



Definitions of the Terminology Describing the Reactions of Plants to Pests¹ for the Vegetable and Ornamental Seed Industry (Adopted by the ISF Coordination Group Phyto in September 2022)

1. Introduction

The objective of this paper is to address company discussions on disease resistance with customers. The relationship between a plant and a disease or insect or nematode pest is very complex and should be described in carefully chosen terms. In this document the word “pest” refers to both plant diseases and insect and nematode pests as defined by FAO. The different terms that describe a reaction of a plant variety to a pest depend on the specific disease development characteristics which are determined by biological tests. These tests are primarily carried out with well-characterized isolates of a pest (species, sub-species, *forma specialis*, biotype, pathotype or race) under controlled environmental conditions. In some cases, claims of resistance are based on field tests carried out under carefully monitored natural conditions. A collected isolate reflects a population of microorganisms, viruses(/viroids), phytoplasmas, nematodes or insects that represent commercially important field pests.

In practice, however, the ability of a pest to cause disease in, or damage to a plant depends on environmental conditions, pest pressure, virulence and other properties of the organism, and the capacity of the plant to defend itself. This defense capacity depends on the genetic makeup of the specific plant variety as well as plant age and growing conditions possibly resulting in variable reactions to a specific pest.

To promote consistency in the Vegetable and Ornamental seed industry with respect to the terminology that is used to describe the reaction of a specific plant to a specific pest, ISF Coordination Group Phyto has proposed the use of the following definitions.

2. Definitions

Susceptibility (S): the inability of a plant variety to restrict growth and/or development of a pest, causing symptoms and/or damage.

Intermediate Resistance (IR): the ability of a plant variety to restrict the growth and/or development of the specified pest, and/or the symptoms and/or damage it causes, to a moderate degree.
IR varieties may exhibit a greater range of symptoms or damage compared to HR varieties (see below High Resistance) under similar environmental conditions and pest pressure. However, IR plant varieties will still show less severe symptoms or damage than susceptible plant varieties when grown under similar environmental conditions and/or pest pressure.

High Resistance (HR): the ability of a plant variety to restrict the growth and/or development of the specified pest, and/or the symptoms and/or damage it causes, to a high degree.
HR varieties may still exhibit minor symptoms or damage under heavy pest pressure and should not be confused with immune plants that are defined as unable to support any pest growth and development.

Note: sometimes different plant varieties within the same resistance class (especially IR) may express different ranges of symptoms upon infection by a pest in similar conditions. As a reference to what can be roughly expected from a specified resistance level in a plant variety from a specific crop infested with a specific pest, industry has defined so called “example varieties” in the Euroseeds Harmonised Resistance Tables ([16.0774.5-HRT-Tables.pdf](#) (euroseeds.eu)).

3. Specification of the pest

Pests are known to continuously develop and in some cases break plant disease resistance. The new resistance-breaking form of the pest can cause disease in, or damage to plants that remain unaffected by the original form of the pest. New resistance-breaking forms of a pest are specified in nomenclature by a new biotype, pathotype or race nomination.

It is to be noted that if resistance (HR or IR) is claimed for a plant variety, this is always limited to the specified pest species, and sometimes also limited to the sub-species, *forma specialis*, biotype, pathotype or race of the pest. For many pests, no biotypes, pathotypes or races have been officially described or generally accepted. In those cases resistance is only claimed against certain not further specified isolates of that pathogen.

In case new biotypes, pathotypes or races emerge ISF will address the re-naming of the resistance claim to ensure it reflects the specific targeted pest appropriately. This also applies when nomenclature of species, sub-species and *formae speciales* changes due to new scientific insights.

4. Statement

The ISF Coordination Group Phyto recommends that Vegetable and Ornamental seed companies only use the terms Susceptibility (S), Intermediate Resistance (IR), and High Resistance (HR) to describe the reaction of plant varieties to pests. The standard abbreviations IR and HR shall be used by companies in communication with their customers in all languages.

Vegetable seed companies should avoid other terms, such as “tolerance”, for describing the level of disease resistance. Obviously, they may continue to use the term tolerance to describe the ability of a plant variety to endure abiotic stresses without serious consequences for growth, appearance and yield.

These definitions and recommendations will be reviewed at least every five years.

¹ FAO defines a pest as: Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products.
<http://www.fao.org/docrep/W3587E/w3587e01.htm>
Pathogens (microorganisms such as bacteria, viruses and fungi that cause a disease) are, therefore, included in the term “pest”.