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Facts for plant protection:
clear, comprehensible, concise

In-depth knowledge of the conditions under which pathogens, in particular parasitic fungi, live and develop is a prerequisite for crop protection. Only with this knowledge can plant diseases be detected in good time and selectively treated.
The video series "The Biology of Fungal Pathogens" gives easy access to this knowledge. Through an exciting blend of vivid 3D animations and real images, with informative commentaries, these videos give a fascinating insight into the life cycles of major fungal pathogens. The series is an outstanding example of communication in modern science.

Target groups:
Students, farmers, technical advisers, teachers

Already published:
Vol. 1: Fungal Pathogens and Diseases of Cereals (3 videos).
Available on DVD and VHS video cassette

In preparation:
Fungal diseases of:
- sugar beet
- canola
- tree fruits and grapes

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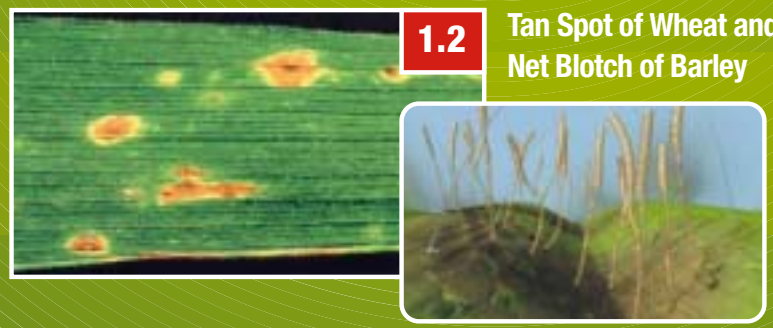
THE BIOLOGY OF FUNGAL PATHOGENS 1

Vol. 1: Fungal Pathogens and Diseases of Cereals (3 Videos)

1.1 Septoria Leaf Blotch of Wheat



1.2 Tan Spot of Wheat and Net Blotch of Barley

1.3 Powdery Mildew of Wheat

Editors' Preface

Plant pathology is a discipline devoted to maintaining plant health and, by so doing, helping to ensure economically and ecologically sound production of foodstuffs in sufficient quantities and of high quality. This places great demands on the effectiveness of research. It also presupposes in-depth knowledge of many aspects of both abiotic and biotic pathogens (e.g. fungi, bacteria, viruses, animal pests) and of plant protection.

Teaching is therefore of great importance. One especially interesting aspect of it is the transfer of knowledge of the sometimes very complex biological relationships in the life or development cycles of pathogenic organisms – host-parasite relationships which run their course under prevailing plant cultivation and environmental conditions.

The video series The Biology of Fungal Pathogens employs state-of-the-art visualization methods to illustrate the life cycles of various fungal pathogens very clearly. The combination of vivid 3D computer animations with real images results in a realistic overall picture that helps the viewer to understand the bio-ecological aspects of host-parasite relationships.

This new information medium addresses both specialist and lay audiences. The target group includes teachers and students at many types of educational institutions, university lecturers, students of agronomy, biology, ecology and their related disciplines, as well as governmental and non-governmental advisory bodies and, last but not least, farmers.

We are deeply indebted to Dr. Randy C. Ploetz, Editor-in-Chief of APS Press, University of Florida, the APS Press staff, and Dr. Thomas J. Baum of Iowa State University for their editorial assistance and dedicated support in bringing this project to a successful conclusion.

We owe a special debt of thanks to Syngenta Agro GmbH (Germany) for their generous support of this project.

Joseph-Alexander Verreet Holger Klink

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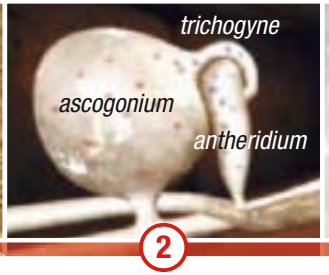
















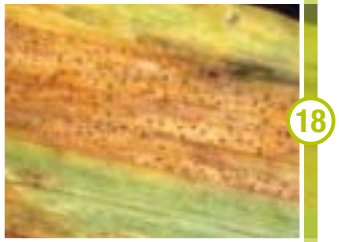

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Septoria Leaf Blotch of Wheat

Teleomorph (sexual stage, primary fruit form):
Mycosphaerella graminicola (Fuckel) Schroeter
Anamorph (asexual stage, secondary fruit form):
Septoria tritici Rob. apud Desm.

(1) After harvest, the fungus survives the winter in stubble residues; there, the teleomorph *Mycosphaerella graminicola* develops.

(2–6) The sexual stage begins with the formation of sex organs (gametangia) – the ascogonium (female) and antheridium (male). The male cell nuclei migrate into the ascogonium via a trichogyne (2). The male and female nuclei pair up (3). Hook-shaped tubes – "croziers" – grow out of the ascogonium (4). The ultimate cell of the crozier becomes an ascus in which the male and female nuclei fuse and undergo several divisions; eight ascospores result from each division (5). This ascus formation takes place in fruiting bodies (pseudothecia) (6).

(7–8) When the relative humidity is high the asci burst; the sexual ascospores are carried away by the wind and infect young wheat plants.

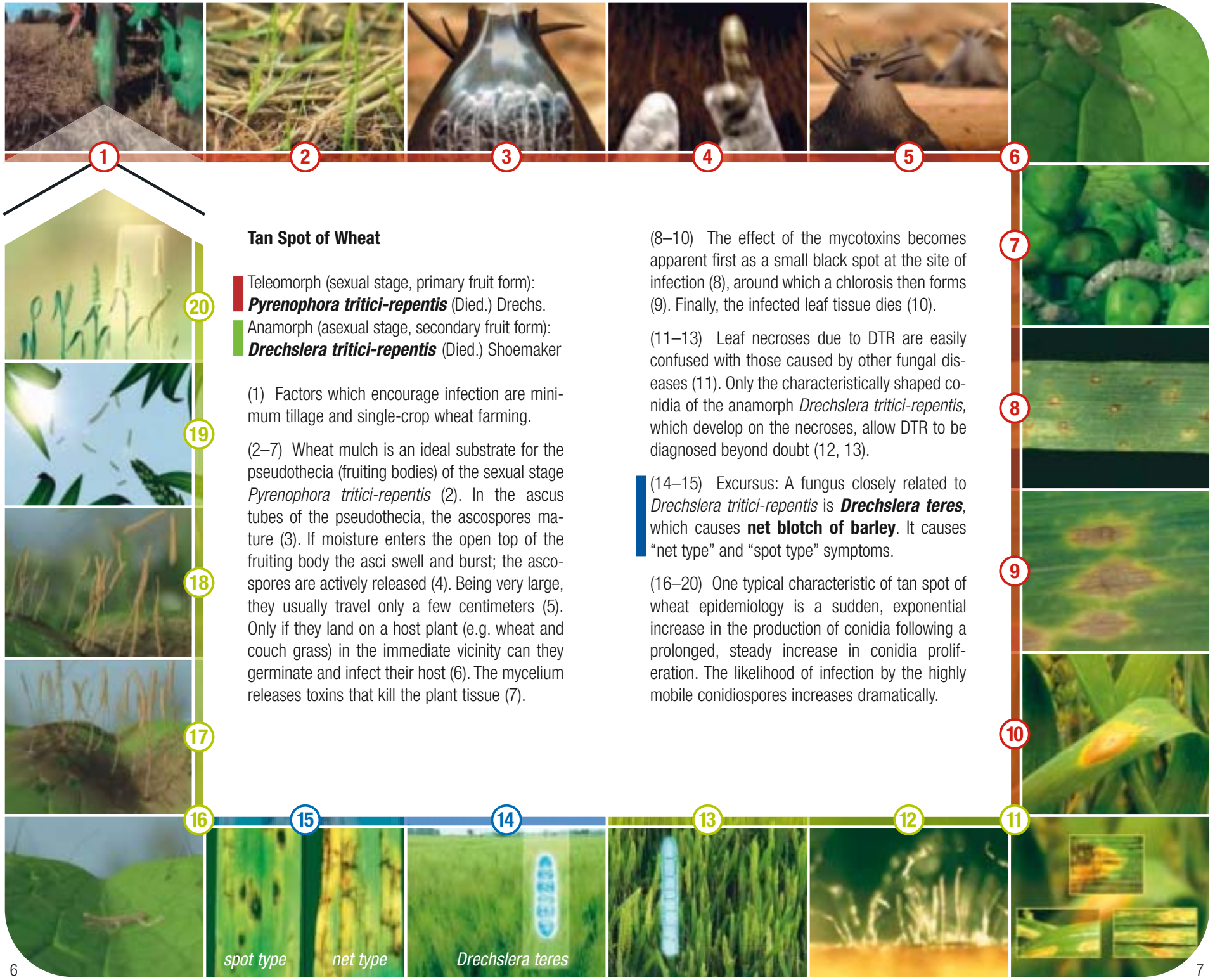
(9–10) Infected leaf tissue turns yellow and then dies (9). In this necrotic tissue, pycnidia – asexual fruiting bodies – develop (10).

(11) The pycnospores formed in the pycnidia are pressed out as mucilaginous tendrils.

(12–13) Raindrops catapult the pycnospores onto adjacent leaves and those directly above.

(14–15) If the leaves are sufficiently moist, the pycnospores germinate. Via stomata the interiors of the leaves are infected. A mycelium develops.

(16–20) The consequences of infection – chloroses (16), which turn into necroses (17) – become visible after a typical latency period of approx. 28 days. On the necrotic leaf surfaces the next, rash-like generation of pycnidia develops (18). In rainy weather the fungus may also affect the top leaves, which are vital for ensuring grain production.



Tan Spot of Wheat

Teleomorph (sexual stage, primary fruit form): ***Pyrenophora tritici-repentis*** (Died.) Drechs.

Anamorph (asexual stage, secondary fruit form): ***Drechslera tritici-repentis*** (Died.) Shoemaker

(1) Factors which encourage infection are minimum tillage and single-crop wheat farming.

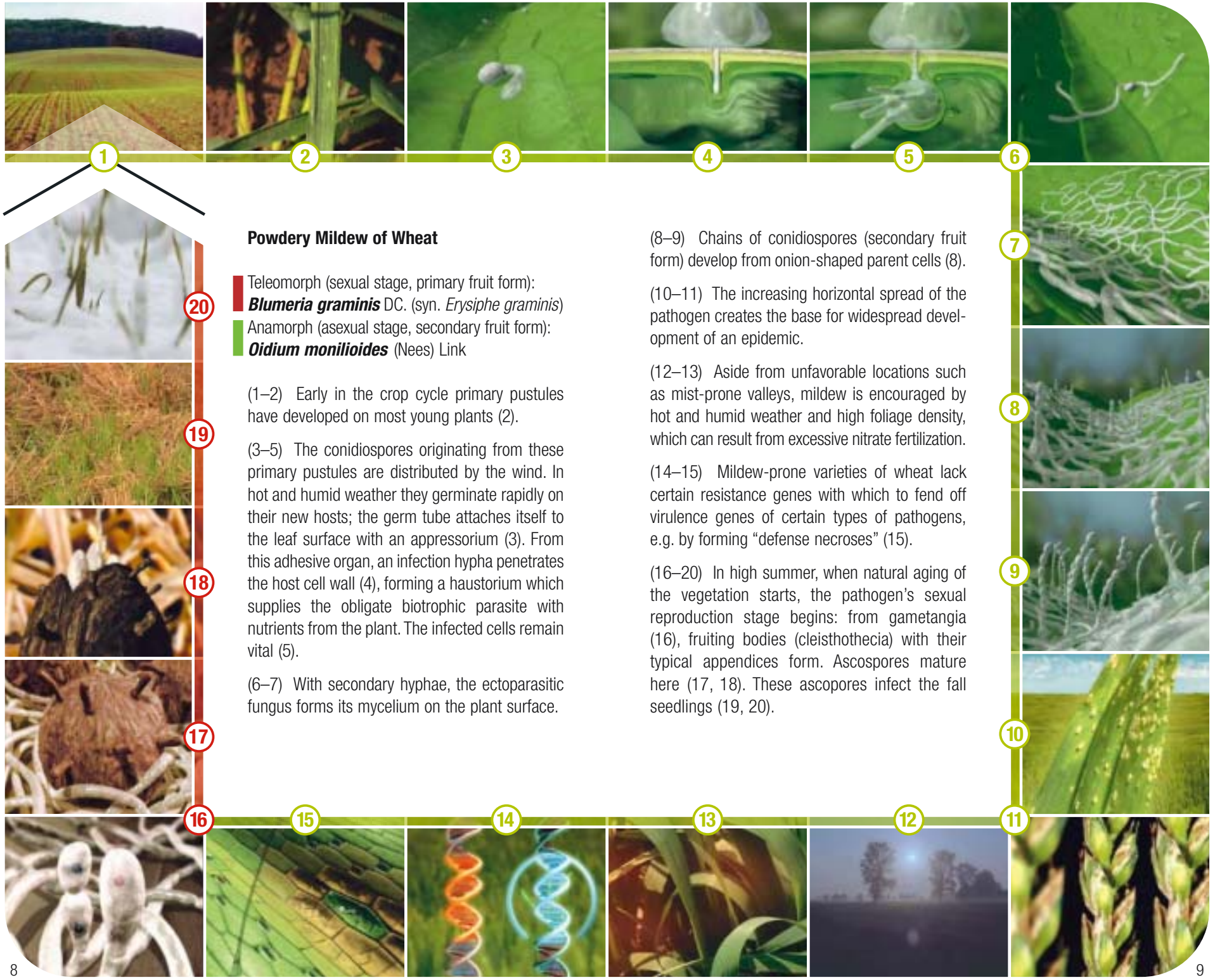
(2–7) Wheat mulch is an ideal substrate for the pseudothecia (fruiting bodies) of the sexual stage *Pyrenophora tritici-repentis* (2). In the ascus tubes of the pseudothecia, the ascospores mature (3). If moisture enters the open top of the fruiting body the asci swell and burst; the ascospores are actively released (4). Being very large, they usually travel only a few centimeters (5). Only if they land on a host plant (e.g. wheat and couch grass) in the immediate vicinity can they germinate and infect their host (6). The mycelium releases toxins that kill the plant tissue (7).

(8–10) The effect of the mycotoxins becomes apparent first as a small black spot at the site of infection (8), around which a chlorosis then forms (9). Finally, the infected leaf tissue dies (10).

(11–13) Leaf necroses due to DTR are easily confused with those caused by other fungal diseases (11). Only the characteristically shaped conidia of the anamorph *Drechslera tritici-repentis,* which develop on the necroses, allow DTR to be diagnosed beyond doubt (12, 13).

(14–15) Excursus: A fungus closely related to *Drechslera tritici-repentis* is ***Drechslera teres***, which causes **net blotch of barley**. It causes "net type" and "spot type" symptoms.

(16–20) One typical characteristic of tan spot of wheat epidemiology is a sudden, exponential increase in the production of conidia following a prolonged, steady increase in conidia proliferation. The likelihood of infection by the highly mobile conidiospores increases dramatically.



Powdery Mildew of Wheat

Teleomorph (sexual stage, primary fruit form):
Blumeria graminis DC. (syn. *Erysiphe graminis*)
Anamorph (asexual stage, secondary fruit form):
Oidium monilioides (Nees) Link

(1–2) Early in the crop cycle primary pustules have developed on most young plants (2).

(3–5) The conidiospores originating from these primary pustules are distributed by the wind. In hot and humid weather they germinate rapidly on their new hosts; the germ tube attaches itself to the leaf surface with an appressorium (3). From this adhesive organ, an infection hypha penetrates the host cell wall (4), forming a haustorium which supplies the obligate biotrophic parasite with nutrients from the plant. The infected cells remain vital (5).

(6–7) With secondary hyphae, the ectoparasitic fungus forms its mycelium on the plant surface.

(8–9) Chains of conidiospores (secondary fruit form) develop from onion-shaped parent cells (8).

(10–11) The increasing horizontal spread of the pathogen creates the base for widespread development of an epidemic.

(12–13) Aside from unfavorable locations such as mist-prone valleys, mildew is encouraged by hot and humid weather and high foliage density, which can result from excessive nitrate fertilization.

(14–15) Mildew-prone varieties of wheat lack certain resistance genes with which to fend off virulence genes of certain types of pathogens, e.g. by forming “defense necroses” (15).

(16–20) In high summer, when natural aging of the vegetation starts, the pathogen’s sexual reproduction stage begins: from gametangia (16), fruiting bodies (cleisthothecia) with their typical appendices form. Ascospores mature here (17, 18). These ascopores infect the fall seedlings (19, 20).