Modification history

Release	Comments
Release 2	This version released with AHC Agriculture, Horticulture, Conservation and Land Management Training Package Version 4.0.
Release 1	This version released with AHC Agriculture, Horticulture, Conservation and Land Management Training Package Version 1.0.

AHCARB8XX	Conduct an entomology research project
Application	This unit of competency describes the skills and knowledge required to conduct an entomology research project requiring the collection and documentation of insects affecting trees. The interrelationships of insects on their environment, forests and trees and the impact they have on economics, health of trees and the control strategies employed to contain infestations are important research themes to be investigated. The unit applies to individuals with advanced theoretical and technical knowledge and skills for professional or highly skilled work and/or further learning in one or more disciplines or areas of practice. This unit applies to individuals with advanced cognitive, technical and communication skills to provide specialist advice, analysis and generate and transmit solutions to complex problems. They demonstrate autonomy, well-developed judgement, adaptability and responsibility as a practitioner or learner. No occupational licensing, legislative or certification requirements are known to apply to this unit at the time of publication.
Prerequisite Unit	Nil
Unit Sector	Arboriculture (ARB)

Elements	Performance Criteria
Elements describe the essential outcomes.	*Performance criteria describe the performance needed to demonstrate achievement of the element.*
1. Research Insects	1.1 Investigate anatomical, morphological and taxonomic features of insects required for identification 1.2 Examine the interaction of insects with trees 1.3 Research annualised population and generational behaviour of insects
2. Construct professional resource collections	2.1 Develop and document an reference collection of insects 2.2 Create a database of tree pests and vectors 2.3 Compile and document host, climatic and geographic distribution data of insects affecting trees 2.4 Record and compile generational phenology of insects
3. Research and assess tree-pest and vector interactions	3.1 Investigate and identify natural antagonists, predators and parasitoids of insects affecting trees 3.2 Investigate phytophagous and damaging insect-tree dynamics 3.3 Investigate the tree dynamics of symbiotic/beneficial and insects 3.4 Investigate physiological responses of tree resistance to insects 3.5 Investigate host-pathogen and pathogen-vector interactions 3.6 Evaluate conditions for selection of host trees by subcortical feeding insects and factors associated with attack 3.7 Investigate and assess insect transmission of disease 3.8 Evaluate multi-trophic interactions between host plant, pest and pathogen/parasitoids

Elements	Performance Criteria
Elements describe the essential outcomes.	*Performance criteria describe the performance needed to demonstrate achievement of the element.*
4. Evaluate control systems	4.1 Determine economic costs of insect damage to trees 4.2 Evaluate insects as indicators of environmental health and condition 4.3 Determine insect biological hazards 4.4 Investigate impact and effects of control strategies on target and non-target organisms 4.5 Investigate insect resistance to pesticides 4.6 Investigate and evaluate biological agents for tree pest control 4.7 Investigate and evaluate tree health management options to manage insect infestation
5. Present results of research	5.1 Collect, tabulate, and analyse data from investigations 5.2 Determine relevance of results to arboriculture 5.3 Compile and communicate research and results into a research paper 5.4 Submit research paper to a professional technical peer-reviewed journal 5.5 Review feedback and amend according to reviewer comments 5.6 Prepare article or presentation to communicate key facts and conclusions to industry

Foundation Skills (NB - will be completed on confirmation of PC's)

This section describes those language, literacy, numeracy and employment skills that are essential for performance in this unit of competency but are not explicit in the performance criteria.

Skill	Description
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Unit Mapping Information

Code and title current version	Code and title previous version	Comments	Equivalence status
AHCARB8XX Conduct an entomology research project	AHCARB704 Conduct an entomology research project	Changes to Elements and Performance Criteria for clarity. Deleted PC 4.7 Updated Performance Evidence and Knowledge Evidence	Equivalent unit

Links	Companion Volumes, including Implementation Guides, are available at VETNet: https://vetnet.education.gov.au/Pages/TrainingDocs.aspx?q=c6399549-9c62-4a5e-bf1a-524b2322cf72

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Performance Evidence

An individual demonstrating competency must satisfy all of the elements and performance criteria in this unit.

There must be evidence that the individual has conducted an entomological research project that must be focused in any two (2) of the following research themes:

- conception, design, and implementation of safe and efficacious control strategy
- research and development of alternative pest management strategies
- investigative study on the longevity, infectivity, and virulence of tree pests
- monitoring and assessment of infestation levels of a pest outbreak
- design and implementation of biocontrol strategies using predators, parasitoids, and entomopathogenic fungi
- design and implementation of methods for monitoring and assessing population dynamics and distribution of tree pest species
- implementation of a comparative ecological field study investigating efficacy and compatibility of pest insect of control strategies
- research and test a management plan for a phytophagous insect
- research and test a breeding program for a beneficial insect
- research three model systems to examine tritrophic effects of tree susceptibility
- design, implement, investigate, evaluate and report on tritrophic interactions
- Investigate preference and survivability of insects in a tree environment
- design projects investigating the subsequent risk analysis and tests required
- development of a tree pest survey strategy
- research and report on geographical or climatic distribution of insect pests
- coordination with an international and domestic multidisciplinary collaborative research initiative

There must also be evidence that the individual has:

- investigated anatomical, morphological and taxonomical features of insects
- examined the interaction of insects with trees
- researched annualised population and generational behaviour of insects
- developed and documented a reference collection of a minimum of one hundred (100) specimens of arboricultural related insects and vectors from at least four (4) orders of insects annotated with the following:
  - date of collection
  - location where insect was collected
  - host tree/plant on which it was collected/feeds
  - name of insect to at least the level of genera
- designed and developed a database to store information of tree pests and vectors
- compiled host climatic and geographic distribution data
- investigated and identified natural antagonists, predators and parasitoids of insects
- investigated phytophagous and damaging insect-tree dynamics
- investigated symbiotic/beneficial and insect-tree dynamics
- investigated physiological responses of tree resistance to insects
- investigated host-pathogen and pathogen-vector interactions
- evaluated conditions affecting selection of host trees by subcortical feeding insects and factors associated with attack
- investigated and assessed insect transmission of disease
- evaluated multi-trophic interactions between host plant-pest-pathogen/parasitoids
- determined economic costs of insect damage to trees
- evaluated insects as environmental indicators of health and condition
- determined insect biological hazards
- investigated impact and effects of control strategies on target and non-target organisms
- investigated insect resistance to pesticides
- investigated and evaluate biological control agents of tree pest control
- researched and evaluated plant health management options to manage insect damage

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Performance Evidence

- collected, tabulated, and analysed data for publications
- determined relevance of results to arboriculture
- compiled and communicated research and results in a research paper
- submitted research paper to a professional technical peer-reviewed journal
- reviewed feedback and amended paper
- communicated key facts and conclusions to industry in an article or presentation.

Knowledge Evidence

An individual must be able to demonstrate the knowledge required to perform the tasks outlined in the elements and performance criteria of this unit. This includes knowledge of:

- research skills and designing research projects including:
  - investigative skills and monitoring techniques
  - defining the scope and purpose of research activity
  - data collection, management and storage
  - data processing, analysis and modelling
  - statistics and data interpretation
  - design and development of formal research papers and the process of peer reviewed publication
  - design and development of industry papers and presentations for communication of research and findings
- entomology and the impact of insects on our environment including:
  - anatomical, morphological and taxonomical features of different classes of insects
  - insect behaviour, ecology and nutrition and their interaction with trees
  - population and generational behaviour and phenology of insects and impact on plants and trees over time
  - host, climatic and geographic distribution of insects
  - insects as indicators of environmental health
- collecting storing and documenting insect reference collections including:
  - catching and preserving techniques
  - taxonomic and naming conventions for insects
  - tagging and labelling specimens
- design and construction of databases and data entry procedures
- insects and their economic impact on society and health of trees including:
  - natural antagonists, predators and parasitoids of insects
  - phytophagous and damaging insects on tree dynamics
  - symbiotic and beneficial insects and impact on tree dynamics
  - natural responses of trees to insect invasion
  - host-pathogen and pathogen-vector interactions
  - subcortical feeding insects and conditions for selecting host trees
  - factors associated with successful attack
  - insect as a vector for transmission of disease
  - insects as biological hazards
- a systems approach to multi-trophic interactions between host plant-pest-pathogen/parasitoids
- pest insect control strategies their advantages and disadvantages including:
  - mechanical control
  - chemical control and pesticide resistance
  - biological control agents
  - managing the environment and tree health to offset infestations
  - integrated pest management (IPM)
- direct and indirect impact of chemical pesticides and biocontrol agents on target and off-target organisms.

Assessment Conditions

Assessment of skills must take place under the following conditions:

- physical conditions:
  - access to a trees and forests with insect populations or environment that accurately represents workplace conditions
- resources, equipment and materials:
  - computer with word processing, database and statistical analysis software
  - internet connection
  - digital imaging device
  - diagnostic tools including sounding hammer, trowel, probe, cordless drill
  - soil testing equipment
  - digital dissection microscope 10 -100x
  - compound microscope
  - microtome, staining and slide mounting equipment
  - histochemical stains
- specifications:
  - access to standard procedures and quality standards performing tests and analysis
  - conducting assessments
  - access to reference materials and keys for insect identification.

Assessors must satisfy current standards for RTOs in the assessment of arboriculture units of competency.

Assessment must be conducted only by persons who have:

- arboriculture vocational competencies at least to the level being assessed
- current arboriculture industry skills directly relevant to the unit of competency being assessed.

Links	Companion Volumes, including Implementation Guides, are available at VETNet: https://vetnet.education.gov.au/Pages/TrainingDocs.aspx?q=c6399549-9c62-4a5e-bf1a-524b2322cf72