

I SPY

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SECTION 8

Glossary

Abdomen: the third and rear (posterior) major division of an insect's body.

Adfrontal area/suture: refers to an area on the head of lepidopteran larvae. The adfrontal suture is formed by the fusion of adfrontal sclerites.

Aestivation: summer dormancy. An invertebrate (i.e. snails) may be metabolically or physically inactive during summer or periods of high temperatures.

Alate: winged form of some insects, such as aphids or ants, that have both winged and wingless forms.

Antennae: a pair of appendages used for sensing, attached to the head.

Anterior: front; in front of.

Aperture: opening. In the context of this manual, this refers to the opening in a snail's shell where its body comes out.

Apical meristem: growing tip of a plant (root and shoot).

Apodous: legless.

Arthropods: members of the Phylum Arthropoda. This includes insects and their allied forms, such as spiders and mites.

Asexual: means 'without sex' and in the context of this manual refers to invertebrates that reproduce without exchanging genetic material between two parents.

Beneficial insect: an insect that helps to suppress pest populations.

Bifurcate: a structure that is divided or forked into two arms.

Biocontrol agents, biological agents: natural enemies (predators, parasites and pathogens) that feed on or attack pests.

Biological control: is the reduction of pest populations by natural enemies (predators, parasites and pathogens). This may involve intervention by people for conservation or release of natural enemies that feed on or attack pests.

Bt: *Bacillus thuringiensis*, a bacterium that is used as an insecticide against many insects, particularly lepidopteran larvae.

Campodeiform: a term used to describe the shape of a larva. Campodeiform larvae are generally elongated with a tapering body and well-developed legs (e.g. ladybird larvae).

Cauda: a tail-like process at the tip of the abdomen. Shape, size and hair patterns are characteristic for certain species.

Cephalothorax: fused head and thorax (Arachnida).

Cerci: a pair of appendages at the end of the abdomen.

Cervical shield: refers to a hardened body part (sclerite) just behind the head (prothorax) of lepidopteran larvae.

Chelicerae: the pointed mouth parts of mites and other arachnids. Anterior pair of appendages in arachnids.

Chlorotic marking: pattern of damage usually caused by insects with piercing and sucking mouthparts (as well as some plant diseases) where parts of the plant leaves/stems lack green colour (chlorophyll) and have a 'bleached' appearance.

Clypeus: anterior sclerite on an insect's head below the face and above the labrum.

Complete metamorphosis: a development process in which the immature insect bears no visual resemblance to, and acts differently from, the adult form. Insects develop in four stages within this lifecycle: egg; larvae; pupae; adult.

Cornicles: see siphuncle.

Cotyledon: a seed leaf; leaf of the embryo of a seed plant.

Crochets: hooks situated at the base of prolegs. In this manual it refers to the 'soles of the feet' of caterpillar rear legs (abdominal legs).

Cultural control: Non-insecticidal tactics to prevent or reduce pest populations. These can include crop rotation, trap cropping, crop hygiene, removal and destruction of weeds and diseased plants, planting/harvest dates, site selection, cultivar and variety selection, nutrient management and the incorporation of nectar producing plants to encourage natural enemies.

Diapause: a 'resting stage'. A state of reduced metabolic and physical activity which is not directly caused by unfavourable environmental conditions (cf. aestivation). For example, redlegged earth mites eggs diapause over summer in southern parts of Australia.

Dorsal: top or uppermost.

Dorsoventral: in a line from the upper to the lower surface.

Elytra: hardened forewing covers present on insects in some orders, but seen mostly in beetles (Coleoptera).

Endophyte: Fungi that live within healthy plant tissue, forming a symbiotic relationship where the endophyte obtains nutrition and from the plant and the plant obtains a number of benefits from chemicals produced by the endophyte, such as increased resistance to pests or drought.

Entomopathogenic: a term used to describe microorganisms and viruses capable of causing disease in an insect host

Eruciform: a term used to describe the shape of a larva. Eruciform larvae have a cylindrical, elongated body and short legs.

Exoskeleton: hard, outer plate coverings on the body. This is characteristic of arthropods.

Exotic pest: a pest that is present in another country but not in Australia or a pest that is native to another country and has been introduced to Australia.

Filamentous: slender or thread-like. Generally refers to the form of antennae.

Filiform: slender or thread-like. Generally refers to the form of antennae.

Frass: insect excreta, faeces.

Furcula: forked tail-like organ used for jumping or springing in springtails (Collembola), usually folded underneath the abdomen. Lucerne fleas have a furcula.

Generalist predators: are mainly free-living predators that consume a large number and range of prey during their life.

Green bridge: describes the role of weeds and volunteer crop plants in helping some pests to survive from one cropping season to the next.

Halteres: rudimentary hindwings (Diptera) used for balance.

Haustellum: part of the proboscis (mouthpart) that is adapted as a sucking organ.

Hemelytra: half leathery/half membranous forewing of hemipterans.

Honeydew: a sticky substance that is secreted by some aphids and scale insects. It is sugar-rich and can be used as a form of reward for predatory arthropods that then protect the herbivores.

Hypocotyl: the stem part of a germinating seedling which bears the cotyledons.

Incomplete metamorphosis: development process in which an immature insect hatches from an egg (or is born live in some insects) and gradually turns into an adult through a series of moults.

Insecticide resistance: Resistance occurs when application of insecticides removes susceptible insects from a population leaving only individuals that are resistant. Mating between these resistant individuals gradually increases the proportion of resistance in the pest population as a whole. Eventually this can render an insecticide ineffective, leading to control failures in the field.

Instar: a stage of growth in an insect's lifecycle between each moult (between the egg and adult stages).

Insurance sprays: applying insecticides when pest levels are below the economic injury level for the crop. This practice is ecologically unsustainable and will increase the risk of insecticide resistance developing and reduce populations of beneficial parasitoids and predators.



Invertebrates: animals without backbones.

IPM: integrated pest management. A control strategy where a range of biological, chemical and cultural control practices are combined to manage and prevent pests from reaching damaging levels in agriculture.

Keel: ridge or raised section, as in the 'keel of a boat'. In the context of this manual, this refers to the ridge present on the upper body of some slug species.

Labium: lower lip.

Labrum: upper lip.

Larva (plural larvae): the juvenile form of invertebrates that undergo complete metamorphosis.

Mandibles and maxilla: hardened jaw structures for chewing plant material or crushing prey.

Mandibulate: mouthparts, chewing mouthparts.

Mantle: a structure on snails/slugs which covers part of the body.

Maxillary and labial palp: segmented sensory extensions.

Mesoseries: the arrangement of crochets of a larval proleg in a band (single, inner or longitudinal).

Mesothorax: middle (2nd) of the three thoracic segments.

Metamorphosis: physical change in the form of an animal during its development.

Metathorax: posterior (3rd) of the three thoracic segments.

Monoculture: the cultivation of a single type of crop over a wide area.

Moult: when an invertebrate sheds its outer layer (exoskeleton) revealing new growth, and passes from one nymphal stage (instar) to another (incomplete and complete metamorphosis).

Mummies: common term for the swollen bodies of parasitised aphids.

Natural enemies: an insect that helps to suppress pest populations (cf. beneficial insect).

Nectar: a sugar-rich liquid produced either by the flowers of plants or by extra-floral nectaries. It is useful for attracting pollinating animals.

Nymph: an immature stage (following hatching) of an insect that undergoes incomplete metamorphosis.

Ocelli: the 'simple' eyes of an insect or other arthropod.

Omnivore: used to describe an organism that feeds on both plant and animal substances.

Ovipositor: egg-laying organ, usually protruding from the tip of the abdomen.

Palps: specialised appendages near the mouth that are used for sensing in a similar way to antennae.

Panicle: a loose, irregularly branched, flower cluster.

Parasite: an organism that lives in or on the body of another organism during some portion of its lifecycle.

Parasitoid: an arthropod that parasitises and kills its host. A parasitoid is parasitic in its immature stages and free-living as an adult.

PestFax/PestFacts: free services designed to keep growers and advisors informed about pest related issues and solutions in southern grains regions of Australia. Electronic newsletters are distributed and aim to help growers by providing timely information about pest outbreaks, effective control and current information about relevant and new research findings.

Pheromones: highly specific odours that function as chemical signals, often as a sex attractant between individuals of the same species. These are often used in traps to attract specific insects.

Phytophagous: plant feeding.

Pleuron: the lateral region of any segment (generally thoracic or abdominal) of an arthropod's body.

Polyphagous: feeds on multiple food types.

Proboscis: extended beak-like mouthpart.

Process: a natural projection from a part of an organism. In the context of this manual it refers to insects with projections, such as cauda on aphids.

Proleg: a non-segmented appendage used for grasping. Abdominal prolegs can be found on moth and butterfly larvae as well as some sawfly larvae. Anal prolegs can also be present on the abdomen.

Pronotum points: the dorsal hardened body section (sclerite) of the prothorax pleuron in true wireworms.

Prophylactic: preventative or protective.

Prothorax: anterior (1st) of the three thoracic segments.

Protoconch: the embryonic (or earliest) part of a snail shell.

Pupa (plural pupae): transition stage in the lifecycle where larval characters are lost and adult features develop (complete metamorphosis).

Radula: rasping mouthpart of molluscs.

Raster: a group of bare areas, hairs (setae) and spines on the ventral surface of the last abdominal segment of scarabaeoid larvae.

Refuge area: a place providing protection or shelter. In the context of this manual, this refers to an area providing protection from insecticide sprays and/or providing suitable habitat for beneficial species.

Residential: permanently living within the system.

Rostrum: the protruding, piercing and sucking mouthparts of all bugs; particularly used to describe a weevil's snout.

Scarabaeiform: refers to the shape of a larva. Scarabaeiform larvae have a 'C'-shaped body, with relatively short legs and a swollen lower abdomen.

Sclerite: a hardened plate on the body wall bounded by structures or membranous areas.

Sclerotised: hardened.

Scutellum: a small shield-like sclerite.

Selective pesticide: a pesticide that kills only target pests and has minimal impact on non-target organisms, particularly beneficial invertebrates. Sometimes referred to as a 'soft' pesticide.

Setae: bristles or hairs.

Siphuncles: paired tubular wax-secreting structures (projections) on the rear of an aphid's abdomen.

Spinnerets: an apparatus from which silk is spun.

Spiracles: small openings in the body that allow oxygen exchange (breathing holes).

Sporulation: the production of spores (fungi).

Striations: a longitudinal ridge or furrow.

Stylet: one of the mouthparts modified for piercing; generally a long, thin, rigid appendage.

Suture: a seam or line of contact between two sclerites that makes the sclerites connected and immovable.

Tarsus (pl. tarsi): insect foot.

Taxonomy: is the branch of science that sorts all living things into groups based on their similarity or relatedness.

Tegmina: hardened, leathery forewings of some insects.

Tentacle: a flexible organ of touch (e.g. 'feeler' of snails/slugs).

Thorax: the middle section of an adult insect's three main body divisions. Legs and wings are attached to the thorax.

Transient: mobile species that do not permanently reside in a system and generally have shorter generation times compared with residential species.

Trochanter: the second segment of an insect leg.

Tubercle: small bumps/humps on the forehead of invertebrates.

Umbilicus: is the hollow space on the underside of a snail's shell, around which the shell coils. Not all snails have an umbilicus.

Vector: an organism, in this context an invertebrate, that transmits disease to another organism (e.g. aphids can be a vector of barley yellow dwarf virus in cereals).

Ventral: front, underneath.

Wing venation: the pattern of veins on an insect's wing.



References

The information in this document was derived in part, from the following sources:

Bailey, P.T. (Ed) (2007). *Pests of field crops and pastures: identification and control*. CSIRO Publishing, Melbourne.

Blackman, R.L. and Eastop, V.F. (2000) *Aphids on the worlds crops, an identification and information guide*, second edition. Wiley, New York.

Brier, H., Charleston, K., McLennan, A., Hughes, J. and Dougall, A. (2009). *Pulse break crop IPM reference manual*. Queensland AgriSciences, Department of Employment Economic Development and Innovation, Mackay.

Child, J. (1965). *Australian spiders*. Periwinkle Press, Gladesville.

CSIRO, Department of Entomology (1991). *The insects of Australia: a text book for students and research workers, second edition*. Melbourne University Press, Melbourne.

Emery, R., Mangano, P. and Michael, P. (Eds) (2005). *Crop insects: the ute guide, western grain belt edition*, Department of Agriculture Western Australia and Grains Research and Development Corporation, Canberra.

Glatz, R. (2009). *SARDI Entomology: Guide to the insects on the northern Adelaide Plains*. South Australian Research and Development Institute (SARDI), Adelaide.

Goodyer, G. (1978). *The identification of armyworm, cutworm, budworm and looper caterpillar pests*. AGbulletin2. Department of Agriculture, New South Wales, Sydney.

Goodyer, G. *Identifying major noctuid caterpillar pests*. NSW Agriculture Rhône-Poulenc Rural Australia Pty Ltd, New South Wales, Baulkham Hills.

Gordh, G. and Headrick, D.H. (2001). *A dictionary of entomology*. CABI Publishing, Cambridge.

Gullan P.J. and Cranston P.S. (2000). *The insects: an outline of entomology*, second edition. Blackwell Science, Melbourne.

Henry, K., Bellati, J., Umina, P. and Wurst, M. (Eds) (2008). *Crop insects: the ute guide, southern grain belt edition*. Government of South Australia PIRSA and Grains Research and Development Corporation, Canberra.

Horne, P. and Page, J. (2008). *Integrated pest management for crops and pastures*. Landlinks Press, Collingwood.

Kono, T. and Papp C.S. (1977). *Handbook of agricultural pests*. State of California Food and Agriculture, Division of Plant Industry, California.

Leonard, E., Baker, G.H. and Hopkins, D. C. (2003). *Bash 'em, burn 'em, bait 'em: integrated snail management in crops and pastures*. South Australian Research and Development Institute, Adelaide.

Mangano P. (2008) *Insect training course manual broadacre crops and pastures*. Department of Agriculture and Food, Perth.

Mascord, R. (1980). *Spiders of Australia: a field guide*. Reed New Holland, Sydney.

Matthews, E.G. (1987). *A guide to the genera of beetles of South Australia, Part 2*. South Australian Museum, Adelaide.

McCaffery, D., Potter, T., Marcroft, S. and Pritchard, F. (Eds) (2009). *Canola best practice management guide for south-eastern Australia*. Grains Research and Development Corporation, Canberra.

Peterson, A. (1960). *Larvae of insects: an introduction to nearctic species*. Ohio State University, Ohio.

Smith, B.J. *Non-marine molluscs: A key to the families of non-marine molluscs of quarantine concern in Australia*. Lucid Key, AQIS.

Smith, B.J and Kershaw, R.C. (1979). *Field guide to the non-marine molluscs of south-eastern Australia*. Australian National University Press, Canberra.

Umina, P.A., Fitt, G.P., Anderson, C.A. and Webb, L.E., (Eds) (2008). *Special issue: invertebrate pests of grain crops and integrated management: current practice and prospects for the future*. Australian Journal of Experimental Agriculture, vol. 48, issue 12, pp. 1481-1607.

Zborowski, P. and Storey, R. (2003). *A field guide to insects in Australia*, second edition. Reed New Holland, Sydney.