Boll. Zool. agr. Bachic.
Ser. II, 33 (3): 175-178

G.W. WATSON

A pictorial key to important Diaspididae (Hemiptera: Coccoidea) of the world

Abstract - A pictorial key to 48 genera and 100 species of Diaspididae (Hemiptera: Coccoidea) of economic or quarantine importance worldwide has been compiled, using Linnaeus II software developed by the Expert Center for Taxonomic Identification (ETI). The CD-ROM will provide information on each species (diagnosis, synonymy, taxonomy, host range, symptoms of infestation, distribution, biology and ecology, economic impact, detection and natural enemies, separation from similar species, and literature, according to the information available). There are also modules on: Methods (collection, preservation, preparation and storage), Host Plants and Higher Taxa. A hyper-linked Glossary and an Index to both Latin and common names is also provided. The CD-ROM is part of the series 'Arthropods of Economic Importance', a project of the Zoological Museum, University of Amsterdam. ETI, the Natural History Museum (London) and CAB International are some of the collaborators in the project. The CD-ROM will be published by ETI (http://www.eti.uva.nl) and should be available from bookstores by the summer of 2002.

Key words: Diaspididae, pests, identification, datasheets, host plants, methods.

INTRODUCTION

The family Diaspididae (Hemiptera: Coccoidea) is the most thoroughly studied family of scale insects because it contains the largest number of pest species. Armoured scale insects can damage their hosts directly, by extracting fluid and nutrients, and indirectly through the toxicity of the saliva they inject into plants while they feed. Heavy infestations can cause severe chlorosis, leaf drop, branch dieback and even death of the host-plant. However, the small size of armoured scale insects makes them hard to detect and difficult to identify.

Available identification keys to species of Diaspididae cover no more than the fauna of a single region. Many are out of print, and some are written in languages not accessible to entomologists worldwide. Similarly, many of the existing taxonomic illustrations are not widely available. The aim of this project is to provide a user-friendly identification aid on CD-ROM, which will make species information and taxonomic illustrations available to entomologists, plant quarantine inspectors and agricultural students worldwide.

The CD-ROM is part of the series 'Arthropods of Economic Importance', a project of the Zoological Museum, University of Amsterdam. The Expert Centre for Taxonomic Identification (Amsterdam) (ETI), the Natural History Museum (London) (NHM) and CAB International (Wallingford) (CABI) are collaborators in the project.

MATERIALS AND METHODS

The CD-ROM is being compiled at The Natural History Museum, London, using Linnaeus II software and training provided by ETI. CABI provided word processing and scanning hardware and software, and access to the CAB Abstracts database through CAB Direct (online) and datasheets on the CABI Crop Protection Compendium (2000). The ScaleNet website (Ben-Dov et al., 2001) was a useful resource, as was the literature on Diaspididae in the NHM library (much of which is out of print) and the scale insect collection at the NHM. The literature and scale insect collection at USDA, Beltsville, Maryland, USA was also consulted during a visit there in March 2000.

Once copyright permissions had been obtained, taxonomic illustrations and photographs from the literature were scanned into a standard electronic format for incorporation into the CD-ROM. Unpublished photographs provided by entomologists from around the world are also being used. There will be about 750 black-and-white line drawings to illustrate taxonomic characters, and (where available) colour photographs to illustrate the appearance of the insects in life and the damage they cause.

RESULTS

The pictorial key is in English and identifies 48 genera and 100 species of Diaspididae of global importance or quarantine potential (Table 1) on CD-ROM. The Picture Key module provides choices between illustrated sets of characters; for each choice, you click on the illustrations that match your specimen. When identification is completed, the final decision takes you directly to the information on the relevant species. Information on each species comprises sections on some or all of: diagnosis, synonymy, taxonomy, host range, distribution, biology and ecology, symptoms of infestation, economic impact, detection and inspection methods, phytosanitary risk and regulations, natural enemies, separation from similar species, literature and photographs and line illustrations (according to availability). About 80 additional (similar) species are covered in less detail within the datasheets.

Entry to the CD-ROM is via the Navigator contents screen, from which information about the collaborating organisations and acknowledgements of the contributors can also be accessed. An Introduction module provides a brief summary of what is available in each module, and warns of limitations. There are modules on: Methods (collection, preservation, preparation and storage); Picture Key; Species; Higher Taxa; a cross-reference system for the major Host Plant genera and the armoured scale insects found

Table 1 - Economically important species of Diaspididae covered by datasheets in the CD-ROM.

Tribe Leucaspidini (3 genera, 4 species)
Leucaspis loewi Colvée
Lopholeucaspis cockerelli (Grandpré & Charmoy)
Lopholeucaspis japonica (Cockerell)
Salicicola archanchelskayae (Archangelskaya)

Tribe Parlatoriini (2 genera, 9 species)
Parlatoria blanchardi (Targioni Tozzetti)
Parlatoria cinerea Hadden
Parlatoria oleae (Colvée)
Parlatoria pergandii Comstock
Parlatoria proteus (Curtis)
Parlatoria pseudaspidiotus Lindinger
Parlatoria theae Cockerell
Parlatoria ziziphi (Lucas)
Radionaspis indica (Marlatt)

Tribe Odonaspidini (2 genera, 4 species)
Froggattiella penicillata (Green)
Odonaspis greenii (Cockerell)
Odonaspis ruthae Kotinsky
Odonaspis saccharicaulis (Zehntner)

Tribe Aspidiotini (19 genera, 40 species)
Acutaspis perseae (Comstock)
Aonidia lauri (Bouché) L (Ferris 1938)
Aonidiella aurantii (Maskell)
Aonidiella citrina (Craw)
Aonidiella orientalis (Newstead)
Aonidiella taxus Leonardi
Aspidiella hartii (Cockerell)
Aspidiella sacchari (Cockerell)
Aspidiotus destructor Signoret
Aspidiotus nerii Bouché
Chrysomphalus aonidum (Linnaeus)
Chrysomphalus bifasciculatus Ferris
Chrysomphalus dictyospermi (Morgan)
Chrysomphalus pinnulifer (Maskell)
Diaspidiotus africanus (Marlatt)
Diaspidiotus juglansregiae (Comstock)
Diaspidiotus ostreaeformis (Curtis)
Diaspidiotus perniciosus (Comstock)
Diaspidiotus pyri (Lichtenstein)
Duplaspidiotus claviger (Cockerell)
Dynaspidiotus britannicus (Newstead)
Dynaspidiotus californicus (Coleman)
Furcaspis biformis (Cockerell)
Hemiberlesia cyanophylli (Signoret)
Hemiberlesia lataniae (Signoret)
Hemiberlesia palmae (Cockerell)
Hemiberlesia pitysophila Takagi
Hemiberlesia rapax (Comstock)
Lindingaspis rossi (Maskell)
Melanaspis glomerata (Green)
Melanaspis obscura (Comstock)
Melanaspis paulista (Hempel)
Morganella longispina (Morgan)
Mycetaspis personata (Comstock)
Pseudaonidia duplex (Cockerell)
Pseudaonidia paeoniae (Cockerell)
Pseudaonidia trilobitiformis (Green)
Pseudischnaspis bowreyi (Cockerell)
Selenaspidus articulatus (Morgan)
Targionia vitis (Signoret)

Tribe Diaspidini (22 genera, 43 species)
Acanthomytilus sacchari (Hall)
Andaspis hawaiiensis (Maskell)
Aonidomytilus albus (Cockerell)
Aulacaspis madiunensis (Zehntner)
Aulacaspis rosae (Bouché)
Aulacaspis tegalensis (Zehntner)
Aulacaspis tubercularis (Newstead)
Aulacaspis vitis (Green)
Aulacaspis yasumatsui Takagi
Carulaspis minima (Targioni Tozzetti)
Chionaspis pinifoliae (Fitch)
Chionaspis salicis (Linnaeus)
Diaspis boisduvalii Signoret
Diaspis bromeliae (Kerner)
Diaspis echinocacti (Bouché)
Epidiaspis leperii (Signoret)
Fiorinia fioriniae (Targioni Tozzetti)
Fiorinia theae Green
Formosaspis formosana (Takahashi)
Furchadaspis zamiae (Morgan)
Howardia biclavis (Comstock)
Ischnaspis longirostris (Signoret)
Kuwanaspis howardi (Cooley)
Kuwanaspis pseudoleucaspis (Kuwana)
Lepidosaphes beckii (Newman)
Lepidosaphes gloverii (Packard)
Lepidosaphes malicola Borchsenius
Lepidosaphes pinnaeformis (Bouché)
Lepidosaphes pistaciae Archangeskaya
Lepidosaphes tapleyi Williams
Lepidosaphes tokionis (Kuwana)
Lepidosaphes ulmi (Linnaeus)
Mercetaspis halli (Green)
Neochionaspis asiatica (Archangelskaya)
Neopinnaspis harperi McKenzie
Pinnaspis buxi (Bouché)
Pinnaspis strachani (Cooley)
Pinnaspis theae (Maskell)
Pseudaulacaspis cockerelli (Cooley)
Pseudaulacaspis pentagona (Targioni Tozzetti)
Pseudoparlatoria parlatoroides (Comstock)
Unaspis citri (Comstock)
Unaspis yanonensis (Kuwana)

feeding on them; Literature; Glossary; and Index. The modules are hyperlinked to the Glossary, in which about 30% of terms are illustrated by line drawings. The Index includes common names of armoured scale species in English and other major languages, and Latin names of valid species and their more important synonyms covered in the CD-ROM.

DISCUSSION

At the time of writing the CD-ROM is incomplete, but already it is useful because it brings together information and illustrations from numerous sources, many of which are not easily available to agricultural entomologists and plant quarantine officers around the world. In covering the family on a global basis, it will provide plant quarantine officers with the means to identify important species of Diaspididae, whether native or alien to the country they are in. The CD-ROM will be published by ETI (http://www.eti.uva.nl) and should be available from bookstores by the summer of 2002.

ACKNOWLEDGEMENTS

The Ðiaspididae CD-ROM project has been funded by the Dutch government through an ICES-KIS grant; CAB International; and The Natural History Museum, London, UK. The work has been greatly assisted by many people. I particularly wish to thank Ms Lynn Meijerman (University of Amsterdam) for her support and advice; and Ms Liesbeth Bakker and Ms Marieke Schouten (ETI) for scanning pictures. Dr Ferenc Kozár (Hungarian Academy of Sciences), Dr Ray Gill (California Department of Food and Agriculture), Dr Dug Miller (USDA, Beltsville, Maryland), Dr Imré Foldi (Muséum National d'Histoire Naturelle, Paris) and numerous other entomologists have kindly helped me to obtain copyright permissions for the re-use of illustrations from the literature. A considerable number of entomologists around the world have generously provided photographs for use in the CD-ROM.

REFERENCES

CABI Crop Protection Compendium (2000) Global module, 2nd edition (on CD-ROM). Wallingford, UK, CAB International.

BEN-DOV, Y., MILLER, D.R., GIBSON, G.A.P. (2001) ScaleNet - a systematic database of the scale insects of the world. Unpaginated. August 2001. http://www.sel.barc.usda.gov/scalenet/scalenet.htm

DR. GILLIAN WATSON - Department of Entomology, The Natural History Museum, Cromwell Road, London, SW7 5BD, UK. E-mail: G.Watson@nhm.ac.uk