

CURRICULUM VITAE

Name Colin Charles Bower
Age 61 years **Date of birth** 29 August 1948
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Current employment Consultant Botanist / Entomologist
FloraSearch, PO Box 300, Orange, NSW 2800

Qualifications B.Sc. (Hons) (Zoology), University of Sydney (1969)
Ph.D. (Zoology), University of Sydney (1975)

Professional history

1975-1992	Employed as a research entomologist by NSW Agriculture at:
1975	Biological and Chemical Research Institute, Rydalmere
1975-1980	Agricultural Research Station, Bathurst
1980-1992	Agricultural Research and Veterinary Centre, Orange
1992- Apr. 2003	Program Leader, Horticulture, NSW Agriculture, Head Office, Orange
Apr. 2003 - present	Full time consultant (economic entomology, flora and fauna surveys, pollination biology, scientific reviews)

Research history:

Undergraduate

1969 Honours thesis on the anatomy and physiology of colour patterns in the mouth breeding cichlid, *Tilapia mossambica*.

Postgraduate

1970-1974 Ph.D. thesis on the behaviour and ecology of the larvae of the Queensland fruitfly, *Dacus tryoni* Froggatt.

Current society memberships:

- Ecological Consultants Association of New South Wales
- Associate of the Australian National Herbarium Canberra
- Australian Entomological Society
- Entomological Society of New South Wales
- Friends of the Royal Botanic Gardens Sydney
- Australasian Native Orchid Society
- Orange Field Naturalist and Conservation Society

Professional Committee:

1998-present Member of Research Committee of the Australian Orchid Foundation.

Licences:

- Scientific Licence No. S11329, NSW National Parks and Wildlife Service

Insurances:

- Public Liability - \$20m
- Professional Indemnity - \$10m

Economic entomology research – Projects led

1975-1978	Ecology and control of apple root weevil, <i>Perperus</i> sp.
1975-1977	Investigation of the insect growth regulator Dimilin for control of codling moth, <i>Cydia pomonella</i> , and its effects on the natural enemies of pest mites
1977-1992	Integrated control of twospotted mite, <i>Tetranychus urticae</i> , and European red mite, <i>Panonychus ulmi</i> , by the introduced predatory mites, <i>Typhlodromus occidentalis</i> and <i>T.pyri</i> . (This work had major benefits for the NSW apple industry and has involved many separate investigations.)
1982-1984	Phenology and control of San Jose Scale, <i>Quadraspidiotus perniciosus</i> .
1985-1992	Damage relationships, biology and economics of apple dimpling bug, <i>Campylomma liebknechti</i> on apples.
1987-1992	Control of European earwig, <i>Forficula auricularia</i> , in stone fruit trees at Young.

Flora surveys and entomological studies – major contract studies as a consultant entomologist / botanist:

1986	Junction Reefs Gold Mine proposal. Flora and fauna survey for Environmental Impact Statement (EIS). R.W. Corkery and Co. Pty. Ltd.
1987	Browns Creek Gold Mine proposal. Flora and fauna survey for EIS. R.W. Corkery and Co. Pty. Ltd.
1990	Prepared Statements of Significance for ten nature conservation areas. Australian Heritage Commission.
1995	Cadia Gold Mine proposal. Flora surveys for EIS with R. W. Medd and Orange Field Naturalist and Conservation Society. AGC Woodward-Clyde Pty. Limited
1996	Remnant vegetation survey and regeneration plan for the Lidster-Cargo-Cudal area west of Orange, NSW with J. Kenna and L. Kingham. Cudal and Lidster Landcare Groups.
1997	Flora survey of the Ophir Reserve, Orange with R.W. Medd and J.I. Kenna for Cabonne Shire Council. R.W. Corkery and Co. Pty. Limited.
1997	Member of expert panel to assess the potential long term environmental impact of a proposed gold mine on the shore of Lake Cowal in Central Western NSW. Resource Strategies Pty. Ltd.
1998	Lake Cowal Gold Mine EIS. Threatened species assessment (Eight Part Tests of Significance). Resource Strategies Pty. Ltd.
1998	Lake Cowal Gold Mine EIS. Targeted searches for the threatened plant species, <i>Lepidium hyssopifolium</i> and <i>Pilularia novae-hollandiae</i> . Resource Strategies Pty. Ltd.
1998	Survey of bushland remnants on the NSW Central Tablelands for populations of a rare undescribed greenhood orchid related to <i>Pterostylis longifolia</i> . Cadia Mines Pty. Limited
1998	Cadia-Ridgeway Gold Mine proposal. Flora survey, vegetation community mapping and targeted searches for threatened species with R.W. Medd and J.I. Kenna. Resource Strategies Pty. Ltd.
2000	Syerston Nickel-Cobalt Mine proposal, Fifield, NSW. Flora survey and targeted searches for threatened species on mine site and service corridors for EIS, with J.I. Kenna. Resource Strategies Pty. Ltd.

2001	Study of the pollination of the endangered Jervis Bay Leek Orchid, <i>Prasophyllum affine</i> , in order to develop a conservation strategy for this species compatible with a major shopping centre and residential development at Vincentia. NSW National Parks and Wildlife Service.
2001/02	Ginkgo Mineral Sand Mine proposal, Pooncarie, NSW. Flora survey of service corridors and targeted searches for threatened species for EIS. Resource Strategies Pty. Ltd.
2002	Cadia Gold Mine, Cadia, NSW. Establishment of permanent flora monitoring sites in the Wire Gully vegetation enhancement area. Resource Strategies Pty. Ltd.
2002	Ridgeway Gold Mine, Cadia, NSW. Flora survey, vegetation community mapping and targeted searches for threatened plant species on the 'Southern Remnant'. Resource Strategies Pty. Ltd.
2002	Wambo Coal Mine Expansion Proposal, Warkworth, NSW. Flora survey, vegetation community mapping, targeted searches for threatened species for EIS, assessment of disturbance. Resource Strategies Pty. Ltd.
2003	Timbarra Gold Mine, Tenterfield, NSW. Assessment of ground cover of individual plant species by vegetation layer and assessment of plant health on long term monitoring plots. Resource Strategies Pty. Ltd.
Spring 2003	Continue study of the pollination of the endangered Jervis Bay Leek Orchid, <i>Prasophyllum affine</i> . Environmental Resources Management Australia.
2003/2004	Country Energy, Temora to Lake Cowal, NSW. Targeted searches for threatened plant species on the Electricity Transmission Line route. Resource Strategies Pty. Ltd.
2003/2004	Hydro Aluminium, Kurri Kurri, NSW. Flora survey, vegetation community mapping, plant species listing, targeted searches for threatened plant species, assessment of disturbance, recommendations for conservation and enhancement of the aluminium smelter's native vegetation buffer zone. Resource Strategies Pty. Ltd.
2004	Cadia Gold Mine, Cadia, NSW. Flora survey of proposed extension area for waste rock dump. Resource Strategies Pty. Ltd.
2004	Proposed Cadia East Gold Mine, Cadia, NSW. Flora survey, vegetation community mapping, plant species listing, targeted searches for threatened plant species. Resource Strategies Pty. Ltd.
2004	Warkworth Coal Mine, Singleton, NSW. Map all occurrences of the Warkworth Sands Endangered Ecological Community on land owned by the Warkworth and Wambo Coal Mines. Resource Strategies Pty. Ltd.
Spring 2004	Continue study of the pollination of the endangered Jervis Bay Leek Orchid. Environmental Resources Management Australia.
2004	Proposed Orange City Council residential subdivision, Ploughmans Creek, Orange, NSW. Flora survey, flora species listing, vegetation mapping, assessment of vegetation condition. Geolyse Pty. Ltd.
2004	Jenolan Caves, NSW. Weed survey of resort environs with recommendations for improved weed management. Jenolan Caves Resort Pty. Ltd.
2004/2005	Review Biosecurity Australia's 2004 draft Import Risk Assessment for the proposed importation of apples from New Zealand. Apple and Pear Australia Limited.
2004/2005	Proposed Wilpinjong Coal Mine, Wollar, NSW. Flora survey, vegetation community mapping, plant species listing, targeted searches for threatened plant species. Resource Strategies Pty. Ltd.

2005	Black Rock Ridge, Cargo, NSW. Flora survey, vegetation community mapping, plant species listing, targeted searches for threatened plant species. Assess value of area as an offset for proposed Cadia East Gold Mine. Resource Strategies Pty. Ltd.
2005	South Mullion Range, Orange, NSW. Flora survey, vegetation community mapping, plant species listing, targeted searches for threatened plant species. Community Biodiversity Survey, National Parks Association of NSW.
2005	Crown Lands, Ulan, NSW. Flora survey, vegetation community mapping, plant species listing, targeted searches for threatened plant species. Community Biodiversity Survey, National Parks Association of NSW.
2005	Hydro Aluminium Smelter, Kurri Kurri. Pre-control burn baseline vegetation survey. Resource Strategies Pty. Ltd.
2005	Duralie Coal Mine expansion, Stroud, NSW. Targeted searches for threatened species and communities; threatened community mapping. Resource Strategies Pty. Ltd.
2005	Orchid pollination workshop, Castlemaine, Vic. Prepare and run two hour workshop on pollination of threatened orchid species. Department of Sustainability and Environment.
2006	Review the entomological aspects of the 2005 draft of Biosecurity Australia's Import Risk Assessment for the Importation of New Zealand apples into Australia. Apple and Pear Australia Limited.
2006	Ulan to Wilpinjong Electricity Transmission Line. Targeted searches for threatened flora species, populations and communities. Wilpinjong Coal Pty. Ltd.
2006	Contribute to the development of the Property Management Plan for the Hydro Aluminium Smelter, Kurri Kurri, particularly the flora monitoring, fire management, weed control and rehabilitation aspects. Resource Strategies Pty. Ltd. and Hydro Aluminium Kurri Kurri Pty. Ltd.
2006	Snapper Mineral Sands Project, Pooncarie, NSW. Baseline flora survey, threatened flora searches, vegetation community mapping. Bemax Resources N/L.
2006	Warkworth Coal Mine. Map former occurrences of the Warkworth Sands Woodland Endangered Ecological Community in the Warkworth area as potential offset and rehabilitation sites for the Warkworth Coal Mine expansion. Coal and Allied Pty. Ltd.
2006	Community Biodiversity Survey. Flora Team Leader for survey of remnant woodlands in the Parkes area, NSW. National Parks Association of NSW.
2006	Molong Electricity Substation. Preliminary flora survey: community identification, plant species list, threatened species search. TransGrid.
2006	Collection and identification of pollinators of eleven threatened orchid (<i>Caladenia</i>) species in South West Victoria. Determination of pollinator distribution and abundance. Department of Sustainability and the Environment, Victoria.
2006	Buffer zone of the Hydro Aluminium Smelter, Kurri Kurri. Monitor effects of planned autumn 2006 hazard reduction burn on five permanent quadrat sites and 14 species of tagged plants in spring 2006. Hydro Aluminium Kurri Kurri Pty Ltd.
2006	Buffer zone of the Hydro Aluminium Smelter, Kurri Kurri. Establish and perform baseline measurements on 28 long term flora quadrats as part of the approved Property Management Plan. Hydro Aluminium Kurri Kurri Pty Ltd.
2006	The Salt Lakes, SW of Pooncarie, NSW. Map vegetation communities and list plant species present along seven transects across The Salt Lakes on Kelleen Station. Bemax Resources N/L.

2006	Orchid Reintroduction Workshop, Melbourne, Vic. Present results of pollinator research on eleven threatened <i>Caladenia</i> species in South West Victoria with implications for potential reintroductions. Department of Sustainability and the Environment, Vic.
2007	Review Australian Pome Fruit Improvement Program (APFIP) in collaboration with another consultant. APFIP and Horticulture Australia Limited.
2007	Flora survey of proposed rural subdivision at Little Hartley, NSW.
2007	Survey habitat value of proposed offset for the Snapper Mineral Sands Mine using the NSW Department of Environment and Climate Change 'Biometric' tool. Bemax Resources N/L
2007	Second measurements of tagged plants and permanent quadrats in a long term monitoring study of the effects of a control burn on threatened flora and communities in the buffer zone of an aluminium smelter in the lower Hunter Valley, NSW. Hydro Aluminium Kurri Kurri.
2007	Inspections for the presence of significant flora on proposed water pipeline routes from the Icely Road Quarry and Gosling Creek Reservoir, Orange, to the Orange to Cadiangullong Dam water pipeline. Cadia Valley Operations Pty. Ltd.
2007	Flora and fauna survey, threatened species searches and impact assessment of proposed Dentistry School, Charles Sturt University, Orange Campus. Charles Sturt University.
2007	Mapping of vegetation communities on farming lands owned by Cadia Valley Operations, Cadia. Cadia Valley Operations Pty. Ltd.
2007	Survey and mapping of vegetation communities and threatened species searches on the Cadia to Blayney concentrate slurry pipeline. Cadia Valley Operations Pty. Ltd.
2007	Survey and mapping of vegetation communities and impact assessment on route of proposed borefield pipeline on Escort Way. Parkes Shire Council.
2007	Flora survey, vegetation community mapping, threatened species searches and impact assessment for proposed vegetation clearance below 33Kv power line through Turon National Park, Capertee. TransGrid.
2007	Flora and fauna survey and assessment for proposed Orange Private Hospital, Forest Road, Orange. Forest Road Syndicate Pty. Ltd.
2007	Second season of pollinator collection and identification project on threatened orchid (<i>Caladenia</i>) species in Victoria. Determination of pollinator distribution and abundance. Department of Sustainability and the Environment, Victoria.
2007	Expert review of survey methodology and impact assessment of a threatened orchid species in a disputed Environmental Assessment for a housing subdivision at Dolphin Point on the NSW South Coast. NSW Department of Planning.
2007	Tagging and baseline measurement of 100 plants of each of three threatened species for long term monitoring under the Property Management Plan for the buffer zone of an aluminium smelter in the lower Hunter Valley. Hydro Aluminium Kurri Kurri.
2008	Baseline flora survey of section of Wentworth Swamp on 'Wangara' property, Kurri Kurri, NSW. Hydro Aluminium Kurri Kurri.
2008	Flora survey, targeted searches for threatened flora and vegetation mapping on the Woronora Plateau and Cumberland Plain for Illawarra Coal Bulli Seam Operations Environmental Assessment. A large ongoing project. BHP Billiton.
2008	Assessment of swamp condition and plant health in 27 Woronora Plateau upland swamps, including swamps over previous longwall mined areas and unmined areas. Helensburgh Coal.

2008	Flora survey and assessment for expansion of the E42 pit at the Lake Cowal Gold Mine. Barrick Australia Limited.
2008	Flora survey of powerline easement, Premer, NSW. Country Energy.
2008	Desktop review of flora and fauna issues for State Significant Site development on the Orange Agricultural Research, Forest Road, Orange. NSW Department of Primary Industries.
2008	Pre-disturbance inspection for threatened flora species of six proposed surface drill sites for groundwater monitoring bores with recommendations for relocation to avoid occurrences of the Prickly Bush-pea. Helensburgh Coal.
2008	Flora survey of the 'Southern Remnant' bushland area, Lake Cowal Gold Mine. Barrick Australia Limited.
2008	Targeted searches for threatened flora species and communities on proposed upgrade of culverts on Gradgery Lane, Macquarie Marshes, NSW. Warren Shire Council.
2008	Pre-clearance survey for threatened flora species and communities in the 'Southern Remnant', Cadia Valley, for expansion of a waste rock emplacement for the Cadia Gold Mine. Cadia Valley Operations.
2008	Participate in development of the Environmental Assessment for the Metropolitan Coal Project. Helensburgh Coal.
2008	Flora survey for Review of Environmental Factors at 'Big Cadia' ore deposit, Cadia, NSW. Cadia Valley Operations.
2008	Flora and fauna survey and assessment of site for student residential complex. Charles Sturt University, Orange.
2008	Flora survey and assessment of proposed stormwater harvesting project on Blackmans Swamp Creek. Orange City Council.
2008	Third season of pollinator studies on threatened Caladenia orchid species in Victoria. Department of Sustainability and the Environment, Vic.
2008	Ongoing monitoring of vegetation recovery (flora quadrats and tagged plant measurements) following hazard reduction burning in autumn 2006 of Blocks X and Y in the buffer zone of the Hydro Aluminium smelter, Kurri Kurri.
2008	Pre-burn baseline flora survey (flora quadrats and measurement of tagged plants of 3 threatened species) in blocks R and U in the buffer zone of the Hydro Aluminium smelter, Kurri Kurri, for a proposed hazard reduction burn in autumn 2009.
2008	Baseline flora survey and establishment of permanent monitoring quadrats for proposed vegetation offset for the Ginkgo and Snapper Mineral Sands Mines, Pooncarie, NSW. Bemax Minerals.

Publications

(Scientific papers and major scientific reports since 1990 only)

Refereed Publications on Economic Entomology

- Bower, C.C. (1992). Control of European earwig, *Forficula auricularia* L., in stone fruit orchards at Young, New South Wales. *General and Applied Entomology* **24**: 11-18.
- Bower, C.C., L.J. Penrose and K. Dodds (1993). A practical approach to pesticide reduction on apple crops using supervised pest and disease control - preliminary results and problems. *Plant Protection Quarterly* **8**: 57-62.
- Dodds, K.A., L.J. Penrose, C.C. Bower and H. Nicol (1994). The importance of pest and disease damage as a cause of downgrading of apple fruit. *Australian Journal of Experimental Agriculture* **34**: 431-434.
- Penrose, L.J., C.C. Bower and H.I. Nicol (1996). Variability in pesticide use as a factor in measuring and bringing about reduction in pesticide usage in apple orchards. *Agriculture, Ecosystems and Environment* **59**: 97-105.
- Penrose, L.J., W.G. Thwaite and C.C. Bower (1994). Rating index as a basis for decision making on pesticide use reduction and for accreditation of fruit produced under integrated pest management. *Crop Protection* **13**: 146-152.
- Thwaite, W.G., C.C. Bower, A.M. Hatley and D. Swist-Swirski (1996). Tebufenpyrad: Compatibility with integrated mite control on apples. *Experimental and Applied Acarology* **20**: 177-191.

Orchid Pollination Biology

- Bower, C.C. (1992). The use of pollinators in the taxonomy of sexually deceptive orchids in the subtribe Caladeniinae (Orchidaceae). *The Orchadian* **10**: 331-338.
- Bower, C.C. (1995). In defence of the New Taxonomy. *The Orchadian* **11**: 356-357.
- Bower, C.C. (1996). Species concepts and the New Taxonomy. *The Orchadian* **11**: 556-557.
- Bower, C.C. (1996). Demonstration of pollinator-mediated reproductive isolation in sexually deceptive species of *Chiloglottis* (Orchidaceae: Caladeniinae). *The Australian Journal of Botany* **44**: 15-33.
- Bower, C. (2001). Pollination of the Elbow Orchid, *Arthrochilus huntianus* (F. Muell.) Blaxell subsp. *huntianus*. *The Orchadian*, **13**: 366-371.
- Bower, C.C. (2001). Pollination (of 37 genera in the orchid subtribe Diurideae). In Pridgeon, A.M., Cribb, P.J. and Chase, M.W. (Eds.) *Genera Orchidacearum*. Volume 2 Orchidoideae (Part 1). Pages 64-213 (in parts). Oxford University Press, Oxford.
- Bower, C.C. (2006). Specific pollinators reveal a cryptic taxon in the bird orchid, *Chiloglottis valida sensu lato* (Orchidaceae) in south-eastern Australia. *The Australian Journal of Botany*, **54**: 53-64.
- Bower, C.C. (2006). Hybridisation between the Lemon Doubletail (*Diuris abbreviata*) and the Veined doubletail (*D. venosa*) at Barrington Tops. *The Orchadian*, **15**: 256-262.
- Bower, C.C. (2007). The Wasp, Ant and Bird Orchids of the *Chiloglottis* Alliance – A general overview. *The Orchadian*, **15**: 402-416.
- Bower, C.C. (2008). Serendipity and pollinators reveal a new cryptic orchid Spider Orchid species related to *Caladenia concinna* (Rupp) D Jones et M Clements. *The*

Orchadian, **16**; 60-69.

- Bower, C.C. and Branwhite, P. (1993). Observations on the pollination of *Calochilus campestris* R.Br. *The Orchadian* **11**: 68-71.
- Bower, C.C. and Brown, G.R. (1997). Hidden biodiversity: Detection of cryptic Thynnine wasp species using sexually deceptive, female mimicking orchids. *Memoirs of the Museum of Victoria*. **56**: 461-466.
- Bower, C.C. and Brown, G.R. (2009). Pollinator specificity, cryptic species and geographical patterns in pollinator responses to sexually deceptive orchids in the genus *Chiloglottis*: the *Chiloglottis gunnii* complex. *Australian Journal of Botany*, **57**: 37-55.
- Mant, J., Bower, C.C., Weston, P.H and Peakall, R. (2005). Phyleography of pollinator-specific sexually deceptive *Chiloglottis* taxa (Orchidaceae): evidence for sympatric divergence? *Molecular Ecology*, **14**: 3067-3076.
- Peakall, R., Bower, C.C., Logan, A.E. and Nicol, H.I. (1997). Confirmation of the hybrid origin of *Chiloglottis X pescottiana* R.Rogers (Orchidaceae: Diurideae). 1. Genetic and morphometric evidence. *The Australian Journal of Botany*. **45**: 839-855.
- Peakall, R., Jones, L. Bower, C.C. and Mackey, B.G. (2002). Bioclimatic assessment of the geographic limits to hybridisation in a sexually deceptive orchid system. *The Australian Journal of Botany*, **50**: 21-30.
- Phillips, R.D., Faast, R., Bower, C.C., Brown, G.R. & Peakall, R. (2009). Implications of pollination by food and sexual deception for pollinator specificity, fruit set, population genetics and conservation of *Caladenia* (Orchidaceae). *Australian Journal of Botany* **57**: 287-306.

Reports to the Australian Orchid Foundation (funding body)

- Bower, C.C. (1993a). Determination of the pollinators of sexually deceptive terrestrial orchids in the subtribe Caladeniinae in New South Wales. Progress Report to the Australian Orchid Foundation. 9 pp.
- Bower, C.C. (1993b). Determination of the pollinators of sexually deceptive terrestrial orchids in the subtribe Caladeniinae in New South Wales. 1992-93 Report to the Australian Orchid Foundation. 29 pp.
- Bower, C.C. (1994). Report on the results of field investigations of the pollinators of the genus *Chiloglottis* (Orchidaceae: Caladeniinae) in 1993-94. Report to the Australian Orchid Foundation. 80 pp.
- Bower, C.C. (1995). Determination of the pollinators of sexually deceptive orchids in the subtribe Caladeniinae. Australian Orchid Foundation. Progress Report, 1994-95. 60 pp.
- Bower, C.C. (1996). Determination of the pollinators of sexually deceptive orchids in the subtribe Caladeniinae. Australian Orchid Foundation. Progress Report, 1995-96. 53 pp.
- Bower, C.C. (2001). Determination of the pollinators of sexually deceptive orchids in the subtribes Drakaeinae and Caladeniinae. Technical Report, 1997-2000. 119 pp. Australian Orchid Foundation.
- Bower, C. (2007). Pollinators of threatened sexually deceptive Spider Orchids (*Caladenia* subgenus *Calonema*) in south western Victoria. Report to the Australian Orchid Foundation. 20 pp.

Bower, C. (2008). Pollinators of sexually deceptive Spider Orchids (*Caladenia/Arachnorchis*) in Victoria. Report to the Australian Orchid Foundation. 18 pp.