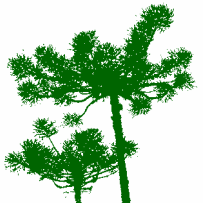
PRÓ ARAUCÁRIA ONLINE

www.pro-araucaria-online.com

ISSN 1619-635X



Araucaria beetles worldwide: evolution and host adaptations of a multi-genus phytophagous guild of disjunct Gondwana-derived biogeographic occurrence

Roland Mecke[1], Christian Mille[2], Wolf Engels[1]

[1] Zoological Institute, University of Tübingen, Germany

[2] Institut Agronomique Néo-Calédonien, Station de Recherches Fruitières de Pocquereux, La Foa Nouvelle-Calédonie

Corresponding author: Roland Mecke

E-mail: roland.mecke@t-online.de

Pró Araucária Online 1: 1-18 (2005)
Received May 9, 2005
Accepted July 5, 2005
Published September 6, 2005

Abstract

Araucaria trees occur widely disjunct in the biogeographic regions Oceania and Neotropis. Of the associated entomofauna phytophagous beetles (Coleoptera) of various taxonomic groups adapted their life history to this ancient host tree. This occurred either already before the late Gondwanian interruption of the previously joint *Araucaria* distribution or only later in the already geographically separated populations. A bibliographic survey of the eastern and western coleopterans recorded on *Araucaria* trees resulted in well over 200 species belonging to 17 families. These studies include records of beetles living on 12 of the 19 extant *Araucaria* species. Their occurrence and adaptations to the host trees are discussed under aspects of evolution and co-speciation.

Keywords: *Araucaria*, Coleoptera, synopsis, evolution, co-speciation, South America, Oceania

Zusammenfassung

Araukarienbäume kommen in den disjunkten biogeographischen Regionen Ozeanien und Neotropis vor. Von der mit diesen Bäumen vergesellschafteten Entomofauna haben sich phytophage Käfer (Coleoptera) unterschiedlicher taxonomischer Gruppen in ihrer Lebensweise an diese altertümlichen Bäume angepasst. Diese Anpassungen entstanden entweder vor der Aufspaltung der ehemals zusammenhängenden gondwanischen Araukarienvorkommen oder erst in den bereits geographisch voneinander getrennten Populationen. Bei einer Erhebung der östlichen und westlichen Araukarienkäfer konnten deutlich mehr als 200 Arten aus 17 Familien registriert werden. In diese Studie wurden 12 der 19 rezenten Araukarienarten mit einbezogen. Das Vorkommen dieser Käfer und die jeweiligen Anpassungen an ihre Wirtsbäume werden unter evolutionsbiologischen Aspekten diskutiert.

Stichworte: *Araucaria*, Coleoptera, Synopse, Evolution, Co-Speziation, Südamerika, Ozeanien

Resumo

As araucárias ocorrem nas disjuntas regiões biogeográficas da Oceânia e Neotrópica. Da entomofauna associada à estas árvores estão besouros (Coleóptera) fitófagos de vários grupos taxonomicos que se adaptaram a estes hospedeiros antigos. Estas adaptações ocorreram antes da interrupção do antigo supercontinente Gondwana quando as araucárias ainda estavam localizadas numa área contígua ou, depois nas populações geograficamente separadas. A análise bibliográfica dos coleópteros relatados das araucárias revelou bem mais do que 200 espécies de 17 famílias. Estes estudos incluíram citações de coleópteros associados às 12 das 19 espécies do gênero *Araucaria*. A ocorrência e as adaptações aos hospedeiros estão sendo discutidas em relação à evolução e à co-especiação.

Palavras chave: *Araucaria*, Coleóptera, sinopse, evolução, co-especiação, América do Sul, Oceânia

Introduction

According to fossil records, the origin of the primitive tree genus *Araucaria* (Araucariaceae) was in the late Triassic, about 220 million years ago, and these trees are considered the oldest extant conifers. In the beginning of the Jurassic, about 180 million years ago, the disintegration of the megacontinent Gondwana began. The former contiguous distribution of *Araucaria* trees became disjunct when 100 million years ago, the break-up was completed and South America, Africa and Oceania were separated. Today, the 19 still existing *Araucaria* species are restricted to tropical and subtropical regions of the Southern Hemisphere and occur mostly in highly diverse mountain rain forests. The natural distribution of these trees is limited to Oceania and the Neotropics: *Araucaria bidwillii* and *A. cunninghamii* in Australia, *A. cunninghamii* and *A. hunsteinii* in Papua New Guinea, *A. heterophylla* at Norfolk Island, *A. bernieri*, *A. biramulata*, *A. columnaris*, *A. humboldtensis*, *A. laubenfelsii*, *A. luxurians*, *A. montana*, *A. nemorosa*, *A. muelleri*, *A. rulei*, *A. schmidii*, *A. scopulorum* and *A. subulata* in New Caledonia, *A. araucana* in Chile and Argentina and *A. angustifolia* in Brazil and Argentina (Golte 1993, Kindel 2001). This biogeographic occurrence at the former extreme eastern and western margins of the Gondwana continent suggests that in the central regions all the *Araucaria* populations became extincted. The absence of Araucariaceae in Africa supports this assumption. Regional climatic conditions during the late Jurassic and Cretaceous ages probably lead to the disappearance of *Araucaria* trees in most parts of their original areas.

Both the high geological age and the disjunct distribution predestinate *Araucaria* trees and their inhabiting insects for evolutionary studies on insect-plant relationships. Today, we know several insect groups restricted in their occurrence to recent Araucariaceae. They belong to various taxa like the leaf beetle subfamily Palophaginae (Megalopodidae), the weevil tribes Araucariini (Cossoninae, Curculionidae) and Mecomacerini (Rhinorhynchinae, Nemonychidae) and the bark beetle genera *Hylurdrectonus* Schedl, 1938, *Hylurgonotus* Schedl, 1951, *Pachycotes* Sharp, 1877 and *Xylechinosomus* Schedl, 1963 (Scolytinae, Curculionidae) (Kuschel 1966, 1994, Kuschel & May 1996, Mecke 2000, Wood 1986).

The question is if insect-*Araucaria* associations already existed before the splitting of Gondwana, and whether they are up to now recognizable in the extant populations. How evolved these insects after the separation of their biogeographical regions? Which insects colonized *Araucaria* trees later on in the disjunct areas?

To answer these questions a detailed overview of the entomofauna associated with *Araucaria* trees in South America and Oceania is required. In a first approach, we surveyed the insects inhabiting 12 of the 19 extant *Araucaria* species. The results are presented here. In a second approach, we studied adaptations of the Araucariofauna to the specific microhabitats provided by their host trees. These interorganismic relations have to be evaluated in order to understand the proximate links between an insect and its particular *Araucaria* host. Knowledge of the life history is needed for an interpretation of the ultimate factors leading to assumed co-speciations in particular of phytophagous insects and their host plants.

Material and Methods

The data for this study were obtained from collections and completed by a bibliographic survey. Field studies were conducted 1997 to 2003 in southern Brazil, 2001 in New Zealand and 2002 in the southern Province of New Caledonia. At the latter location previously no detailed study on insects living on *Araucaria* trees had been undertaken. We collected the beetles from dead trunks and branches of *Araucaria columnaris* at Bourail, Baie de Tortues, Ile des Pins and La Foa, *A. laubenfelsii* at Mont Do, *A. montana*

at Mont Kaala, *A. muelleri* at Montagne des Sources and Goro Plateau and *A. rulei* at Col de Poro (Figs 1 – 6). Emerging adults were obtained in photoeclectors (emergence traps) consisting of perforated plastic barrels (45 cm height, diameter 35 cm), sealed against light with a dark synthetic textile, and provided with a collecting box on top. The eclectors were filled with branches and logs, moistened every 1 – 3 days and emerging insects were removed weekly. Similar sampling was carried out in Brazil and results have been published in earlier papers (Mecke et al 2000, 2001).

In addition, a detailed literature search of *Araucaria*-associated insects was carried out. Kindly communicated personally records of Roger A. Beaver (Thailand), Pierre Jolivet (France), Michael Schneider (Mozambique) and Simon Lawson (Australia) were included.

Fig. 1: *Araucaria muelleri* on ultramafic soil at the Goro Plateau, New Caledonia

Fig. 2: *Araucaria columnaris* on a sandy coastal ground, Baie des Tortues, New Caledonia

Fig. 3: An *Araucaria laubenfelsii* seedling at Mont Do, New Caledonia

Fig. 4: Small remnants of *Araucaria montana* in a destroyed environment as a consequence of intensive Nickel mining at Mont Kaala, New Caledonia

Fig. 5: A fresh branchlet of *Araucaria Montana*

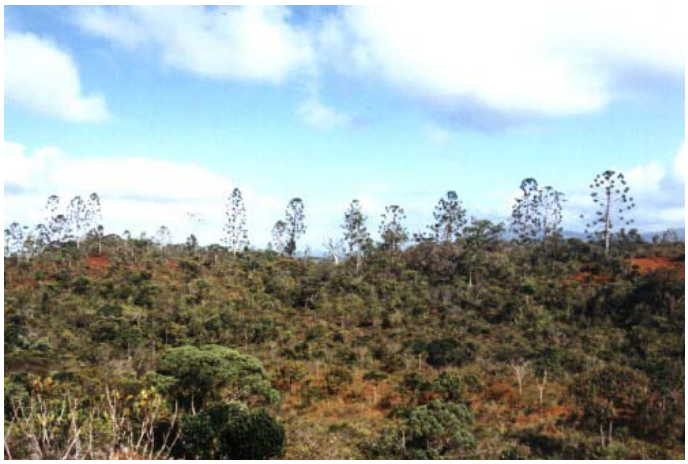


Fig. 6: *Araucaria rulei* on ultramafic soil at Col de Poro, New Caledonia

Results

Caledonian *Araucaria* beetles

Our field study in New Caledonia resulted in a sample of beetles comprising 33 species associated with *Araucaria columnaris*, *A. laubenfelsii*, *A. montana*, *A. muelleri* or *A. rulei* (Tab. 1, Annex). Only seven of these species could be determined of which just two (Anthribidae: *Aranthribus araucariae*; Curculionidae: *Dobionus araucarinus*) had been recorded before from New Caledonian *Araucaria* trees. Three species of bark beetles (Curculionidae: Scolytinae) were new and have been described in the meantime as *Pachycotes grandis*, *P. engelsi* and *Xylechinus araucariae* (Mecke 2004a). The beetles of

the remaining 24 taxa could only be identified to genus or even higher levels. According to Kuschel (personal communication), who is studying the Cossoninae, Curculioninae and Dryophthorinae, this rest evidently contains 14 yet unidentified morphospecies, probably most of which will have to be described as new species. Four additional species - 1 still unidentified chrysomelid beetle (Eumolpinae) and the 3 nemonychids *Notomacer araucariae*, *N. hirtulus* and *N. caledonicus* - were recorded from other authors so that the currently known number of New Caledonian *Araucaria* beetles is 37.

Synopsis of *Araucaria*-associated beetles

The result of the field studies and the bibliographic search is a list comprising a total of 233 beetle species using *Araucaria* trees as hosts (Tab. 1, Annex). These beetles belong to 17 families: Alleculidae, Anthribidae, Belidae, Biphyllidae, Brentidae, Buprestidae, Cerambycidae, Chrysomelidae, Cucujidae, Curculionidae (including the subfamilies Brachycerinae, Cossoninae, Curculioninae, Dryophthorinae, Platypodinae, Rhynchophorinae and Scolytinae), Lucanidae, Megalopodidae, Melandryidae, Nemonychidae, Nitidulidae, Oedemeridae and Silvanidae. According to the present taxonomic status, the araucariophagous beetles comprise 114 described genera and some taxa not fitting in any of these, thus presumably species for which a new genus has to be established.

Within the many beetles living on *Araucaria* trees, the most diverse family is Curculionidae with 148 species, followed by Cerambycidae (Figs. 7 – 8) with 32 and Nemonychidae with 24 taxa. Accordingly a great multiplicity of niches is occupied, and a remarkable richness of life histories evolved.

Fig. 7: Larva of the long-horned beetle *Taurorcus chabrillacii* (Cerambycidae) in a branch of *Araucaria angustifolia*, Brazil

Fig. 8: The long-horned beetle of *Tithonus virescens* (Cerambycidae) from *Araucaria angustifolia*, Brazil

Discussion

Araucaria beetles of presumed Gondwana origin

Insect taxa with presumed Gondwana origin are considered those with an extant distribution on *Araucaria* trees in both biogeographic regions, the Neotropics and Oceania. On species or genus level there is no example of a taxon shared in both regions except for the worldwide distributed and extremely polyphagous bark beetle species *Hypothenemus eruditus* and *Xyleborus affinis* or the worldwide distributed genera *Syllitus* (Cerambycidae), *Platypus* (Fig. 9) (Curculionidae: Platypodinae), *Xylechinus* and *Xyleborus* (Curculionidae: Scolytinae).

Fig. 9: A male pin-hole borer of *Platypus araucariae* (Curculionidae, Platypodinae) from *Araucaria angustifolia*, Brazil

But there are tribes and subfamilies exclusively occurring on trees of the family Araucariaceae in South America and Oceania. One example is the subfamily Palophaginae (Megalopodidae), comprising 3 Australian beetle species whose larvae feed on pollen inside of male cones of *Araucaria* and *Agathis* (Kuschel & May 1990). Recently, the fourth member of this subfamily was discovered by Kuschel & May (1996) in the Neotropical Region in male cones of the Chilean *Araucaria araucana.*

Another example is the nemonychid tribe Mecomacerini, proposed by Kuschel (1994) for the four South American genera *Brarus* Kuschel (Fig. 10), *Mecomacer* Kuschel,

Rhynchitomacerinus Kuschel, *Rhynchitoplesius* Voss and the four Oceanian genera *Aragomacer* Kuschel, *Bunyaeus* Kuschel, *Eutactobius* Kuschel and *Notomacer* Kuschel (Tab. 1, Annex). All adults and larvae feed on pollen of Araucariaceae and, except for *Aragomacer leai* recorded from *Araucaria cunninghamii*, *Agathis atropurpurea* and *A. robusta* (Araucariaceae), the remaining 20 species are exclusively known from *Araucaria* trees in these two disjunct geographic regions.

Fig. 10: *Brarus mystes* (Nemonychidae) on a male cone of *Araucaria angustifolia*, Brazil

The Araucariini, a weevil tribe (Curculionidae, Cossoninae) erected by Kuschel (1966), is covering the neotropical genus *Araucarius* Kuschel and the four oceanian genera *Coptocorynus* Marshall, *Mastersinella* Lea, *Xenocnema* Wollaston and *Inosomus* Broun (Zarazaga & Lyal, 1999). The single species of the latter genus, *Inosomus rufopiceus* Broun 1881, is known from *Podocarpus* in New Zealand. These trees belong to the family Podocarpaceae which is adelphic to Araucariaceae and shows a similar disjunct distribution. The remaining 4 genera are exclusively associated with Araucariaceae: *Araucarius* with both South American *Araucaria* species, *Coptocorynus* with the Australian *Araucaria cunninghamii* and *Mastersinella* and *Xenocnema* with oceanian *Agathis* species (Kuschel, 1966).

All the beetle groups, found exclusively on Araucariaceae in both biogeographic regions, belong to the more archaic taxa within their respective families and share several primitive characters (Kuschel 1966, 1994, 1995, Kuschel & May 1990, Sequeira & Farrell 2001, Sequeira et al. 2000). In addition to their disjunct distribution, this confirms the assumption that the associations with *Araucaria* trees originate from Gondwanan periods. The extremely consistent microhabitat conditions under the bark or inside the male cones evidently conserved a very old and highly specialized araucariofauna.

Post-Gondwana associations of insects with *Araucaria* trees

With exception of the taxa treated in the previous paragraph, most of the remaining taxa listed in Tab. 1 (Annex) have to be regarded post-Gondwanian newcomers on *Araucaria* trees. Their actual biogeographic distribution is either neotropical or oceanic. Of course this exclusive western or eastern occurrence could also result from former extinction of taxa in one of the regions of todays *Araucaria* populations.

Patterns of abundance and established feeding guilds of *Araucaria* beetles

The relatively thick phloem of *Araucaria* trees is colonized by a distinct curculionid fauna composed of several *Araucaria* specialized genera of Cossoninae and Tomicini (Scolytinae) (Figs. 11 - 13). Male cones host an unique Nemonychidae (Fig. 10) and Palophaginae (Megalopodidae) fauna. According to *Araucaria* fossils, the reproductive

organs and the phloem did not change their morphological structure since cretaceous times (Stockey 1994) and, therefore, these plant organs preserved absolutely stable microclimatic conditions over extremely long periods. This seems to be the main reason for the high degree of specialization and the large number of primitive faunistic elements representing this portion of the araucariofauna (Kuschel 1966, 1994, 1995, Kuschel & May 1990). Within the entire disjunct distribution area of the extant *Araucaria* species, these four subfamilies comprise highly abundant taxa and a remarkable diversity within the araucariophagous insects. The beetles of nearly all of these 79 species are monophagous on *Araucaria* male cones and phloem, respectively, representing well established old feeding guilds on their host trees.

Fig. 11: The weevil *Araucarius kuscheli* (Curculionidae, Cossoninae) feeding on the phloem of *Araucaria angustifolia*, Brazil

Fig. 12: Galleries of the bark beetle *Xylechinus araucariae* (Curculionidae, Scolytinae) in the wood of *Araucaria laubenfelsii*, New Caledonia

Fig. 13: The bark beetle *Xylechinosomus contractus* (Curculionidae, Scolytinae), Brazil

Microhabitat adaptations of the *Araucaria* entomofauna

Weevils of the tribe Araucariini (Curculionidae, Cossoninae) form the unique representatives of cossonine weevils that live and feed as adults inside of bark. As a special adaption to this microhabitat their large spinelike tibial hairs may be interpreted. Most bark beetles *sensu strictu* (Curculionidae, Scolytinae) also have such tibial structures, looking rather similar. This was considered by Kuschel (1966) to indicate a close phylogenetic relationship between Scolytionae and Cossoninae. As recently shown by SEM analyses, all these tibial structures are much enlarged true hairs rooted in a socket (Mecke, in press). They clearly facilitate the locomotion of bark tunneling beetles within their galleries (Fig. 14). Weevils of the tribe Araucariini (Fig. 11) are the only extant curculionids (Cossoninae, Curculioninae) that live as larvae and adults inside of the phloem like most bark beetles do and, therefore, like in the Scolytinae, their ancestral character of possessing giant tibial hairs has been preserved until today.

Fig. 14: Galleries of the weevil cf. *Dobionus* sp. (Curculionidae, Cossoninae) in a dead branch of *Araucaria montana*

Co-speciation of beetles living exclusively on one or a few *Araucaria* species

Co-speciation of beetle genera with an at least Gondwanian *Araucaria* association took place in the neotropical genera *Araucarius* (Curculionidae, Cossoninae), *Sinophloeus*, *Xylechinosomus* (Fig. 13) (Curculionidae, Scolytinae) and *Mecomacer* (Nemonychidae, Rhinorhynchinae). *Sinophloeus* and *Mecomacer* are restricted to the Chilean *Araucaria araucana*. Beetles of the genera *Araucarius* and *Xylechinosomus* live on both South American *Araucaria* trees, but there is no species occurring on both *A. araucana* and *A. angustifolia* the geographic areas of which are separated from each other nowadays by more than 1,000 km and the Andean barriere.

In Oceania, the genera *Prospheres* (Buprestidae, Polycestinae), *Pachycotes*, *Hylurdrectonus* (Curculionidae, Scolytinae), *Aragomacer* and *Notomacer* (Nemonychidae, Rhinorhynchinae) are restricted to *Araucaria* trees. Some of the beetle species belonging to these genera accept two or more *Araucaria* species as hosts, but except for *Hylurdrectonus corticinus*, found on trees of all the three naturally occurring *Araucaria* species of Australia and Papua New Guinea, the remaining taxa are limited to *Araucaria* trees of one locality only.

Acknowledgements

Financial support by the Wilhelm-Schuler-Stiftung Tübingen for the research in New Caledonia is gratefully acknowledged. For the issuing of the required collection and exportation permits we thank the DRN Province Sud, namely Cendrine Meresse, Joseph Manauté and Thierry Chaverot. The assistance of our field collections in New Caledonia by Stéphane Lebégin and Sylvie Cazères is gratefully acknowledged. For help with species identification we like to thank Roger A. Beaver (Chiangmai, Thailand), Svatopluk Bílý (Praha, Czech Republic), Don E. Bright (Ottawa, Ontario), Maria Helena M. Galileo (Porto Alegre, Brazil), Guillermo Kuschel (Auckland, New Zealand) and Al Samuelson (Honolulu, Hawaii). For the personal communication of unpublished data about insects from *Araucaria* trees and for the permission to publish these data we wish to thank Roger A. Beaver (Chiangmai, Thailand), Pierre Jolivet (France), Michael Schneider (Mozambique) and Simon Lawson (Australia).

Annex

Tab. 1: Taxonomic list of Coleoptera feeding on *Araucaria* trees. Abbreviations: **Host**: an = *A. angustifolia*, ar = *A. araucana*, br = *A. biramulata*, bi = *A. bidwillii*, cu = *A. cunninghamii*, co = *A. columnaris*, la = *A. laubenfelsii*, he = *A. heterophylla*, hu = *A. hunsteinii*, mo = *A. montana*, mu = *A. muelleri*, ru = *A. rulei*, sp. = species not identified. **Origin**: AR = Argentinien, AU = Australia, BR = Brazil, CH = Chile, NC = New Caledonia, NI = Norfolk Island, NZ = New Zealand, PN = Papua New Guinea. **Observations**: br = in branches, ne = needles, se = in seeds (female cones), st = in strobili (male cones), tr = in trunks. **References**: 1 = McKeown (1938); 2 = Marshall (1948); 3 = Zajciw (1962); 4 = Schedl (1964); 5 = Viana (1965); 6 = Kuschel (1966); 7 = Schedl, (1966a); 8 = Schedl (1966b); 9 = Vernalha (1967); 10 = Gray (1968); 11 = Silva et al. (1968); 12 = Marinoni (1969); 13 = Voss (1971); 14 = Schedl (1972); 15 = Gray (1974); 16 =Schedl, 1976; 17 = Levey (1978a); 18 = Levey (1978b); 19 = Peredo et al. (1980); 20 = Hoffmann (1981); 21 = Schönherr & Pedrosa-Macedo (1981); 22 = Browne (1984); 23 = Pedrosa-Macedo & Schönherr (1985); 24 = Wood (1985); 25 = Galileo (1987); 26 = Costa et al. (1988); 27 = Hawkswood (1990); 28 = Wood & Bright (1992); 29 = Barriga et al., (1993); 30 = Lyal (1993); 31 = Kuschel (1994); 32 = Schönherr (1994); 33 = Barreto et al. (1996); 34 = Kuschel & May (1996); 35 = Morrone (1997); 36 =Bright & Skidmore (1997); 37 = Kuschel & May (1997); 38 = Kuschel (1998); 39 = Klein Koch & Waterhouse (2000); 40 = Kuschel (2000); 41 = Mecke (2000); 42 = Mecke et al. (2000); 43 = Kuschel et al. (2000); 44 = Mecke et al. (2001); 45 = Mecke (2002); 46 = Mecke (2004a); 47 = Mecke (2004b); 48 = Mecke & Galileo (2004); 49 =Beaver (pers. com); 50 = Jolivet (pers. com.); 51 = Lawson (pers. com.); 52 = Mecke (pers. obs.); 53 =Schneider (pers com.). Unpublished species records are printed in **bold letters**

Taxa	Host	Origin	Observ.	References
Alleculidae – Alleculinae				
Lobopoda dallieri Pic, 1927	an	BR	br	44,45
Anthribidae – Anthribinae				
Aranthribus araucariae Kuschel, 1998	br,**la**	NC	br	38,**52**
Cacephatus sp.	he	NI		38
Choraginae				
***Araecerus bicristatus* Blackburn, 1900**	**cu**	**AU**		**51**
Belidae – Oxycoryninae				
Oxycraspedus cornutus Kuschel, 1959	ar	CH	se	35,40
Oxycraspedus cribricollis (Blanchard, 1851)	ar	CH	se	35,40
Oxycraspedus minutus (Philippi & Philippi, 1864)	ar	CH	se	35,40
Biphyllidae				
Diplocoelus cf. *amplicollis* Reitter, 1877	an	BR	st	26

Brentidae – Taphroderinae				
Taphroderes sahlbergi (Sharp, 1895)	an	BR	br	44,45
Buprestidae – Buprestinae				
Araucariana queenslandica Levey, 1978	cu	AU		17
Chalcophorinae				
Baudonisia villosiventris (Chevrolat, 1938)	an	BR	tr	3,11,44,45
Euchroma gigantea Linnaeus, 1758	an	BR	tr	11,45
Polycestinae				
Prospheres alternecostata Levey, 1978	cu,hu.	PN	tr, br	18
Prospheres aurantiopicta (Laporte & Gory, 1838)	cu	AU	tr	18
***Prospheres chrysocomus* Fauvel, 1891**	**co**	**NC**	**tr**	**52**
Prospheres norfolkensis Levey, 1978	he	NI		18
Cerambycidae – Cerambycinae				
***Diotimana undulata* (Pascoe, 1859)**	**cu**	**PN**		**51,53**
Epipodocarpus andinus Bosq, 1951	ar	CH	br	19,29
Grammicosum flavofasciatum Blanchard, 1843	ar	CH	tr,br	19
Huequenia araucana (Cerda, 1980)	ar	CH		29
Huequenia livida (Germain, 1898)	ar	CH		29
Paraholopterus nahuelbutensis Cerda & Cekalovic, 1986	ar	CH		29
***Strongylurus decoratus* (McKeown, 1940)**	**cu**	**AU**		**51**
Syllitus araucariae McKeown, 1938	cu	AU		1
Syllitus schajovskoii Bosq, 1953	ar	CH		19
Lamiinae				
Acanthocinini (4 spp., indet.)	**la**	**NC**		**52**
Acanthoderes juno Fisher, 1938	an	BR	tr	3,11,20
Acalolepta tincturata Pascoe,1866	cu	PN		27
***Dysthaeta anomala* Pascoe, 1859**	**cu**	**AU**		**51**
***Enicodes fichteli* (Schreibers, 1802)**	**la**	**NC**		**52**
Estola hirsutella Aurivillius, 1922	ar	CH	br	19,29
Leptostylus perniciosus Monné & Hoffmann, 1981	an	BR		20
Potemnemus detzneri Kriesche,1923	cu,hu	PN		53
Steirastoma marmoratum Thunberg, 1822	an	BR		12,20,45
Taurorcus chabrillacii Thomson, 1857	an	BR	br,se	11,12,20,44,45
Taurorcus mourei Marinoni, 1969	an?	BR		12,44,45
Tithonus virescens (Melzer, 1931)	an	BR		44,45
Urgleptes sp.	an	BR		20
Lepturinae				
Strangalia dimidiata (Redtenbacher, 1867)	an	BR	br	44,45
Parandrinae				
Hesperandra glabra (De Geer, 1774)	an	BR	tr	3,11,20,44
Parandra araucana Bosq, 1951	ar	CH	tr	19,29
Prioninae				
Microplophorus calverti Philippi, 1897	ar	CH	tr	19
Microplophorus penai Galileo, 1987	ar	CH		25,29
***Olethrius tyrannus* Thomson,1860**	**co**	**NC**	**tr**	**52**
Chrysomelidae – Chrysomelinae				
Calligrapha polyspila Germar, 1821	an	BR	ne	9,45
Eumolpinae				
Gen. sp. indet.	**an**	**BR**	**ne**	**52**
Gen. sp. indet.	**sp.**	**NC**		**50**
Cucujidae				
Laemophloeus minutus Olivier, 1791	an	BR	se	11
Curculionidae – Brachycerinae				
***Aesiotes notabilis* Pascoe, 1865**	**cu**	**AU**		**51**
Oribius destructor (Marshall, 1957)	cu	PN	br	10
Cossoninae				
Araucarius brasiliensis Kuschel, 1966	an	BR	br	6,41,45,48
Araucarius chilensis Kuschel, 1966	ar	CH	br	6,35,40
Araucarius crassipunctatus Mecke, 2000	an	BR	br	6,41,48

Araucarius kuscheli Mecke, 2000	an	BR	br	6,41,45,48
Araucarius major Kuschel, 1966	ar	CH	tr	6,35,40
Araucarius medius Kuschel, 1966	ar	CH	tr	6,35,40
Araucarius minor Kuschel, 1966	ar	CH	br	6,35,40
Araucarius ruehmi Kuschel, 1966	an	BR	br,tr,st	6,35,40
Coptocorynus araucariae Marshall, 1948	cu	AU		2,6
Dobionus araucarinus Kuschel, 2000	br,**la,ru**	NC	tr, br	43,**52**
***Dobionus brachyrhinus* (Montrouzier, 1861)**	**co**	**NC**	**br**	**52**
***Dobionus* sp.**	**co**	**NC**	**br**	**52**
cf. *Dobionus* spp. (6 species)	**co**,**la**,**mo**,**mu**,**ru**	**NC**	**br**	**52**
Eurycorynophorus scabriculus Voss, 1964	an	BR	br	42,44,45,48
Micromimus sp.	an	BR	br	44,48
cf. *Ochronanus* sp.	**mo**	**NC**	**br**	**52**
Pseudostenoscelis araucariae Voss, 1971	cu	PN	tr	13
***Rhyncolus longicollis* (Montrouzier, 1861)**	**co**	**NC**	**tr**	**52**
Curculioninae				
Achopera araucariae Marshall, 1948	cu	AU		2
Araucarietius viridans Kuschel, 1952	ar	CH	st	35,40
Calvertius tuberosus (Fairmaire & Germain, 1860)	ar	CH	tr	35,40
Eisingius araucariae Kuschel, 2000	ar	CH	st	35,40
Eisingius chusqueae (Bondar, 1949)	ar	CH	st	35,40
***Eurhamphus fasciculatus* Schuckard, 1838**	**cu**	**AU**		**51**
Heilipodus tuberculatus (Boheman, 1836)	an	BR	tr	42,44,45,48
***Ilacuris laticollis* Pascoe, 1865**	**cu**,**hu**	**AU**,**PN**		**51**,**53**
Mallus costatus Marshall, 1948	cu	AU		2
***Mechistocerus* sp.**	**co**	**NC**	**br**	**52**
Mitrastethus australiae	**cu**,**hu**	**AU**,**PN**		**51**,**53**
Mitrastethus baridioides Redtenbacher, 1868	he	NZ	tr	30
***Orthorhinus cylindrirostris* (Fabricius)**	**cu**	**AU**		**51**
***Orthorhinus patruelis* (Fabricius)**	**cu**	**PN**		**53**
Planus barbatus Kuschel, 1952	ar	CH	se	40
***Scelodolichus* sp.**	**mu**	**NC**	**tr**	**52**
Spermologus rufus Boheman, 1843	an	BR	se	33,48
***Tyrtaeosus microthorax* Pascoe, 1870**	**cu**	**AU**		**51**
Vanapa oberthuri Pouillaude, 1915	cu	PN		10
Dryophthorinae				
***Dryophthorus* spp. (4 species)**	**mo**,**mu**	**NC**	**br**,**tr**	**52**
Platypodinae				
Cenocephalus thoracicus Chapuis, 1865	an	BR		7,48
***Crossotarsus barbatus* Chapuis, 1865**	**hu**	**PN**	**tr**	**49**
Diapus nanus Schedl, 1969	cu,**hu**	PN	tr	28,**49**
Diapus papuans Schedl, 1968	hu	PN		28
***Diapus pusillimus* Chapuis, 1865**	**hu**	**PN**		**49**
Diapus quinquespinatus Chapuis, 1865	hu	PN		28
***Dinoplatypus pseudocupulatus* (Schedl, 1935)**	**cu**	**PN**		**49**
Euplatypus parallelus (Fabricius, 1801)	cu	AU		28
Platypus araucariae Schedl, 1966	an	BR	tr	7,21,45,48
Platypus froggatti Sampson, 1926	cu	AU		28
***Platypus geminatus* Chapuis, 1865**	**hu**	**PN**		**49**
Platypus jansoni Chapuis, 1865	cu,hu	AU,PN		28
Platypus mutatus Chapuis, 1865	an	BR	tr	16,21,48
Platypus omnivorus (Lea, 1904)	cu	AU		7
Platypus opacideclivis Schedl, 1969	cu	PN		28
Platypus parallelus (Fabricius, 1801)	an	BR	tr,se	16,48
Platypus praepositus Schedl, 1969	hu	PN		28
Platypus queenslandi Schedl, 1936	cu	AU		28
Platypus semigranosus (Sampson, 1925)	cu	AU		7
Platypus subgranosus Schedl, 1936	cu	AU		7
Platypus varipennis Schedl, 1968	cu	PN		28
Tesserocerus insignis Saunders, 1936	an	BR		7,21,45,48
Treptoplatypus australis (Chapuis, 1865)	cu	AU		7
Rhynchophorinae				
Sitophilus oryzae Linnaeus, 1763	an	BR	se	11,48
Scolytinae, BOTHROSTERNINI				

Cnesinus dividuus Schedl, 1938	an	BR		23,48
Pagiocerus punctatus Eggers, 1928	an	BR	st	16,23,48
CORTHYLINI				
Araptus araucariae (Schedl, 1966)	an	AR	se	8,48
Corthylus papulans Eichhoff, 1868	an	BR	br	44,48
Corthylus praealtus Schedl, 1976	an	BR	br	42,44,45,48
Corthylus rufopilosus Eggers, 1931	an	BR	br	42,44,48
Monarthrum brasiliensis (Schedl, 1936)	an	BR	se	21,23,48
Pityophthorus anticus Schedl, 1976	an	BR	br,se,st	16,21,45,48
CRYPHALINI				
Cryphalus araucariae Schedl, 1969	cu	PN		28
Cryphalus brunneus Browne, 1984	hu	PN		22
Cryphalus cylindrus Browne, 1984	hu	PN		22
Cryphalus diversicolor Browne, 1984	hu	PN		22
***Cryphalus* spp. (5 species)**	**co**,**la**,**mu**	**NC**		**52**
***Cryphalus tetricus* (Schedl, 1940)**	**cu**,**hu**	**PN**		**49**
Cryptocarenus seriatus Eggers, 1933	an	BR	br	21,23,48
Hypothenemus eruditus Westwood, 1836	an,cu,**co**,hu,	BR,PN,**NC**	br	15,48,**52**
PHLOEOSININI				
Hyleops glabratus Schedl, 1938	cu	AU		7
PHLOEOTRIBINI				
Phloeotribus argentinensis (Schedl, 1951)	an	AR,BR	se	5,48
Phloeotribus cylindricus Schedl, 1951	an	BR	br	5,48
TOMICINI				
Chaetoptelius impar Schedl, 1975	hu	PN		28
Hylurdrectonus araucariae Schedl, 1964	cu	PN	br	4,7,10
Hylurdrectonus corticinus Wood, 1980	**bi**,**cu**,**he**,hu	**AU**,PN		28,**49**
Hylurdrectonus nanus Browne, 1984	cu	PN		22
Hylurdrectonus piniarius Schedl, 1938	bi,cu,	AU		7
Hylurgonotus armaticeps Schedl, 1955	ar	CH	tr	35,40
Hylurgonotus tuberculatus (Eggers, 1942)	ar	CH	tr	35,40
Pachycotes araucariae Schedl, 1975	cu	PN		28
Pachycotes australis Schedl, 1938	cu	AU		28
Pachycotes clavatus Schedl, 1938	cu	AU		28
Pachycotes engelsi Mecke, 2004	mu	NC	tr	46
Pachycotes grandis Mecke, 2004	la,mu	NC	tr	46
Pachycotes kuscheli Schedl, 1972	he	NI		14
Pachycotes minor Wood, 1985	cu	AU		28
Pachycotes peregrinus (Chapuis, 1869)	sp.	NZ		28
Sinophloeus antipodus (Eggers, 1942)	ar	CH	br	35,40
Sinophloeus porteri (Brèthes, 1922)	ar	CH		35,40
Sinophloeus solidus (Schedl, 1976)	ar	CH	br	35,40
Xylechinosomus brasiliensis (Schedl, 1951)	an	BR	br	16,21,23,48
Xylechinosomus contractus (Chapuis, 1873)	an	BR	br,tr,se	5,7,16,45,48
Xylechinosomus hirsutus Schedl, 1963	an	BR	br,se	7,21,23,48
Xylechinosomus humilis (Blanchard, 1851)	ar	CH		36
Xylechinosomus lucianae Mecke, 2004	an	BR	br	47,48
Xylechinosomus minimus Schedl, 1963	an	BR	br,tr,se,st	7,21,23,45,48
Xylechinosomus paranaensis (Schönherr, 1994)	an	BR	br,tr	32,48
Xylechinosomus pilosus Wood, 1985	an	BR		24,48
Xylechinosomus bicolor (Philippi & Philippi, 1864)	ar	CH		35,40
Xylechinus araucariae Mecke, 2004	la	NC	br	46
Xylechinus porteri (Brèthes, 1925)	ar	CH		28
XYLEBORINI				
Ambrosiodmus catharinensis (Eggers, 1928)	an	BR	br	44,48
Ambrosiodmus compressus (Lea, 1893)	bi,cu	AU		7,28
Arixyleborus canaliculatus (Eggers, 1923)	cu	PN		15
Coptodryas eucalyptica (Schedl, 1938)	cu	AU		7,28
Coptodryas intermedius (Eggers, 1923)	cu	PN		15
Coptodryas libra (Eggers, 1923)	cu	PN		15
Cryptoxyleborus gracilior Browne, 1984	cu	PN		22,28
Eccoptopterus spinosus (Olivier, 1795)	cu	PN		15
Euwallacea barbatus (Hagedorn, 1910)	cu	AU,PN		15,28

Euwallacea piceus Motschulsky, 1863	cu	PN		15
Euwallacea wallacei (Blandford, 1896)	cu	PN		49
Xyleborinus linearicollis (Schedl, 1937)	an	BR	br	16,21,23,48
Xyleborinus sentosus (Eichhoff, 1868)	an	BR		7,21,23,45,48
Xyleborus adelographus Eichhoff, 1868	an	BR	se	16,21,23,48
Xyleborus affinis Eichhoff, 1868	an,cu	BR,AU		16,21,23,45,48
Xyleborus andrewesi (Blandford, 1896)	cu	PN		15
Xyleborus ferrugineus (Fabricius, 1801)	an	BR	br,se	7,21,23,48
Xyleborus gratiosus Schedl, 1975	cu	PN		28
Xyleborus nitellus Browne, 1984	cu	PN		22
Xyleborus perforans (Wollaston, 1857)	cu,hu,	AU,PN		7,15
Xyleborus perplexus Schedl, 1969	cu	PN		28
Xyleborus similis; Ferrari, 1867	cu	AU		28
Xyleborus volvulus (Fabricius, 1775)	an	BR		16,21,23,48
***Xylosandrus morigerus* (Blandford, 1894)**	**cu**	**PN**		**49**
Xylosandrus pseudosolidus Schedl, 1936	cu	AU		28
Lucanidae				
Sclerognathus fairmairei Parry	ar	CH		39
Megalopodidae – Palophaginae				
Palophagoides vargasorum Kuschel, 1996	ar	CH	st	34
Palophagus australiensis Kuschel, 1990	cu	AU		34
Palophagus bunyae Kuschel, 1990	bi	AU	se	34
Melandryidae				
Eudircaea laticornis Champion, 1916	an	BR	br	44
Megapsilaphus sexnotatus (Champion, 1916)	an	BR	br	44
Nemonychidae – Rhinorhynchinae				
Aragomacer grayi Kuschel, 1994	cu	PN		31
Aragomacer leai Kuschel, 1994	cu	AU		31
Aragomacer munus Kuschel, 1994	hu	PN		31
Aragomacer papuae Kuschel, 1994	cu	PN		31
Aragomacer uniformis Kuschel, 1994	cu	AU		31
Basiliogeus prasinus Kuschel, 1994	bi	AU		31
Basiliogeus striatopunctatus (Lea, 1926)	cu	AU		31
Basiliorhinus araucariae Kuschel, 1994	bi	AU		31
Brarus mystes Kuschel, 1997	an	BR	st	37,44
Bunyaeus eutactae Kuschel, 1994	cu	AU		31
Bunyaeus monteithi Kuschel, 1994	bi	AU		31
Eutactobius puellus Kuschel, 1994	cu	AU		31
Mecomacer collaris (Voss, 1952)	ar	CH	st	35,40
Mecomacer hirticeps Kuschel, 1954	ar	CH	st	35,40
Mecomacer ruficornis Kuschel, 1955	ar	CH	st	35,40
Mecomacer scambus Kuschel, 1954	ar	CH	st	35,40
Notomacer araucariae Kuschel, 1994	br	NC		31
Notomacer eximius Kuschel, 1994	cu	AU		31
Notomacer hirtulus Kuschel, 1994	br	NC		31
Notomacer reginae Kuschel, 1994	cu	AU		31
Notomacer zimmermani Kuschel, 1994	cu	AU		31
Notomacer caledonicus Kuschel, 1994	co	NC		31
Rhynchitomacerinus kuscheli (Voss, 1952)	ar	CH	st	35,40
Rhynchitoplesius eximius (Voss, 1937);	an	BR	st	26,37
Nitidulidae				
Conotelus sp.	an	BR		26
Oedemeridae				
Copidita sp.	an	BR		44
Silvanidae				
Ahasverus sp.	an	BR		44

References

Alonso-Zarazaga MA, Lyal CHC (1999) A world catalogue of families and genera of Curculionoidea (Insecta: Coleoptera) (Excepting Scolytidae and Platypodidae). Barcelona, Entomopraxis, 315 p

Barreto MR, Dos Anjos N, De Souza MP (1996) Occorrência de *Spermologus rufus* Boheman (Coleoptera: Curculionidae) em sementes de *Araucaria angustifolia*. An Soc Entomol Bras 25: 567-568

Barriga JE, Curkovic T, Fichet T, Henriquez JL, Macaya J (1993) Nuevos antecedentes de coleopteros xilofagos y plantas hospedeiras en Chile, con una recopilacion de citas previas. Rev Chilena Entomol 20: 65-91

Bright DE, Skidmore RE (1997) A catalog of Scolytidae and Platypodidae (Coleoptera), Supplement 1 (1990-1994). Ottawa, NRC Research Press, VII+368p

Browne FG (1984) More new species of Scolytidae (Coleoptera) from Papua New Guinea. S Pac J Nat Sci 6: 86-102

Costa C, Vanin SA, Casari-Chen SA (1988) Larvas de Coleoptera do Brasil. São Paulo, Mus Zool, Univ São Paulo, FAPESP, 282 p

Galileo MHM (1987) Sistemática das tribos Meroscelisini e Anacolini (Coleoptera, Cerambycidae, Prioninae) nas américas. I. Meroscelisini. Rev Bras Entomol 31: 141-367

Gray B (1968) Forest tree and timber insect pests in the territory of Papua and New Guinea. Pacific Insects 10: 301-323

Gray B (1974) Observations on insect flight in a tropical forest plantation. IV. Flight activity of Scolytidae (Coleoptera). Z angew Entomol 75: 178-186

Hawkeswood TJ (1990) Observations on the biology, host plants and immature stages of *Dihammus tincturatus* Pascoe (Coleoptera, Cerambycidae, Lamiinae) in Papua New Guinea. Part 1: General biology and host plants. Giorn Ital Entomol 5: 95-101

Hoffmann M (1981) Notas sobre a biologia e ontogenia de *Leptostylus perniciosus* Monné & Hoffmann (Coleoptera, Cerambycidae, Lamiinae). Rev bras Ent 25: 265-269

Klein Koch C, Waterhouse DF (2000) The distribution and importance of arthropods associated with agriculture and forestry in Chile. ACIAR Monograph 68: 1-234

Kuschel G (1994) Nemonychidae of Australia, New Guinea and New Caledonia. In: Zimmermann EC (Hrsg), Australian Weevils (Coleoptera: Curculionoidea). Bd. I, CSIRO Publications, Melbourne, 563-699

Kuschel G (1998) The subfamily Anthribinae in New Caledonia and Vanuatu (Coleotpera: Anthribidae). NZ J Zool 25: 335-408

Kuschel G (2000) La fauna curculiónica (Coleoptera: Curculionoidea) de la *Araucaria araucana*. Rev Chilena Entomol 27: 41-51

Kuschel G, Leschen RAB, Zimmerman EC (2000) Platypodidae under scrutiny. Invertebrate Taxonomy 14: 771-805

Kuschel G, May BM (1990) Palophaginae, a new subfamily for leaf-beetles, feeding as adult and larva on araucarian pollen in Australia (Coleoptera: Megalopodidae). Invertebrate Taxonomy 3: 697-719

Kuschel G, May BM (1996) Discovery of Palophaginae (Coleoptera, Megalopodidae) on *Araucaria araucana* in Chile and Argentina. NZ Entomol 19: 1-13

Kuschel G, May BM (1997) A new genus and species of Nemonychidae (Coleoptera) associated with *Araucaria angustifolia* in Brazil. NZ Entomol 20: 15-22

Levey B (1978a) A new tribe, Epistomentini, of Buprestidae (Coleoptera) with a redefinition of the tribe Chrysochroini. Syst Entomol 3: 153-158

Levey B (1978b) A taxonomic revision of the genus *Prospheres* (Coleoptera: Buprestidae). Aust J Zool 26: 713-726

Lyal CHC (1993) Cryptorhynchinae (Insecta: Coleoptera: Curculionidae). Fauna of New Zealand 29: 1-307

Marinoni RC (1969) Revisão do Gênero *Taurorcus* (Coleoptera - Cerambycidae). Rev Flor 1: 51-63

Marshall GAK (1948) Five new weevils from Queensland (Coleoptera, Curculionidae). Ann Mag Nat Hist Zool Bot 11: 485-493

McKeown KC (1938) Descriptions of new species of Australian Cerambycidae (Coleoptera). Aust Zool 9: 173-179

Mecke R (2000) Two new species of cossonine weevils, *Araucarius kuscheli* spec. nov. and *A. crassipunctatus* spec. nov. (Coleoptera: Curculionidae) from Southern Brazil. Stud Neotrop Fauna & Environm 35: 195-199

Mecke R (2002) Insetos do Pinheiro Brasileiro – Insekten der Brasilianischen Araukarie – Insects of the Brazilian Pine. Tübingen, Attempto Service, 79 p

Mecke R (2004a) New species of *Pachycotes* Sharp and *Xylechinus* Chapuis (Coleoptera: Curculionidae: Scolytinae, Tomicini) from New Caledonian *Araucaria* spp. (Coniferales: Araucariaceae). NZ J Zool 31: 343-349

Mecke R (2004b) A new Brazilian bark beetle, *Xylechinosomus lucianae* sp. n. (Coleoptera, Curculionidae, Scolytinae, Tomicini), from *Araucaria angustifolia* (Conifera, Araucariaceae). Dtsch Entomolog Zeitschr 51: 217-220

Mecke R (2005) Spine-like tibial hairs - a homology between bark beetles (Coleoptera, Curculionidae, Scolytinae) and weevils of the tribe Araucariini (Coleoptera, Curculionidae, Cossoninae). Entomol General 28 (in press)

Mecke R, Galileo MHM (2004) A review of the weevil fauna (Coleoptera, Curculionoidea) of *Araucaria angustifolia* (Bert.) O. Kuntze (Araucariaceae) in South Brazil. Rev Bras Zool 21: 505-513

Mecke R, Galileo MHM, Engels W (2000) Insetos e ácaros associados à *Araucaria angustifolia* (Araucariaceae, Coniferae) no sul do Brasil. Iheringia, Série Zoologia 88: 165-172

Mecke R, Galileo MHM, Engels W (2001) New records of insects associated with *Araucaria* trees: Phytophagous Coleoptera and Hymenoptera and their natural enemies. Stud Neotrop Fauna & Environm 36: 113-124

Morrone JJ (1997) Weevils (Coleoptera: Curculionidae) that feed on *Araucaria araucana* (Araucariaceae) in southern Chile and Argentina, with an annotated checklist. Folia Entomol Mex 100: 1-14

Pedrosa-Macedo JH, Schönherr J (1985) Manual dos Scolytidae nos reflorestamentos Brasileiros. Universidade Federal, Curitiba, 71 p

Peredo H, Ososrio M, Cerda L (1980) Revision de la situacion sanitaria de *Araucaria araucana* en chile. In: IUFRO (Hrsg.), Problemas florestais do gênero *Araucaria*. Curitiba, Parana (Brasil) 252-254

Schedl KE (1964) On some Coleoptera of economic importance from New Guinea and Australia. Pacific Insects 6: 211-214

Schedl KE (1966a) Etwas über die Borkenkäfer der Araucarien - 239. Beitrag zur Morphologie und Systematik der Scolytoidea. Anz Schädlingsk 39: 42-45

Schedl KE (1966b) Neotropische Scolytoidea VIII - 238. Beitrag zur Morphologie und Systematik der Scolytoidea. Ent Arb Mus Frey 17: 74-128

Schedl KE (1972) Bark and Timber Beetles of the Pacific Islands. NZ J Sci 15: 265-272

Schedl KE (1976) Neotropische Scolytoidea XIII (Coleoptera) - 323. Beitrag zur Morphologie und Systematik der Scolytoidea. Entom Abh Staatl Mus Tierk Dresden 41: 49-92

Schönherr J (1994) Neue Borkenkäfer von Brasilien (Coleoptera, Scolytidae). Dtsch Entomol Z N F 41: 63-69

Schönherr J, Pedrosa-Macedo JH (1981) Scolytoidea in den Aufforstungen Brasiliens - Ein Beitrag zur Kenntnis der Borkenkäfer Südamerikas. Z angew Entomol 92: 48-61

Sequeira AS, Normark BB, Farrell BD (2000) Evolutionary assembly of the conifer fauna: distinguishing ancient from recent associations in bark beetles. Proc R Soc London B 267: 2359-2366

Sequeira AS, Farrell BD (2001) Evolutionary origin of Gondwanan interactions: How old are *Araucaria* beetle herbivores? Biol J Linn Soc 74: 459-474

Silva AGA, Gonçalves CR, Galvao DM, Gonçalves AJL, Gomes J, Silva MN, Simoni L (1968) Quarto catálogo dos insetos que vivem nas plantas do Brasil; seus parasitos e predadores. Ministério de Agricultura, Rio de Janeiro: 622 p

Stockey RA (1994) Mesozoic Araucariaceae: Morphology and systematic relationships. J Plant Res 107: 493-502

Vernalha MM (1967) Uma nova praga da *Araucaria angustifolia* (Bert.) O. Kuntze no estado do Paraná. Rev Esc Agron Vet Univ Fed Paraná 3: 139-141

Viana MJ (1965) Datos ecologicos de Scolytidae Argentinos (Coleoptera). Rev Soc Ent Arg 27: 119-130

Wood SL (1985) New synonymy and new species of bark beetles (Coleoptera: Scolytidae). Great Basin Naturalist 45: 266-275

Wood SL, Bright DE (1992) A catalog of Scolytidae and Platypodidae (Coleoptera), Part 2: Taxonomic Index. Great Basin Naturalist Memoirs, Provo, 13: 1-1553

Zajciw D (1962) Observações sôbre os insetos nocivos das plantas nos parques florestais do Instituto Nacional do Pinho, nos anos de 1961 e 1962. An Bras Econ Flor 14: 67-76