with keeping sufficient produce per hectare by means of combating diseases and pests, and further with improving the quality of the product.

As the qualitative properties of tobacco mainly determine the remunerativeness of the culture, of late years no more experiments have been made with a view to obtaining increase of produce.

The staff consists of: a director, charged with the general organization, chemical and physiological studies and breeding-work; a phytopathologist, charged with the study and the control of diseases and pests and an agricultural chemist, charged with soil-investigations, mapping and the study of fertilizers. Further two analysts, one assistant for breedingwork, one assistant for the service of the experimental fields and 32 javanese in permanent service.

Breeding.

Originally the tobacco-cultivation in the Principalities consisted of a population of a great number of very different tobacco-strains.

Already about 30 years ago a qualitative selection was effected by means of seed-winning from plants selected in the field. JENSEN and LODEWIJKS obtained, through self-pollination, two strains that were pure with regard to most outward qualitative properties. The descendants of these strains, propagated by self-pollination, for the greater part still form the present plantation. They are indicated by the names Kanari and Y 10.

After that time breeding aims at obtaining strains, which show a better quality of tobacco than these original Kanari and Y 10 (increase of the percentage of tobacco suitable for wrapper), in which at the same time differentiation is aimed at with regard to the various soils.

It was d'ANGREMOND's object to combine the good quality of Kanari with the better leaf-shape of another tobacco-strain, indicated by the letter E.

For that purpose he crossed E with Kanari (EK-strains) and applied pedigree-selection in the second and following generations, in which the leaf-quality of individually reaped plants was judged after the curing and the fermentation.

A second method of improvement was selection within the existing Kanari and Y 10- cultivations. Thus some improved strains were obtained, which at once proved to be fixed. Chief amongst these is a Kanari-strain with very good colours (KW

10) and a Kanari-strain with increased combustibility (KBS). Both strains are cultivated on a large scale.

Of great importance was also the raising of artificial mutations by means of X-raying the inflorescences (TOLLENAAR).

One of these mutations, *Chlorina,* shows a particularly bright leaf-colour and this promises to become of importance for practice.

As, owing to a further mutating and segregating about 8 to 10 % of Kanari's, the cultivation of the mutation is considered to be rather unfavourable, the desired uniformity is obtained by cultivating the cross Kanari × Chlorina, in which the brightness of Chlorina predominates.

Finally, breeding also aimed at obtaining a tobacco-strain of good quality and resistant against the *Phytophthora nicotianae.* D'ANGREMOND tested a very great number of indigenous and exotic tobacco-varieties for resistance against this attack. Thus one variety, from Timor, proved to be of a strong resistance. Although the outward appearance of this tobacco on the field greatly resembles the varieties of the Principalities, the quality of the fermented leaf turned out to be bad. TOLLENAAR a few times back-crossed it with Kanari and continued the selection. Going on with this, COOLHAAS has at present obtained a strongly resisting strain of satisfactory quality, which will this year be cultivated for the first time in places where diseases may be expected (inlet - places of the irrigation - water from the wet rice-fields, with which culture the tobacco is cultivated in rotation of crops). Meanwhile the selection-work is continued.

Phytopathological Investigations

Like all research stations, the one at Klaten was also chiefly founded with a view to combating the continually spreading diseases.

In the first place this concerned the combating of the *Phytophthora nicotianae.* JENSEN and d'ANGREMOND investigated where the infection of the plantations took place, making use of a method of estimating the measure of infection of the soil, the water or the manure. Some soil - pulp is then smooted on living tobacco-leaves and of many leaves the number of *Phytophthora*-stains is counted.

In consequence of the better insight obtained by this method numerous soil-hygienic measures could be recommended such as burning diseased plants, removing rests of tobacco after the harvest, heating the stable-manure used and so on. Preventing the disease on the seedbeds, too, by means of spraying

with Bordeaux mixture has contributed much to combating the diseases.

By THUNG these hygienic measures have of late years been further perfected. Owing to this combating the *Phytophthora* lost its disastrous nature in the Principalities.

In combating most of the other principal diseases, mosaic disease, field-mould (*Oidium tabaci*) and *Cercospora,* we have not yet advanced so far.

THUNG isolated a very large number of virus-diseases in pure culture, which occur all of them in the Principalities. It is very interesting, that certain mosaic viruses can immunize the plant against other viruses. These investigations of THUNG open practical perspectives with respect to the combating of the most noxious mosaic disease, because it appeared, that viruses can be isolated which cause hardly any visible changes in our tobacco-plant.

The investigation is continued, in order to find such innoxious viruses, which show the same immunizing influence on the „ordinary" mosaic-disease as several noxious viruses that are already known.

The combating of *Oidium tabaci* and *Cercospora* is being investigated by THUNG, for the present by collecting clinical observations.

The slime-disease dreaded so much in Sumatra occurs only sporadically in the Principalities, only one must guard against cultivating certain plants, such as earth-nuts, as first plants before cultivating the tobacco.

Based on this is a prohibition of planting. The crinkle-disease which caused much damage, proved also in the Principalities, to be transmitted by a white fly (*Aleyrodidae*). THUNG traced the most important host-plants (three weeds in the native villages). By eradicating these plants the disease can be wholly prevented.

Combating the pricipal animal pests is being energetically taken in hand. A large number of chemical preparations are tested for usefulness. Besides caterpillars, thrips have of late years also caused much damage. The combating of them is provisionally concentrated on the seed-beds.

Apart from these investigations of a botanical nature, much attention is paid to investigation of the soil and mapping of the ground, to the experimental field service, to problems of manuring, to chemical and physiological research work, and to the technological side of the tobacco-culture.

The Research Station issues: Mededeelingen van het Proefstation voor Vorstenlandsche Tabak (Communications of the

Research Station for Tobacco in the Principalities), among which an Annual Report.

THE EXPERIMENT STATION OF THE SOCIETY OF RUBBER GROWERS ON THE EAST COAST OF SUMATRA (ALGEMEEN PROEFSTATION DER ALGEMEENE VEREENIGING VAN RUBBERONDERNEMINGEN OP SUMATRA, A.V.R.O.S.) MEDAN, SUMATRA

This Experiment Station belongs to the A.V.R.O.S. (Algemeene Vereeniging Rubberplanters Oostkust Sumatra or General Association Rubbergrowers Eastcoast Sumatra). The required funds are raised by the members of the A.V.R.O.S., according to a subscription which is fixed every year.

Although the area attached to the Experiment Station and planted with *Hevea* (300,000 hectares) is actually the largest, the institute at the same time takes care of the important cultivations of oil-palm (*Elaeis guineensis*) (51, 753 hectares), of tea (22,853 hectares), of coffee (6,429 hectares), of fibrous plants, coconut-palm and some other cultivated plants.

The task of the Experiment Station is 1) to assist the plantations, by means of an advice-service, in overcoming the daily difficulties, and 2) to improve the methods of cultivation and technology by means of research work. The Experiment Station is subdivided in a botanical, an agricultural, and a chemical-technical department.

Normally the staff consists of a director, a secretary, two botanists, three agriculturists, and two chemists, assisted by an analyst and native assistants. On January 1st., 1935 the European staff was formed by Dr A. D'ANGREMOND, director, A. THISSEN, secretary; in the botanical department Dr A. d'ANGREMOND and Dr W. F. VAN HELL; in the agricultural department Ir J. F. SCHMÖLE, Ir H. GONGGRIJP and Ir B. SCHELTEMA; in the chemical department Dr Ir N. H. VAN HARPEN, Ir R. VAN DILLEN and the analyst Mr ROCKLAND.

Research work in botany has necessarily always been limited to that which is directly connected with practice. Thus, cytological work is done in connection with problems of pollination and fertilization on behalf of seedselection of *Hevea* and oil-palm; physiological work on behalf of rubber-tapping and of vegetative reproduction of *Hevea;* mycological-pathological work for combating diseases in these cultivated plants.

The results of these researches are published in „Mededeelingen van het Algemeen Proefstation der A. V. R. O. S."

(Communications of the General Experiment Station of the A. V. R. O. S.), divided in two series 1): a Rubber series, which also appears in the „Archief voor de Rubbercultuur in Nederlandsch Indië", a periodical issued in common with the Java sister-experiment-stations, and 2) a General series. A complete list of these publications is found on the cover of each Annual Report of the Director of the Experiment Station.

THE AGRICULTURAL DEPARTMENT OF THE JAVA SUGAR EXPERIMENT STATION (CULTUURAFDEELING VAN HET PROEFSTATION VOOR DE JAVA-SUIKERINDUSTRIE) PASOEROEAN, JAVA

The Java-Sugar Experiment Station (Proefstation voor de Java-Suikerindustrie) at Pasoeroean (East-Java) used to be the largest experiment station in the Netherlands East Indies, where much botanical research work has been and is done. Originally in 1885, 1886 and 1887 three small local experiment stations were established by the sugar cane planters, resp. in Semarang, Tegal and Pasoeroean. In that time the sugar industry in Java was struck by a disastrous cane disease, called „sereh" disease, since the habit of attacked cane reminds that of the „sereh" grass *(Andropogon schoenanthus)*.

The primary aim of the experiment stations was to combat the sereh disease; it was the genius of Dr. F. SOLTWEDEL, the first Director of the Semarang Experiment Station (1885—1890), which in those early days indicated the directions, along which the problem should be attacked: a) by means of pathological investigations, b) by special cultivation methods and c) by breeding resistant varieties. The first direction (a) never yielded conclusive results, although noted scientists studied the nature of the disease. The idea of breeding resistant varieties (c) has always directed the breeding work of the station. It was, however, not realized until 1921, when the cane variety 2878 POJ (= Proefstation Oost-Java) was obtained, which proved to be sereh resistant and surpassed the older varieties considerably in sugar yield. SOLTWEDEL himself, however, succeeded in growing healthy cane at a higher elevation (over 2000 feet above sea level) and taught the way to keep the plantations free from sereh disease by growing the nursey fields in the hills.

This early success made the scope and the program of the experiment stations extend in the lapse of time to the entire field of cane cultivation and sugar manufacturing. All kinds of questions on cultivation, tillage, field operations, fertilizing,

breeding, pathology and entomology were studied, further the improvement of the sugar manufacturing procedure and of the sugar quality, the fuel problem, the equipment, the implements and the engines in the factories.

After several reorganizations in 1921 all experimental work was centralized in Pasoeroean, a small local sub-station in Cheribon excepted. The experiment station was divided into three departments, one of agriculture and botany, one of technology and one of engineering. The station is entirely financed by the Java-sugar industry itself, which contributes a certain annual amount per acreage planted. In 1930 the staff of the station consisted of 60 European scientists and about 250 native assistants, the annual budget being about *f* 1.500.000. The present crisis proved that such a private institute is entirely and directly dependent on the profits made by the industry concerned: during the last years the annual balance has been curtailed to about fl. 500.000, a great number of staff people has been released and much of the research work has been abandoned. Still an important part of the present activities of the department of agriculture and botany (acting director: Dr. K. G. BOOBERG) is devoted to botanical research in the field of breeding, taxonomy, cytology, pathology and physiology.

Actually all cultivated cane varieties are clones and several thousands of such clones are represented in the collection fields of the station. It is, of course, of prominent importance to keep these clones apart and to prevent contaminations and therefore Dr. J. JESWIET deserved much of the sugar cane growers by devising a method of describing clones in such a way, that they easily can be determined. This method is chiefly based on the implantation of the buds, on the form of the bud leaves and on the groups of silica hairs on these bud leaves (1916). A standard collection of buds of all known cane clones is kept at the station for identification purposes.

The clone description of the native „Kassoer" cane brought JESWIET to the suggestion, that this vigorous cane would be a natural species hybrid of *Saccharum officinarum* and of the wild *Saccharum spontaneum,* an idea which since played a leading part in the breeding work, from which the famous 2878 POJ cane resulted (1921). Hybrids of the „Kassoer" type being almost immune to sereh disease, the sereh puzzle lost its practical interest by the introduction of the recent POJ-canes in the commercial plantations.

JESWIET's „Kassoer" suggestion was confirmed by the cytological investigations of Dr. G. BREMER (1921), who found moreover that the eggcell of *Saccharum officinarum,* when

fertilized by alien pollen, can duplicate its haploid number of chromosomes. The diploid chromosome numbers of *S. officinarum* being 80 and that of *S. spontaneum* 112, „Kassoer", the hybrid, has (40 + 40) + 56 = 136 chromosomes in its somatic cells.

As a result of these discoveries cytological investigations of the different clones of sugar cane and of the genus *Saccharum* and of other genera of the *Andropogoneae* have an important share in the breeding work; Dr. G. BREMER and Dr. C. L. Rümke are in charge of them.

The section of cane breeding for commercial purposes is directed by Dr. O. POSTHUMUS; the elaborate organization of the selection work falls beyond a botanical survey.

In early days eminent pioneer work on tropical phytopathology has been done by Dr. J. H. WAKKER and Dr. F. A. F. C. WENT, which has been resumed in their noted book: „De ziekten van het Suikerriet op Java" (1898). Of more recent years the noted work of Miss Dr. G. WILBRINK (of the Cheribon sub-station) must be mentioned, who studied more especially the vascular diseases (sereh disease, leaf scald, shoot wilt and „fourth disease") and the mosaic disease and its insect vectors. The studies on vascular diseases are continued by the present pathologist, Miss Dr. P. C. BOLLE, who further is investigating the influence of external conditions on bunchtop and toprot, caused by *Fusarium moniliforme*. The urgency of this work is stressed by the fact, that the recent POJ-varieties are all more or less susceptible to *Fusarium*. The other pathological investigations refer to yellow leaf spot disease, caused by *Cercospora köpkei*, and root rot in its different forms.

Physiological research, done by Dr. T. H. VAN DEN HONERT, is closely connected with the pathological and soil investigations. The symptoms of lack of different mineral nutrients have been thoroughly studied (1932) and also the optimum concentration of some important nutrients (e.g. phosphate) for a due development of the sugar cane. For the latter investigations an accurate equipment for cultivation in continuously flowing nutrient solutions has been devised and described (1933). Further experiments are carried on on the transpiration and water economy of sugar cane.

Earlier research (1932; Dr. W. M. COELINGH and Dr. V. J. KONINGSBERGER) on the assimilation of carbon dioxide, on the first assimilates and on the transport of sugars had to be checked during the crisis.

In this short survey no mention will be made of the organization of field experiments and of the soil research work. They

are essential parts of the work of the experiment station, but bear an entirely applied character without special botanical interest.

All publications were issued as communications („Mededeelingen") of the experiment station, which formed an annual volume (III) of the „Archief voor de Suikerindustrie in Nederlandsch-Indië"). The interested reader easily will find the publications, referred to in this survey, in the annual volumes indicated. This valuable periodical too, however, was checked in the end of 1934 by lack of funds.

THE EXPERIMENT STATION AT BESOEKI (BESOEKI PROEFSTATION) DJEMBER, JAVA

The Work of the Botanical section can be at once divided into two separate divisions, the selection work together with more theoretical genetic research and physiological research work.

1. *Selection activities.*

These are sub-divided into coffee, rubber and tobacco.

C o f f e e.

Besides the usual selection work such as searching for mother trees and testing them as seedlings and as grafts, there are also many crossings made between mutual mother trees. With an end in view of finding the most suitable coffee plants for the various heights, climates and soils. The inter planted cultivation system (catch crop, Hevea and coffee planted together) calls for, in East Java particularly, further special demands.

For low, dry estates, where the coffee berries are small due to external factors, coffee types with large hereditary determined berries are looked for: already important results have been obtained. Very special thought is being given to the crossings between *C. Arabica* and *C. Robusta.* The intention, to win a type as near as possible to Java coffee which will regain the ground lost by *C. Arabica.* Very many crossings have already been planted but unfortunately in most cases they are sterile. There are types that have practically the same leaf and habitus as *C. Arabica* and that are further immune against *Hemileia vastatrix,* however small producers. The aim of these crossings is to find a plant that has the fine qualities of the *C. Arabica* product, combined with the strong growth and resistance against diseases of the *C. Robusta.* The reason of the very remarkable phenomena of

blossom malformation: „Star bloom" (virescence) is being genetically examined.

Importation of foreign kinds of coffees (specially *Arabica* types) as basis for selection material takes up a large part of the agenda.

Hevea.

With rubber, much thought is given to generative selection, the making of artificial crossings between good mother trees and the testing of the resulting seedlings. Many of these legitimate seedlings are already in tap. Further through means of bud graftings the trees are set out for practical purposes.

Much attention is given to the selection of *Heveas,* which through their habitus, leaf form etc. are specially suited for interplanted cultivation (catch crop). At the same time a research about the periodical phenomena (generative and vegetative growth) is in hand. In connection with the combating of diseases (mildew) it is very important to have clones or pure lines that are wintering early in the year. Also for the regulation of the industry this factor is of consequence because production is at a minimum and the composition of the latex changes most, during wintering.

Tobacco.

The tobacco selection of the last years has been principally composed of making crossings between already well known pure lines selected by us. Out of which through repeated self pollination again pure lines are cultivated, which have the wished for combination of properties. Quality characteristics of tobacco are extraordinarily dependent on soil and climate, therefore the most suitable types for each district must be looked for. The differentiation in this respect is very far advanced. Characteristics selected for are production, quality, form, nervation, colour, odour and fireholding capacity of the leaf.

Latterly research with regard to cigarette tobacco has been taken in hand.

Also one or two other genetical researches such as the peculiarity „double flower" and a remarkable malformation of leaf (gila tobacco, a sort of fasciation).

II. *Physiological researches.*

Coffee.

Researches have been started a short time ago over the effect of different inorganic nutrient salts on the form and chemical structure of the coffee plant. This is carried out by means of

water cultures. To begin with a research respecting the nitrogen and the calcium nutriment. Together with this, researches have been started, likewise with water cultures, over the root competition (ultimate poisoning) between coffees and the ground covering *Salvia.* Everything points to a possibility that Salvia gives off a poison that with enough aeration is oxidized. The damage is thus only noticeable by suffocation, yet this is not the direct cause.

A chemical-physiological research has been undertaken with regard to coffee leaves turning yellow; there are numerous factors that can cause this phenomenon, too much sun, bad soil, too much water and root competition. In close connection herewith, the metabolism of nitrogenous content of the respective plants is also being examined.

Assimilation experiments with the different sorts of coffees have been undertaken; which are daily studied and their dependence on external influences examined (dampness, shade, manuring, East Monsoon and West Monsoon, etc.).

These researches must form the bases of shade, pruning and suchlike cultural problems. Here various questions arise, i.e. increases manuring the intake of substances only or also the assimilative capacity? The preliminary results point in the direction of the first mentioned.

Further there are experiments concerning the repartition of the food reserves in the plant, their availableness for the different growth stages; about connection between habit (underground and above ground) and food reserves; about connection between regenerative capacity, food reserves and assimilation. Researches are in hand, about the connection between the C/N quotient and blossom forming, about the dependence of mentioned phenomena on sun or shade. Parallel with this run the researches on the hydrature of the coffee plant, because we are of opinion that this factor has a great influence on the stages of vegetative and generative growth.

The Starbloom (*virescence, chloranthie*) will also be examined in this connection. Vegetative growth is caused by too high hydrature; generative growth due to too low hydrature. Through climatical conditions very great changes can be brought in the succession of these growth phases; with *C. Arabica,* virescence is caused by that; with other sorts of coffees, leaf and branch formation in place of blossom. Both cause a loss in crop.

Abnormality in blossom setting, i.e. pea berry, when only one egg has fructified, and their dependence on climatical factors is examined, because the consequences of this are of great practical importance.

Biochemical and physiological research is necessary for a series of diseases, that are not possible to bring down to micro-organisms, such as die-back (other than overproduction), discolouration of leaf (mosaic, marble), branch and leaf malformation (frenching, kroepoek leaf) etc.

The knowledge of the composition and the changes of the cell sap and its dependence on external influences is necessary for a logical and decisive combating of some insect enemies, (white and green louse; *Pseudococcus, Lecanium).*

Rubber.

The composition, and the alteration of the latex of individual trees in connection with the periodical phenomena of the plant, is being studied. This research is being enlarged to clones and has in view the establishing of a connection between the mentioned composition, and unusual qualities of the product (rubber or latex). The reciprocal influence of stock and scion in bud grafts is being examined (periodical phenomena, composition of the latex, productiveness, etc.).

Hydrature of *Hevea* is being examined and its connection between periodical phenomena and the composition of the latex.

Tobacco.

Hydrature of the tobacco plant is being studied in connection with the early or late flowering of the plant, the formation or nonformation of suckers.

The chemical composition of the tobacco leaf is being examined in connection with soil, climate, manuring, cultivation measures (topping, slow or faster drying, fermentation) and burning qualities of the leaf.

A chemical-physiological research is in hand regarding the reaching of „pluck ripeness" of the leaf.

Virus diseases (mosaic, leaf curling, ringspot etc.) and „inorganic" diseases (frenching, marble etc.) are being studied and the economical importance gone into.

THE EXPERIMENT STATION WEST-JAVA (PROEFSTATION WEST JAVA) BUITENZORG, JAVA

In the West Java Research Station (Present Director Dr. Th. G. E. Hoedt) botanical research work is necessary for rubber- and teaculture. In accordance with the nature of the Institution the object of this work is to obtain results which can find practical application in the industries. In the field of anatomy,

physiology, genetics, and of phytopathology, numerous subjects arise, which are of direct or indirect importance.

As to *Hevea,* there are in existence so many botanical investigations, of which the results, however provisional they may sometimes be, are useful for the industries, that at present there is no special need of extending this work. Only the selection problem and some phytopathological problems continue to be of importance.

With regard to tea, matters are quite different. Whereas full attention has always been paid to the selection and phytopathological problems, this is not the case with those dealing with the anatomical and physiological aspect. The latter have gradually grown so much in importance, that at present it may be said, that the solution of numerous difficulties is really delayed by the insufficiency of the botanical knowledge of the tea-plant. Besides continuing the botanical work in the field of genetics and phytopathology, much attention is paid to the anatomical and physiological research work for the tea-culture.

Hevea brasiliensis. All the botanical work with regard to *Hevea* that is now being done and will be done for some time to come is connected with selection. Two main distinctions are usually made: vegetative and generative selection. The object of vegetative selection is to find clones which excel both in production and in other properties (imperviousness to the effects of wind, high resistance to diseases, proper growth of bark etc.) in order to lay out plantations of them that will produce abundantly. As the vegetative descendants consist of oculations, it is of great importance to study the influence of the stock on the „noble" scion. For there are indications that the latex-production of the scion is better when use has been made of stocks, which have a genetical relation to the clone. There are also indications that the latex-production of the stock improves, if the stem is oculated with abundantly producing clones. In many cases, different clones seem to influence the production of the stock differently. Experiments that are now being made, however will have to give more derisive answers to these problems.

Closely connected with vegetative selection is the need for a systematic description of characteristics (habits and leaves) shown by various clones. This has already been done with many clones. With vegetative selection it has further been established, that the productions of *Hevea*-plantations, consisting of oculations of closely observed and well-tested clones, have become at least twice as large.

The generative selection of *Hevea,* too, has yielded encouraging results. In the years 1927—1929 numerous artificial

pollinations between a great number of promising clones were carried out. The seeds thus obtained were planted out in the experimental garden of the research station. The *Hevea*-trees grown from them can at present be tapped and the production-data collected enable us to study the value of the various clones for purposes of seed-growing. It appeared that combinations of certain clones always yield a highly productive generative offspring, while with other clones this is not the case.

Of the phytopathological problems, the appearance of root-moulds, mildew and groove-diseases form the objects of research. Although several lines of attack are available, an effective one has not yet been found, except in the case of mildew. Mildew is successfully combated by dusting with sulphur-powder. Investigations with regard to the other above-mentioned diseases will be continued.

Tea. Whereas the anatomy and physiology of *Hevea* have been investigated to a large extent, with tea systematic investigations are still part of the programme of the future. Such anatomical research work as has been done on the structure of the leaf, stalk and twigs of tea, has only been incidental to the major study of *Helopeltis*-problems, of which they formed unmistakable links. Later these investigations were extended and continued in a physiological direction, because there were indications that the chemical composition of tea-leaves and twigs is of great influence on the appearance of *Helopeltis*-attacks. For the present these indications show, that tea-plants with sufficient starch-reserves in the branches and roots suffer less from *Helopeltis* than those with little starch-reserves. This observation tallies with the experience that exhausted tea-plantations suffer most from *Helopeltis*-attacks.

The testing of the tea-leaves for starch proved to be of importance in another respect. Just as with tobacco, it was possible to ascertain a difference in the quality of tea prepared from leaves gathered (1) in the morning and (2) in the afternoon. On account of this an investigation was made into the formation and disappearance of starch in the tea-leaf. Amongst other things, an indication was then obtained that various tea-plants react differently with regard to the formation of starch. The assimilation-capacity in various individuals seems under otherwise equal conditions to be unequal. Further investigations will have to corroborate this, because of its importance in the matter of selection for quality.

Connected with the testing of tea-twigs and stalks for starch, is also the study of the formation of wound-gums and callus, which is of the greatest importance to the tea-cultures, because

the plants are periodically pruned. It appeared that the formation of tilosis and wound-gums greatly depends on the reserve-materials in the wood, so that the die-back of pruned wood is the more serious, the fewer opportunities the plant has had to collect reserve-materials. In connection with the above-mentioned indications, an elaborate and protracted physiological-anatomical study of the tea-plant will be taken up.

The selection of tea has had and continues to have more attention. In the main the aim has been to grow a superior seed, from which plants, with a type of leaf much in demand and a high-production-capacity, can be obtained. For that purpose, plants are chosen, which produce many good leaves, after which they are planted out together in a seedgarden. Unfortunately a proper method is still lacking to test the clones for the internal properties of the prepared tea-leaf. Of late, vegetative descendants have been made of the good mother-plants, so that in the seed-gardens a number of superior clones have been planted out. Attention has been paid in this connection to the problem of the vegetative reproduction of tea-plants. It appears to be now practicable to make oculations just as in the case of *Hevea,* and, even if in the tea-culture this will not immediately lead to an equally extensive application, it has opened up new prospects. Seed-selection will now be promoted in the same way as with *Hevea.* Only the link of artificial pollination is still missing; the need for expert knowledge in this subject is vital. Meanwhile with a sufficient selection, a highly productive plantation can already be obtained. Generally speaking, the relatively most powerfully developed plants on seed-plots appear to be the relatively best producers. Experiments in this direction, it is true, did not show an absolute correlation between the production-capacity of the shrubs and the development of the grown plant. Despite this, however, in practice a much better yield can be obtained, at least for a few years, by selection of grown plants than could be obtained without such a selection. Investigations are being made to ascertain whether such a relative selection cannot be performed in an even earlier stage of the plant.

Finally attention is paid in the research station to phytopathological problems, the most important of which are those concerning the appearance and the combating of root-moulds and Red-rust (*Cephaleuros*). Especially this last-mentioned algal species, which usually appears together with *Helopeltis,* will be studied thoroughly on account of the serious damage caused by it.

THE EXPERIMENT STATION MIDDLE AND EAST JAVA JAVA (PROEFSTATION MIDDEN- EN OOST-JAVA) MALANG, JAVA

The botanical investigations made by the Experimental Station Middle and East Java Malang, are for the greater part concerned with an enquiry into the cultivation of coffee (principally robusta) and (as regards the Middle Java department at Semarang) mainly into the cultivation of cocoa.

The investigations can be subdivided as regards coffee as follows:

1. *Physiological-anatomical research.*
2. *Genetic and systematic research.*
3. *Research on plantdiseases and pests.*

Under heading 1 may be specially mentioned:

a. *Vegetative multiplication* of the coffee plant by means of grafts, cuttings, layerings.
   At the moment one of the most important questions is the reciprocal influence of the scion and the stock, more especially with regard to resistance against attacks by *Xyleborus* spec. (borers), nematodes and with regard to unfavourable soil and climatic conditions (non parasitical mortality of branches).
   The interest taken by planters in coffee grafts for planting material is rapidly increasing.
b. *The conduct of the coffeeplant* above as well as in the soil, specially with regard to attacks by nematodes, non parasitical twig mortality, in general the factors mentioned sub. a.
c. *Blossombiology.* Having regard to the fact that robusta coffee is practically self-sterile, practical experiments on the possibilities of cross fertilisation are being made. Research into the reciprocal fertility of coffee clones. Research into the self-fertility of selected numbers.

2. *Genetic and systematic research.*
   a. Selection of superior planting material (seedlings and grafts). This is done by pedigree selection and by artificial crossings. The place of socalled mixed seed has now altogether been taken by the seed of selected numbers.
   b. Systematization of coffee species and varieties.
      The determination of morphological characteristics, which can serve in practice to distinguish the clones.
3. *Research on plant diseases.*
   Biological research and the combat of diseases and pests of coffee plant. (Topdisease mould, rootrots, nematodes, twigborers, berryborers, mealy bugs, green bugs, etc.).

During the last few years special attention has been given to the reaction of the plant on the most important of the above mentioned diseases and pests. Under this heading may be mentioned the investigations into the development of the roots under varying conditions, the mortality of twigs through twigborers and the fall of berries through berryborers.

Cocoa-cultivation.

The investigations on cocoa-cultivation, are carried out mainly along the same lines as those on coffee.

Mention must be made of the fact that with cocoa, selection on qualitative improvement of the product plays a greater part in genetical research than is the case with coffee.

As regards phytopathological research on cocoa, the phytophthora amongst the diseases and the Helopeltis and the cocoa moth amongst the pests demand most attention.

A beginning has been made with the biological investigation of cocoa fermentation.

Rubber-cultivation.

The botanical investigations which are carried on in Malang are confined to plant diseases. Special attention is being given to the control of mildew (Oidium Heveae), rootrots and diseases of the tap panel (Phytophthora spec.).

THE FOREST RESEARCH INSTITUTE (PROEFSTATION VOOR HET BOSCHWEZEN) BUITENZORG, JAVA

In order to be able to obtain an adequate idea of the economic, hydrological and climatological value and influence of our forests, so as to be in a position to exercise a proper choice from the considerable number of tree species (there being about 1200 species on Java, and upwards of 3000 in the Outer Provinces), it is necessary to have some knowledge of the situation, the composition, and the formation of our forests.

As regards Java, our knowledge in these respects has already advanced considerably, but, where the Outer Provinces are concerned there still remains a great deal to be done. Herbarium material and wood samples are constantly being forwarded to this Experimental Station (Present Director Dr WOLFF VON WÜLFING) by the local foresters, and here they are identified and classified in accordance with their properties. Seeing that, as a rule, sterile material is sent in, it was found necessary to conduct extensive investigations into the various vegetative characteristics. This study led to the compilation of generic keys, based upon the vegetative characteristics (Communication No. 20, 1928). Prior thereto, investigations had already been

conducted, to discover such characteristics as could be used in identifying trees by their bark (Communication No. 16, 1926).

The outcome of the anatomical research of timber was published in Communication No. 5 (1920), No. 7 (1922), No. 11 (1925), and No. 13 (1926). It refers to descriptions, photographic reproductions, and keys of important timber species of the Netherlands Indies.

At present the investigation, recently begun, of plants producing rattan, is being continued, both by the aid of herbarium material and by the determination of anatomical characteristics.

Considerable investigation is proceeding in connection with cultivable species. A special Section has been assigned, to deal with problems, arising in relation to the cultivation of teak, in view of the fact that, for Java, teak represents the most important economic timber.

Besides having been subject to field experiments (Communications No. 12, 1925; No. 22, 1928; No. 23, 1929; No. 24, 1929) the question of cultivation has also been considered from the physiological side. Thus, root investigations were carried out (Short Communications No. 29, 1932; No. 31, 1932; No. 35, 1933), as also germination tests (Short Communic. No. 23, 1932; No. 42, 1934; Communic. No. 26, 1933), and evaporation phenomena (now in the press), the latter, in additon, for the purpose of determining the hydrological value of various kinds of vegetation.

Certain species of trees were the subject of special interest, such as sandalwood *(Santalum album),* which, as will be remembered, in its earlier stages is a root parasite, thus causing peculiar difficulties in its cultivation (Short Communic. No. 10, 1925; No. 11, 1925), mahogany *(Swietenia macrophylla* and *S. Mahagoni,* Communic. No. 15, 1926); *Pinus Merkusii,* of importance by reason of its resin (Communic. No. 19, 1928); trees producing tanning bark (Communic. No. 9, 1924), more particularly *Acacia decurrens* (Short Communic. No. 8, 1924, and No. 17, 1930).

As regards teak *(Tectona grandis)* numerous investigations have been carried on. Its cultivation on poor soil still has our very close attention. It has been found that the teak roots require a thorough soil ventilation, and this requirement is not being satisfied by physically inadequate soil. Thus to an ever greater extent, teak on the poorest soils is being replaced by other species, in view of the fact that, in such cases but very little is to be expected from lasting soil improvements (as, for instance, by means of precultivation, in which connection experiments are still in progress).

For several years past, attention has also been devoted to investigations, connected with the selection of teak (Short Commun. No. 40, 1934, No. 49, 1935), in the course of which various native and foreign teak varieties have been, and are tested as to their peculiar characteristics.

In addition to artificial regeneration, the natural regeneration of teak and other species of trees has also been studied. We would specifically refer to an extensive investigation, carried on in the mountainous forests of the Preangan, in connection with natural regeneration and selection felling. (Communic. No. 14, 1926; Short Communic. No. 33, 1933).

WEST INDIES

SURINAM

Surinam forms together with the other Guyanas and the Amazonian region the mighty rain-wood area of tropical South America. The low coastal district 20 kilometres in breadth, consisting of solid clay of fluvio-marine origin, is covered with marsh-woods, partly, too, with extensive treeless swamp-savannahs.

To the South of this region lies a zone, almost equally broad, of deficient alluvial sandy soil. The rivers and brooks are here bordered by more or less broad belts of wood, while the plateaux and ridges lying in between and covered with coarse lixiviated white quartz-sand are scantily overgrown with low shrubs, herbs, and grasses.

In the dry season these plants are withered and often burnt down to the subterranean parts. In the rainy season, on the other hand, the water cannot be sufficiently drained away. The bare sandy spots are then covered for some months with hygrophytes, such as *Drosera, Xyris* and *Utricularia.*

The rest of the country, about four-fifths, which is hilly to mountainous, is covered with lateritic weathered grounds, mostly resulting from granite and gneiss. The whole of this region is overgrown with a connected primeval forest, which reaches up to the highest mountain-tops of 1200 and 1300 metres and is only rarely interrupted by a naked dome of granite or a vast rocky plateau.

In the farthest South, however, near the frontier, savannahs

are again to be seen, offshoots of the extensive stretches of grass in northern Brazil.

About the year 1750 plants were for the first time collected in Brazil, viz. by DALBERG, a pupil of LINNAEUS. Only between 1820—1860, however, more comprehensive herbaria were made, chiefly by KAPPLER. The latter came to Surinam in 1835 as a military man and in later years did much for the investigation of the flora of the country. In this period, large collections were also sent to Europe by HOSTMANN, SPLITTGERBER, KEGEL, and WALLSCHLAGEL, where they were distributed among a great many herbaria (Leyden, Utrecht, Kew, Bruxelles, Paris, Göttingen, etc.). All these collections were made in the coastal district in the neighbouring hilly country. Only KAPPLER had an opportunity in 1861 to collect far inland near the sources of the river Marowyne. This was his last collection and also the last of any importance to come to the Netherlands in the 19th century.

In 1900, however, a new period of energetic collecting set in, this time chiefly far into the interior. This was made possible, because a number of topographical expeditions mapped out the interior, practically unknown up to 1900, and the medical men attached to them were charged with collecting plants. Apart from these, collections of plants were in this period made by botanists, e.g. WENT, PULLE, BOLDINGH, and KUYPER. From 1900 to 1912 the collections were, just as before that time, chiefly made along the banks of the rivers, on savannahs and such places, where a herbarium can be formed fairly easily and whithout great expense. At this time, too, there appeared two important publications, both by PULLE in Utrecht: 1906, „Enumeration of the vascular plants known from Surinam", and 1908, the „Zakflora van Suriname", which makes it possible to determine the genera known up to 1908.

Now the tree-flora of the dense primeval forest, by far the most important part of the flora, was only very incompletely represented in these collections. After 1912 this, too, was changed. In this year the forester GONGGRIJP began to form two wood-reserves at a distance of 45 and 65 kilometres to the south of Paramaribo. After 1914 the collecting was done for 9 years by the forester GONGGRIJP and the botanist STAHEL in company. The number of trees marked in the two above-mentioned places increased considerably, while two new reserves were assigned, one of them on a plateau 450 metres above sea-level.

The total number of trees marked in these 4 places was 1067. For many years these trees were regularly inspected by a collector, who climbed them with the aid of climbing-irons, if there

were any flowers and fruits visible. Thus the complete herbarium material belonging to one and the same tree could be collected from numerous trees.

Besides, GONGGRIJP and STAHEL made extensive collections on numerous journeys far into the interior. On these expeditions, they had as a rule 10 to 12 labourers at their disposal, who were for days at a stretch engaged on the spot in felling blossoming trees together with their epiphytes and lianas. The material collected was then soldered in tins according to the Schweinfurth method with a small quantity of alcohol, and later pressed in Paramaribo. In these 9 years a total of 6700 herbarium numbers was collected.

At the end of 1924 the Surinam Forest Service was discontinued, so that through lack of funds it became impossible to collect the numbered trees in the wood-reserves. In 1926, on the occasion of the expedition to the Wilhelmina mountain range, STAHEL made a collection of plants, while in 1933 the conservator of the Utrecht herbarium, Dr. LANJOUW, collected in the northern part of the country.

All these comprehensive collections sent to Europe after 1900 are, unlike those of the 19th century, preserved in one single herbarium, viz. that of the University of Utrecht. Thus a concentration of material was affected, which facilitated the publication, from 1932 onwards, of a „Flora of Surinam", under the general editorship of PULLE.

Of this standard-work, to be published in 4 volumes, a large number of families has already been treated by specialists and published. After the „Flora Brasiliensis" this is the most important floristic work on the tropical rain-wood in South America.

STAHEL also collected and preserved in alcohol numerous fungi. The *Gasteromycetaceae* were treated by FISCHER in Bern. Among the new species, two belonged to new genera (*Stahelio-myces* and *Tromellogaster*).

Biological anatomical investigations were especially made by the officials of the agricultural experiment station in Paramaribo, naturally for the greater part uncultivated plants.

Investigations of a more general nature were also made, chiefly in the feld of embryology. The material for this was collected and fixed in Surinam, but with only one exception, it was not worked up in Surinam. Well-known are the embryological investigations by F. A. F. C. WENT on Podostemonaceae, those by KUYPER on *Theobroma Cocoa,* those by D'ANGREMOND on *Musa Sapientium,* by UMIKER on *Helosis guyanensis,* by RUYS on *Melastomaceae* and by RUTGERS on *Moringa oleifera.*

In 1923 the biology of the *Podostemonaceae* was studied by

F. A. F. C. WENT, together with his son F. W. WENT, during a three weeks' stay at one of the largest waterfalls of Surinam, the Raleigh-falls of the uninhabitated Boven-Coppename river. This family is there abundantly represented in various genera and species. In a field-laboratory erected on an island in the falls, microscopic and physiological investigation could be made. The results were published in an important treatise of the „Koninklijke Akademie van Wetenschappen" (Royal Academy of Sciences) in Amsterdam.

STAHEL has done work on the flower-biology and on the structure of the inflorescences of *Theobroma Cocoa.* Several phytochemical studies were made by STACK, among others on the chemical processes with the fermentation of *Cocoa.* KUYPER has described various diseases of coffee and *Hevea.* He has also investigated, at what time the flower-bunch of bananas starts at the growing point, which appeared to take place a month and a half before the flower-bunches become visible. FERNANDES has studied the die-back of cocoa as a result of drought.

Circumstantial investigations on the curl of cocoa caused by *Marasmius perniciosus* have been published by F. A. F. C. WENT, VAN HALL, and STAHEL. This disease, discovered for the first time in the Surinam cocoa-plantation about 1900, gradually spread over most cocoa-countries of South America. Later it appeared, that the wild cocoa-woods in the interior of Surinam are all terribly infected with this disease, which thus was carried from there to the plantation-cocoa.

Curl, strongly resembling that of cocoa, could also be diagnosed on a wild growing *Eugenia,* which is often found on the dams of plantations. According to STAHEL, however, the causative agent proved to be not a fungus, but a bacterium *Pseudomonas hypertrophicum.*

Another very serious disease, the South American *Hevea* leaf-disease, caused by *Melanopsammopsis Ulei,* was also carried from the primeval forest to the rubber-trees of the plantations, and has entirely ruined this cultivation in Surinam and Demerara. In spite of this failure, Ford laid out rubber-plantations in Brazil, which are now more and more stricken with this leaf-disease.

Bananas, too, have of late been suffering in Surinam from a leaf-disease, caused by *Helminthosporium torulosum.*

According to investigations by STAHEL the germ-tubes of the Hevea- and Banana leaf-mildew penetrates the leaf through the cuticula, for which an uninterrupted dew-covering of 12 hours is necessary. Consequently, in Trinidad, with a shorter dew-covering, both these cultivated plants suffer but little harm from this disease, which also occurs there.

Two leaf-diseases of the coffee-plant, the *Sclerotium-* and the silverthread disease investigated by KUYPER and STAHEL, can only develop under stress of rainy weather and afterwards immediately vanish again.

Now, from a scientific point of view, the most interesting disease is the phloëmnecrosis of coffee, which every year ruins thousands of coffee-trees. This disease was formerly considered as being a virus-disease. In 1929, however, STAHEL was able to show, that it is caused by a Trypanosomide: *Phytomonas (Leptomonas) leptovasorum,* which lives in the sieve-vessels and makes them die off after 5 weeks. The disease is easily transmitted to sound trees, by grafting roots containing living flagella. The transmitter in nature, however, has at the moment not yet been found, but it is very probable, that it is a bug, a Pentatomide, which lives underground on the taproot.

ANTILLES

The knowledge of the Flora of the Netherlands Antilles, the so-called Windward Isles, St. Eustatius, Saba and St. Martin, and the so-called Leeward Islands, Curaçao, Aruba and Bonaire, was slight up to 1909. In the older botanical literature only very rarely something is mentioned about the Flora of these islands. Grisebach's Flora of the British West-Indian Islands mentions hardly any plants of the Netherlands Antilles and in Urbans Symbolae Antillanae no collections of these islands are worked out either. The Leyden Professor W. F. R. SURINGAR, who visited the islands in 1885, made a small collection, which has never been published. It was not until 1904—1906, that the wife of the then Governor of St. Eustatius, Mrs. VAN GROLL, made a rather important collection, which was worked out by Dr. I. BOLDINGH in the Botanical Museum and Herbarium of the University of Utrecht. In 1906 Dr. BOLDINGH visited the three Windward Islands and published in 1909, in the English language, an extensive enumeration of the Vascular Plants entitled: „The Flora of the Dutch West Indian Islands St. Eustatius, Saba and St. Martin". In 1909 Dr. BOLDINGH made a second voyage, this time to the Leeward Islands, the results of which were published in the same form under the title „The Flora of Curaçao, Aruba and Bonaire." Both works contained, besides the enumeration of the species collected and the description of some new species of Vascular Plants, numerous data about the distribution and about the plant geography. By way of summary there appeared in 1913, in Dutch, a *Zakflora*

(Pocketflora) of the 6 islands with tables for determining the about 1000 wild and cultivated species of Vascular Plants. All Dr. BOLDINGH's collections, which give a fairly complete idea of the Flora of the Netherlands Antilles, are in the possession of the Botanical Museum and Herbarium of the University of Utrecht.

There is a rather important difference between the Flora of the Windward Isles and that of the Leeward Isles. In the first group of islands 132 cultivated and 674 wild species of Vascular Plants occur together, about 450 species of these on each island.

Of these, 14 species are endemic for the Antilles, only 3 species are endemic for the Netherlands Islands.

Although the rainfall (1100 mm per annum) is great enough and sufficiently regularly divided over the year for the presence of rainwood, this occurs very little there, thanks to the cultivation and the powerful North Eastern trade-wind. Only on the highest top of St. Eustatius an important rainwood may be found.

BOLDINGH distinguishes:

1. The vegetation of the higher parts of the mountains, the so-called *Eriodendron*-vegetation. The highest point of St. Eustatius is 581 m, of Saba 880 m and of St. Martin 412 m.
2. The vegetation of the cultivated plains and of the lower parts of the mountains, the so-called *Croton*-vegetation.
3. The vegetation of the seashore and of the rockey localities, the littoral vegetation.
4. *Eriodendron-* and *Croton*-vegetation intermixed with and partly replaced by plants of the cultivated region.

Only on St. Eustatius the four vegetation-types are well developed. On Saba the cultivated plain is not represented and on St. Martin the vegetation of the higher parts of the mountains is not to be found.

The precipitation per annum on the Leeward Islands is considerably smaller, on Curaçao only 526 mm per annum. The islands are much lower, too, Curaçao 400 mm, Aruba not quite 200 mm, Bonaire 240 mm. The number of species on the three islands together is only 400, 350 of which occur on Curaçao, more than 200 on Aruba and 240 on Bonaire. There are about 10 endemic varieties. The vegetation is very monotonous. Cactuses and thorny bushes prevail and the 4 vegetation types of the other islands cannot be distinguished. Only the *Croton*-vegetation and the littoral vegetation are more or less well developed.

After the travels of Dr. BOLDINGH hardly any more collec-

tions were made on the islands. In 1933 some islands were visited by a group of students in geology in the University of Utrecht under the guidance of Professor L. RUTTEN. A biologist amongst them, Mr. P. WAGENAAR HUMMELINCK, was especially engaged on collecting and studying the varieties of Agave. The results of this investigation have not yet been published.