

Subcommittee on Plant Health Diagnostics

SPHD Reference Standard No. 2 (SPHD RS No. 2)

Development of National Diagnostic Protocols - Procedures for Authors

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1. INTRODUCTION

1.1 Scope

The *Development of National Diagnostic Protocols – Procedures for Authors* (SPHD RS No.2) is a SPHD Reference Standard providing guidelines for authors on the development of diagnostic procedures/protocols (refer to SPHD RS No.1 for definitions). In this document the term “diagnostic protocol” will infer reference to either a diagnostic procedure or a diagnostic protocol. The Reference Standard has been developed to standardise and incorporate relevant information in diagnostic protocols for the ***identification of emergency plant pests in Australia***.

1.2 Purpose

The purpose of this Reference Standard is to provide guidelines and instructions to authors for the development of a diagnostic protocol. Once developed, the diagnostic protocol will be submitted to SPHD for approval and Plant Health Committee endorsement, and when approved and endorsed, the document will be recognised as a National Diagnostic Protocol (NDP).

If an approved IPPC protocol exists, this should be used unless that protocol is proven not to work in Australian conditions.

1.3 Review

The SPHD RS No.2 will be reviewed every five years or earlier if required. The review will be implemented by the Diagnostic Standards Working Group (in consultation with SPHD) for expert input. Changes to the Standard are subject to the approval of SPHD members for adoption, and endorsement by the Plant Health Committee.

1.4 Reference Standards

All SPHD Reference Standards can be found on the SPHD website <http://plantbiosecuritydiagnostics.net.au/sphd/sphd-reference-standards>

1.5 References

- IPPC. 1997. ISPM No. 6 *Guidelines for Surveillance*. Food and Agriculture Organisation for the United Nations, Rome.
- IPPC. 2001. ISPM No. 13 *Guidelines for the Notification of Non-compliance and Emergency Action*. Food and Agriculture Organisation for the United Nations, Rome.
- IPPC. 2006. ISPM No. 27 *Diagnostic Protocols for Regulated Pests*. Food and Agriculture Organisation for the United Nations, Rome.
- IPPC. 2011. *Procedural Manual*. Food and Agriculture Organisation for the United Nations, Rome. September 2011.
- IPPC. 2012. ISPM No. 5 *Glossary of Phytosanitary Terms*. FAO, Rome.

2. SPHD PROCEDURE FOR THE DEVELOPMENT OF NATIONAL DIAGNOSTIC PROTOCOLS

2.1 Introduction

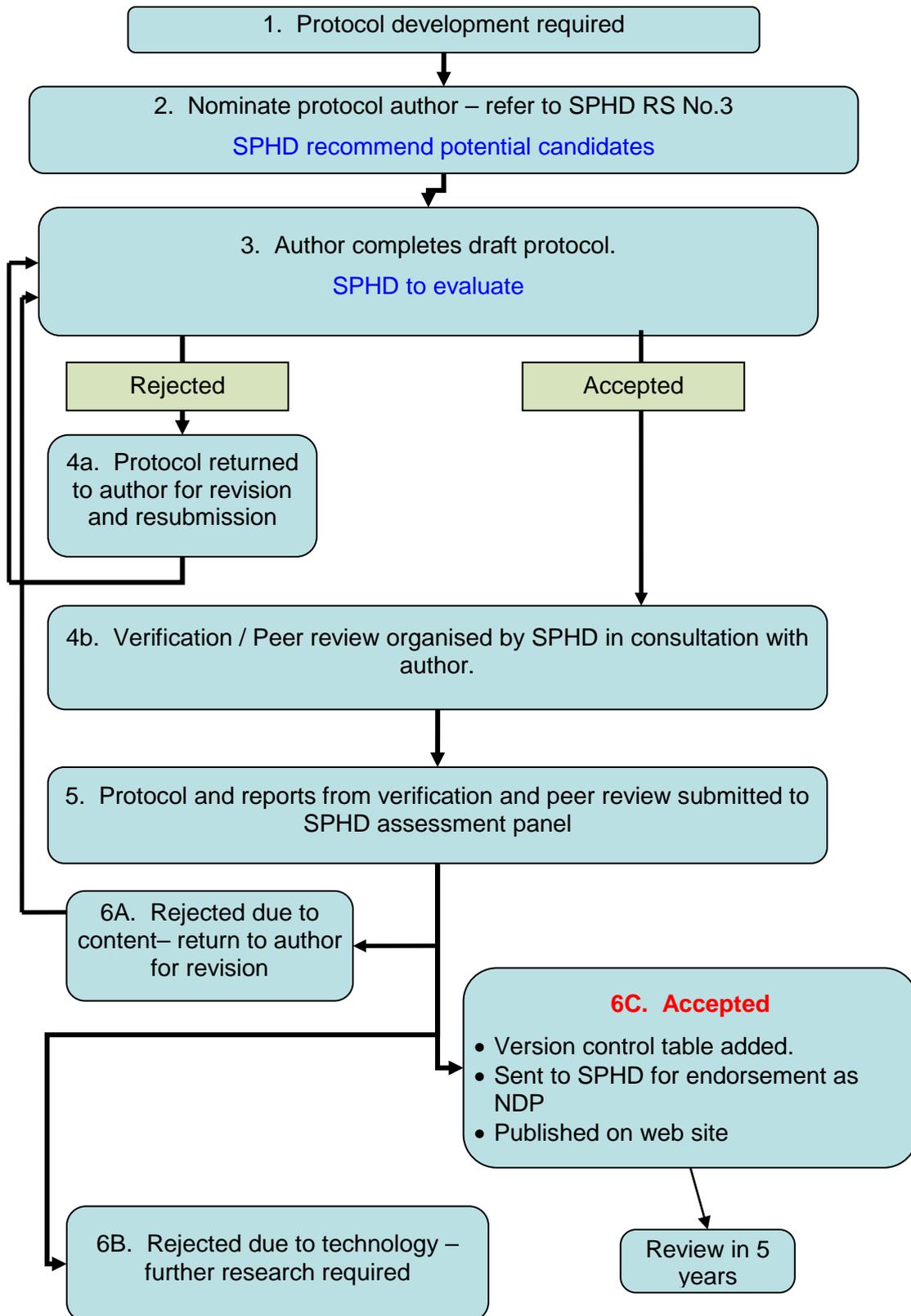
The SPHD Procedure for the Development of NDPs has been adapted from the IPPC Procedural Manual, Section 3.6.3. *Technical Panel to Develop Diagnostic Protocols for Specific Pests (IPPC 2011)*.

Definitions of terms, acronyms and abbreviations used are contained in the SPHD RS No.1: *Glossary of Terms and ISPM No. 5 Glossary of Phytosanitary Terms (IPPC 2012)*.

2.2 Procedures

1. A suitable expert/author approved by SPHD will lead the development of a diagnostic protocol either by adapting an existing diagnostic protocol or by developing a new diagnostic protocol as required. The author uses the Instructions to Authors for NDPs for guidance (SPHD RS No.2 Section 3) and if needed additional instructions may also be given by DSWG. A proforma is provided in Section 4.
2. A draft protocol should be submitted to SPHD for approval.
3. The protocol is evaluated by SPHD and may be returned to the author if considered not to contain sufficient detail.
4. Peer review of the diagnostic protocol is undertaken by a Plant Health Expert approved by SPHD (in accordance with SPHD RS No. 4).
5. Verification of the diagnostic protocol is undertaken by an Independent Laboratory approved by SPHD (in accordance with SPHD RS No. 4).
6. The diagnostic protocol and the associated peer review and verification reports are submitted to SPHD for approval by the Assessment Panel (in accordance with SPHD RS No. 3).
7. The diagnostic protocol is either approved by SPHD and submitted to PHC for endorsement, or returned to the author, applicant or person nominated by SPHD with comments for further work required before resubmission. When completed, SPHD Executive Officer (EO) will include acknowledgment of the reviewer(s), verifying laboratory and original authors of the protocol.
8. The endorsed diagnostic protocol is published on the SPHD website.

Figure 1. Protocol development flowchart



3. INSTRUCTIONS TO AUTHORS OF NATIONAL DIAGNOSTIC PROTOCOLS

3.1 Introduction

These instructions to authors of NDPs are based on the ISPM No. 27 *Diagnostic Protocols for Regulated Pests* (IPPC 2006) and IPPC *Procedural Manual* section 3.6.3 (*Technical Panel to Develop Diagnostic Protocols for Specific Pests* (TPDP)) and Annex 11 (*TPDP Guidance, Part 1: Guidelines on Formatting of Diagnostic Protocols*).

Definitions of terms, acronyms and abbreviations used are contained in the SPHD RS No.1: *Glossary of terms* and the *ISPM No. 5 Glossary on Phytosanitary Terms* (IPPC 2012).

Authors can use the proforma in Section 4 of this reference standard and also refer to NDPs on the web site (<http://plantbiosecuritydiagnostics.net.au/resource-hub/priority-pest-diagnostic-resources>) for examples.

2.2 Instructions

3.1.1 General requirements

A protocol should only contain information directly relevant to the accurate taxonomic identification of the organism.

Diagnostic protocols provide the minimum requirements for diagnostic procedures and methods for the detection and identification of plant pests. Information is provided on the pest, its host and taxonomic status and the methods to detect and identify it based on the best available information.

Diagnostic protocols may cover a species, an intra-specific taxon, several species within a genus or multiple genera of related pests.

Authors must ensure that all text and images are appropriately cited and correctly acknowledged. Authors must not violate intellectual property or copyright conventions. Any images not copyright to authors must have written permission from the copyright owner, or be cited if from a published document, for use in the protocol.

All figures must be numbered and the figure caption include the country or region where images were taken and name of the copyright holder.

The document should include page numbers and text font should be Arial size 11 (see *Style Checklist for Authors* in Section 4).

3.1.2 Definitions

Pest detection in a diagnostic protocol is the information needed to detect the pest in the host material so it can then be identified.

Pest identification in a diagnostic protocol is defined as the process of ascertaining the taxonomic identity of an organism.

3.1.3 Methodology

Each protocol should contain the diagnostic procedures and guidance necessary for the named pest(s) to be detected and positively identified by a diagnostician. Authors should select diagnostic procedures on the basis of their accuracy; sensitivity and reproducibility, also taking into account the availability of equipment, the expertise required for these procedures and their practicality (e.g. ease of use, speed and cost).

Diagnostic protocols should include more than one diagnostic procedure, if appropriate, to take into account the varying capabilities of laboratories. Diagnosis of different developmental stages of organisms may require different methodologies. In cases where morphological procedures can be reliably used, but appropriate molecular procedures have been developed, the use of both procedures must be described.

Authors should provide information and guidance on diagnostic procedures that either singly or in combination lead to diagnosis of the pest. When several procedures are mentioned, their advantages/disadvantages should be given as well as the extent to which the procedures or combinations of procedures are equivalent. If several procedures are needed for the diagnosis, and/or if many alternative procedures are included, a schematic flow diagram may be necessary.

Only methods relevant for the definitive diagnosis should be included. Additional techniques which are more suitable for high throughput diagnostics (i.e. the ability to process large numbers of samples in a short time period) which could be used in a surveillance situation can be included in an appendix.

3.1.4 Structure and content of a diagnostic protocol

Diagnostic protocols should be arranged as per the protocol template provided with the following sections (with additional sub-headings as appropriate):

Contents

1. Introduction
2. Taxonomic information
3. Detection
4. Identification
5. Contact points for further information
6. Acknowledgements
7. References
8. Appendices (optional)

3.1.5 Introduction

This section should be no greater than 400 words.

Authors should provide brief information on the pest that is directly relevant for diagnosis and should be referenced. This information may include: host range, effect on hosts and brief description of mode of transmission and dissemination (e.g. vectors).

Host range should be entered in list format: for long hosts lists this can be included in the appendix.

No geographical information, control or risk assessment (entry, spread, establishment potential or consequences of entry) should be included.

Other relevant information can be included in the appendix, e.g. life cycle, full details of transmission and dissemination.

Authors should include information on whether other protocols are available, reference them, and comment on why they are not suitable, or how they are related to this protocol.

3.1.5.1 Taxonomic information

The correct scientific name and authority should be given and an overview of the relevant taxonomic hierarchy (Kingdom, Phylum, Class, Order, Family, Genus, Species, relevant subspecific taxon). Include synonyms and relevant former names (these may be taxonomically incorrect, but relevant in relation to the literature) as appropriate. Internationally recognised acronyms should be included.

For protocols that detect and identify groups of organisms (e.g. several species within a genus, several genera within a family etc), the scope of the protocol should be clearly defined. Where possible, the taxonomic rules used to define this group should be included as well as evidence via referred papers that demonstrate the diagnostic capacity of the protocol. If appropriate a list of organisms that have been detected and identified using the diagnostic protocol can be included in an appendix.

Any taxonomic disagreements should be stated along with appropriate references.

A taxonomic description can be included only if this information is not covered in detection.

3.1.5.2 Detection

Detection is the information needed to detect the pest in or on the host material so it can then be identified. It is NOT the procedures used for identification.

However for some pests, particularly insects, there may be significant cross-over of information. If the information for detection is also the method used for identification, place the method in the identification section.

Authors should provide information and guidance on:

- The part(s) of the plant, plant products or other articles on/in which it may be found;
- The likely occurrence of the pest associated with developmental stages of the host(s), climatic conditions and seasonality;
- The signs or symptoms associated with the pest including illustrations/images;
- Differences or similarities with signs and/or symptoms from other pests/causes including illustrations/images;
- The developmental stages of the pest that may be encountered, together with their likely distribution on/in the plants/plant products or other articles;
- Sampling procedures critical for the detection methods and the diagnostic procedures. Any aspects of the sample that may impact on the diagnostic procedure must be included, e.g. age of the sample, chemical sprays applied to the crop prior to sampling, sample storage (sampling procedures for surveillance should not be included); and
- Detection procedures for extracting, recovering, and collecting the pest from the plants. These methods should be described in sufficient detail that the user of the protocol will be able to apply the method without further reference to the literature.

Sub headings should be included as appropriate, but it is not necessary to include all dot points as subheadings.

All illustrations/images should be of sufficient quality and size when printed to show required features and the country or region where images were taken must also be provided. All text and images must be appropriately cited and correctly acknowledged. Authors must not violate intellectual property or copyright conventions.

3.1.5.3 Identification

In this section, authors should provide information and guidance on diagnostic procedures that either singly or in combination lead to the identification of the pest. The minimum requirements for identification must be clearly stated. Diagnostic procedures for quick, presumptive indications of identity (which will later need to be confirmed) may also be included. Each diagnostic procedure should be described separately.

For all the diagnostic procedures, information should be provided on their accuracy, specificity and reproducibility, and specifications from multi-laboratory validation trials (if available). For protocols that detect and identify more than one organism information should be provided that clearly defines the scope of the protocol. If the list of organisms is extensive, this data can be presented as a table in an appendix.

Guidance should be provided on positive and negative controls and reference material to be included in each of the procedures. Sources and specifications (technical, commercial, collection entry codes) of controls and reference material should be indicated. Where the inclusion of additional specific controls, including reference material, is essential, this must be indicated in the protocol.

Guidance should be provided on the criteria for the determination of a positive or negative result for each method, and methods to resolve ambiguous results. Guidance should also be provided on resolving possible confusion with similar and related species or taxa.

Where appropriate, diagnostic procedures for detection of pests from asymptomatic plants or plant products should also be given.

Two main types of methodologies are included in diagnostic protocols, those which are based on morphological and morphometric characteristics and those based on biochemical or molecular properties.

Methodologies based on morphological and morphometric characteristics of a pest.

Details should be provided, as appropriate, on:

- Methods for extracting, recovering, and collecting the pest from the plants, plant products or other articles, including isolation and culture of the pest and duration of the process;
- Methods to prepare, mount and examine the pest (such as for light microscopy, electron microscopy);
- Identification keys (to family, genus, species and others), with references;
- Descriptions of the morphology of the pest, or of its colonies, including gender of the pest, illustrations of diagnostic characteristics, morphometric data and an indication of any difficulties in seeing particular structures;
- Comparison with similar or related species; and
- Relevant reference specimens or cultures, if available.

Methodologies based on biochemical and molecular properties.

- For biochemical or molecular identifications, each method (e.g. serology, ELISA, electrophoresis, PCR, real-time PCR and RFLP) should be described separately in sufficient detail (including equipment, reagents and consumables) to be able to perform the diagnostic procedures without further reference to the literature. Where appropriate, reference may be made to methodology described in other diagnostic protocols annexed to this standard. Standard methods for DNA cloning and sequencing do not need to be described.

- Where DNA extraction methods used are not standard methods, reasons must be given for their use over a standard kit extraction method. Details of kit methods should not be included unless they are modified. Any modification must be justified.
- Where gene sequences used to develop the tests are not referenced, information on their stability, the alignment from which they are developed and the population sample used to develop them should be included.
- Where a protocol is based on species-specific or group-specific PCR amplification, sequencing of the amplicon is mandatory for confirmation of a suspected EPP. At least one reference sequence must be nominated and made available in a publically available DNA database (e.g. GenBank, EMBL, DDBJ) and the expected level (%) of intra-specific sequence variation must be provided. Where used, data from International sequence databases must be derived from appropriately validated specimens and accession numbers or the appropriate reference must be included.
- Where culturing or isolation are necessary components of these methods, details should be provided including the duration of the process if not previously included.

3.1.5.4 Contact points for further information

In this section, authors should provide contact details of institutes and individuals (Australian and/or international) with particular expertise on the pest(s), who may be consulted regarding any questions or for confirmatory diagnosis. Contact details should include address, email and phone.

The author should seek permission from the experts to include their details.

3.1.5.5 Acknowledgements

In this section, the name and address of the experts who wrote the first draft are included, together with those of any others who made major contributions.

3.1.5.6 References

In this section, references cited in the protocol must be included. Other references to scientific publications, published laboratory manuals and web sites can be included in a separate section if they directly relate to detection or identification.

Use referencing style from *Australasian Plant Pathology* or *Journal of Australian Entomology Society*.

3.1.5.7 Appendices

Appendices may be used to provide relevant information such as life cycle, full details of transmission and dissemination.

High throughput diagnostic techniques, which can be used in a surveillance situation but are not used in the definitive diagnosis, can be included as an appendix.

4. PROFORMA FOR NATIONAL DIAGNOSTIC PROTOCOL.

This proforma can also be obtained as a separate file from the SPHD EO.

Instructions to Authors

- This template serves as a guideline to authors in the production of a diagnostic protocol.
- Information in text boxes are guides and should not be included in the protocol draft.
- This template complies with the format as outlined in SPHD Reference Standard No.2 – *Development of National Diagnostic Protocols –Procedures for authors*. Authors should familiarise themselves with the requirements of Reference Standard No. 2 prior to completion of the report.
- Various components (headings) of the template may relate only to specific groups of plant pests or diseases. Authors may select or add headings/sub-headings relevant to their pest organism.
- Authors must ensure that all text and images are appropriately cited and correctly acknowledged. Authors must not violate intellectual property or copyright conventions. The country or region where images were taken must also be provided.
- Table of Contents must reflect the contents of your report.
- One hard copy and an electronic copy of the scholarship report must be sent to the SPHD Executive Officer:

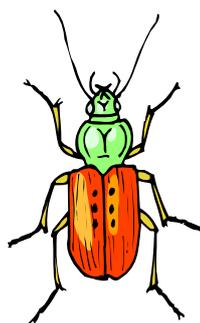
SPHD Executive Officer
Department of Agriculture
GPO Box 858
Canberra, ACT 2601
Email: sphds@agriculture.gov.au

A protocol should only contain information directly relevant to the accurate taxonomic identification of the organism(s).

Draft Diagnostic Protocol for [Common name of pest (Taxonomic name of pest)]

Or:

[Taxonomic name of pest], the cause of [common name of pest]



[INSERT Image of plant pest/disease in colour]

Prepared by:

[Insert Date]

[Address of agency]:

Mailing address:

Website:

Ph #:

Fax. #:

*[Department of Agriculture
logo]*

[Agency logo if applicable]

[The “Contents” table below is developed from the headings selected in the document. If you do not know how to use this function in word consult the help function in Word.

Contents can be updated by clicking on the contents heading, then the “update table” tab that will appear above it. Choose “Update entire table”.]

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1. INTRODUCTION

The introduction should be no greater than 400 words (approximately 1 page).

Authors should provide brief information on the pest that is directly relevant for diagnosis and should be referenced. This information may include: host range, effect on hosts and brief description of mode of transmission and dissemination (e.g. vectors).

Host range should be entered in list format and if numerous can be included in the appendix.

No geographical information, control or risk assessment (entry, spread, establishment potential or consequences of entry) should be included.

Other relevant information can be included in the appendix, e.g. life cycle, full details of transmission and dissemination.

Authors should include information on whether other protocols are available, reference them, and comment on why they are not suitable, or how they are related to this protocol.

2. TAXONOMIC INFORMATION

The correct scientific name and authority should be given and an overview of the relevant taxonomic hierarchy (Kingdom, Phylum, Class, Order, Family, Genus, Species, relevant subspecific taxon). Include synonyms and relevant former names (these may be taxonomically incorrect, but relevant in relation to the literature) as appropriate. Internationally recognised acronyms should be included.

For protocols that detect and identify groups of organisms (e.g. several species within a genus, several genera within a family etc), the scope of the protocol should be clearly defined. Where possible, the taxonomic rules used to define this group should be included as well as evidence via referred papers that demonstrate the diagnostic capacity of the protocol. If appropriate a list of organisms that have been detected and identified using the diagnostic protocol can be included in an appendix.

Any taxonomic disagreements should be stated along with appropriate references.

A taxonomic description can be included if necessary and only if this information is not covered in detection.

3. DETECTION

Detection is the information needed to detect the pest in or on the host material so it can then be identified. It is NOT the procedures used for identification.

However for some pests, particularly insects, there may be significant cross-over of information. If the information for detection is also the method used for identification, place the method in the identification section.

Authors should provide information and guidance on:

- The part(s) of the plant, plant products or other articles on/in which it may be found;
- The likely occurrence of the pest associated with developmental stages of the host(s), climatic conditions and seasonality;
- The signs or symptoms associated with the pest including illustrations/images;
- Differences or similarities with signs and/or symptoms from other pests/causes including illustrations/images;
- The developmental stages of the pest that may be encountered, together with their likely distribution on/in the plants/plant products or other articles;
- Sampling procedures critical for the detection methods and the diagnostic procedures. Any aspects of the sample that may impact on the diagnostic procedure must be included, e.g. age of the sample, chemical sprays applied to the crop prior to sampling, sample storage (sampling procedures for surveillance should not be included); and
- Detection procedures for extracting, recovering, and collecting the pest from the plants. These methods should be described in sufficient detail that the user of the protocol will be able to apply the method without further reference to the literature.

Sub headings should be included as appropriate, but it is not necessary to include all dot points as subheadings.

[These subheadings are examples – delete or include others as needed using Heading 2.]

3.1 Symptoms

All illustrations/images should be of sufficient quality and size when printed to show required features and the country or region where images were taken must also be provided. All text and images must be appropriately cited and correctly acknowledged. Authors must not violate intellectual property or copyright conventions.

3.2 Sampling

Sampling procedures critical for the detection methods and the diagnostic procedures.

Any aspects of the sample that may impact on the diagnostic procedure must be included, eg. age of the sample, chemical sprays applied to the crop prior to sampling, sample storage.

Sampling procedures for surveillance should not be included (this may be added as an appendix or be referred to as part of the national response plan if such a plan exists).

3.3 Methods

Methods for extracting, recovering, and collecting the pest from the plants, plant products or other articles.

4. IDENTIFICATION

Information and guidance on diagnostic procedures that either singly or in combination lead to the taxonomically accurate identification of the pest.

The minimum requirements for identification must be clearly stated. Diagnostic procedures for quick, presumptive indications of identity (which will need to be confirmed) may also be included. Each diagnostic procedure should be described separately.

High throughput diagnostic techniques which can be used in a surveillance situation but are not used in the definitive diagnosis, should not be included here but can be included as an appendix.

For all the diagnostic procedures, information should be provided on their accuracy, specificity and reproducibility, and specifications from multi-laboratory validation trials (if available).

For protocols that detect and identify more than one organism information should be provided that clearly defines the scope of the protocol. If the list of organisms is extensive, this data can be presented as a table in an appendix.

Guidance should be provided on positive and negative controls and reference material to be included in each of the procedures. Sources and specifications (technical, commercial, collection entry codes) of controls and reference material should be indicated. Where the inclusion of additional specific controls, including reference material, is essential, this must be indicated in the protocol.

Guidance should be provided on the criteria for the determination of a positive or negative result for each method, and methods to resolve ambiguous results. Guidance should also be provided on resolving possible confusion with similar and related species or taxa.

Where appropriate, diagnostic procedures for detection of pests from asymptomatic plants or plant products should also be given.

Two main types of methodologies are included in diagnostic protocols, those which are based on morphological and morphometric characteristics and those based on biochemical or molecular properties.

[These subheadings are examples – delete, amend or include others as needed using the appropriate heading level. Only heading levels 1, 2 and 3 are included in the contents]

4.1 Morphological or morphometric characteristics

Details should be provided, as appropriate, on:

- Methods for extracting, recovering, and collecting the pest from the plants, plant products or other articles, including isolation and culture of the pest and duration of the process;
- Methods to prepare, mount and examine the pest (such as for light microscopy, electron microscopy);
- Identification keys (to family, genus, species and others), with references;
- Descriptions of the morphology of the pest, or of its colonies, including gender of the pest, illustrations of diagnostic characteristics, morphometric data and an indication of any difficulties in seeing particular structures;
- Comparison with similar or related species; and
- Relevant reference specimens or cultures, if available.

4.1.1 Sub heading level 3 example

4.1.1.1 Sub heading level 4 example

Sub heading level 5 example

4.2 Biochemical and molecular properties.

- For biochemical or molecular identifications, each method should be described separately in sufficient detail (including equipment, reagents and consumables) to be able to perform the diagnostic procedures without further reference to the literature. Where appropriate, reference may be made to methodology described in other diagnostic protocols annexed to this standard. Standard methods for DNA cloning and sequencing do not need to be described.
- Where DNA extraction methods used are not standard methods, reasons must be given for their use over a standard kit extraction method. Details of kit methods should not be included unless they are modified. Any modification must be justified.
- Where gene sequences used to develop the tests are not referenced, information on their stability, the alignment from which they are developed and the population sample used to develop them should be included.
- Where a protocol is based on species-specific or group-specific PCR amplification, sequencing of the amplicon is mandatory for confirmation of a suspected EPP. At least one reference sequence must be nominated and made available in a publically available DNA database (e.g. GenBank, EMBL, DDBJ) and the expected level (%) of intra-specific sequence variation must be provided. Where used, data from International sequence databases must be derived from appropriately validated specimens and accession numbers or the appropriate reference must be included.
- Where culturing or isolation are necessary components of these methods, details should be provided including the duration of the process if not previously included.

5. CONTACT POINTS FOR FURTHER INFORMATION

Authors should provide contact details of institutes and individuals (Australian and/or international) with particular expertise on the pest(s), who may be consulted regarding any questions or for confirmatory diagnosis. Contact details should include address, email and phone.

The author should see permission from the experts to include their details

6. ACKNOWLEDGEMENTS

The name and address of the experts who wrote the first draft should be included, together with those of any others who made major contributions.

7. REFERENCES

References cited in the protocol must be included. Other references to scientific publications, published laboratory manuals and web sites can be included in a separate section if they directly relate to detection or identification.

Use referencing style from *Australasian Plant Pathology* or *Journal of Australian Entomology Society*.

8. APPENDICES

Appendices may be used to provide relevant information such as life cycle, full details of transmission and dissemination.

High throughput diagnostic techniques, which can be used in a surveillance situation but are not used in the definitive diagnosis, can be included as an appendix.

STYLE CHECKLIST FOR AUTHORS

When writing the scholarship, the author should ensure the following style points are checked.

Overall	Font size Arial 11	
	Formatting with headings numbered	
	Contents page generated from “Table of Contents”	
	Pages numbered	
	Appropriate image on title page	
Images	Numbered, captioned, geography and copyright included. Eg “ Figure 1 Ringspot symptoms on tree in Hungary (Photo J. Bloggs)”	
Introduction	Length <400 words	
	No risk or geographic information	
	Host range included as list	
Taxonomy	Hierarchy included	
References	Use style from <i>Australasian Plant Pathology</i> or <i>Journal of Australian Entomology Society</i> .	