

Observations on the biology, host plants and immature stages of
Dihammus tinctoratus Pascoe
(Coleoptera: Cerambycidae: Lamiinae)
in Papua New Guinea. Part 1. General biology and host plants

by

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Abstract - Observations on the biology and host plants of the tropical longicorn beetle *Dihammus tinctoratus* Pascoe (Cerambycidae: Lamiinae: Monochamini) are provided from recent field observations and collections from the East Sepik Province, Papua New Guinea. New larval host plants are recorded, viz. *Hevea brasiliensis* (Willd. ex A. Juss.) Muell. Arg. (Euphorbiaceae), *Plumeria acutifolia* Poir. (Apocynaceae), *Spathodea campanulata* Beauv. (Bignoniaceae) and *Ficus* sp. (Moraceae). Other previously recorded larval hosts in Papua New Guinea include *Araucaria cunninghamii* Ait. ex D. Don (Araucariaceae), *Anisoptera polyandra* Bl. [= *A. thurifera* (Bl.) Bl.] (Dipterocarpaceae) and *Pinus patula* Schlecht. & Cham. (Pinaceae). These data indicate that *D. tinctoratus* is polyphagous and has adapted to feed on the wood of a wide variety of tree species from non-related families. Some of the above-mentioned plant hosts, e.g. *Plumeria acutifolia*, *Hevea brasiliensis* and *Spathodea campanulata*, are introduced plants to Papua New Guinea. In the Passam area, East Sepik Province, adults are nocturnal but in other areas of Papua New Guinea they may be diurnally active on leaves and fallen logs. The larvae appear to prefer the smaller diameter branches/stems of the host plants. All of the known host plants have either resin or latex in the wood/bark which are attractive to the adults and are probably the main energy/nutrient sources for the developing larvae.

Riassunto - Osservazioni sulla biologia e le piante ospiti del cerambicide tropicale *Dihammus tinctoratus* (Lamiinae, Monochamini) da recenti studi e raccolte effettuati in Nuova Guinea. Risultano nuovi ospiti larvali *Hevea brasiliensis* (Euphorbiaceae), *Plumeria acutifolia* (Apocynaceae), *Spathodea campanulata* (Bignoniaceae), *Ficus* sp. (Moraceae); già erano note *Araucaria cunninghamii* (Araucariaceae), *Anisoptera polyandra* (= *A. thurifera*) (Dipterocarpaceae) e *Pinus patula* (Pinaceae). La specie è dunque polifaga, adattata a cibarsi del legno di un'ampia varietà di alberi appartenenti a famiglie non correlate; alcune delle piante ospiti sopra menzionate (*Plumeria acutifolia*, *Hevea brasiliensis*, *Spathodea campanulata*) sono state introdotte in Nuova Guinea. Presso Passam (East Sepik Province) gli adulti sono notturni, ma in altre aree dell'isola possono essere scorti in attività durante il giorno su foglie e tronchi caduti. Le larve sembrano preferire tronchi e rami di ridotte dimensioni. Tutte le piante ospiti note contengono resina o lattice nel legno e/o nella corteccia in grado di attrarre gli adulti e probabilmente principali risorse energetiche/nutritive per le larve.

INTRODUCTION

Dihammus tinctoratus Pascoe (Cerambycidae: Lamiinae: Monochamini) (fig. 1) is a medium-sized longicorn beetle from northern Papua New Guinea and Irian Jaya. Adults measure mostly about 20-25 mm in total body length and are dark chocolate-brown in colour, with the elytra having a pale grey-brown pubescence and a broad band of chocolate-brown below the humerus and

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a smaller area of dark brown near the lateral margins of the elytra towards the apex. Previous biological notes on this species have been provided by GRAY & WYLIE (1974). The species was keyed using GRESSITT (1952). Further biological observations are provided here (the larva and pupa will be described in the second part of this paper). All collections and measurements have been undertaken by the author in northern Papua New Guinea during 1989. This is the second in a series of papers on the biology and host plants of Papua New Guinean *Cerambycidae*, the first being HAWKESWOOD & DAUBER (1990).

OBSERVATIONS

During the night of 23 March 1989 (c. 1930 hrs), one adult was collected resting on a dead branchlet of a rainforest shrub at the back of a local residence at Passam, East Sepik Province, Papua New Guinea (3°48'S, 143°35'E). The adult had been attracted most likely to bright house lights in the near vicinity. It stridulated and attempted to bite when handled. The dimensions of this specimen are shown in table 1.

On 26 March 1989, one adult was collected from a pupal chamber at the base of a fallen branch (sapling?) of *Spathodea campanulata* Beauv. (*Bignoniaceae*) in secondary rainforest near a clearing adjacent to the Passam National High School. The branch (4-5 cm in diameter) had rested on the ground for a considerable amount of time and decay was well advanced underneath the bark. The pupal chamber measured 57 mm long, 5-7 mm high and 8-12 mm wide. The beetle had been attacked recently by large numbers of small reddish-brown ants (*Formicidae*) which had invaded the chamber and removed all of the beetle's legs, the antennae (except for the basal segments), the apical half and lateral margins of the elytra and most of the abdomen. Despite this damage, the beetle was still alive and active; it stridulated when removed from the pupal chamber and attempted to bite fiercely when handled. The dimensions of this specimen are shown in table 1.

On 6 May 1989 five last instar larvae and two pupae of *D. tincturatus* were collected from the dead, moist, partially decayed wood of *Plumeria acutifolia* Poir. (*Apocynaceae*), which had been cut from living trees growing on the Passam National High School grounds about 6-9 months earlier and were lying amongst grass, dead sticks and other debris near the banks of a creek running through the school grounds. One of the pupae developed into an adult 4 days later on 10 May and took about 4.5 days to reach full adult coloration. The other pupa developed into an adult on 14 May and took 5 days to reach full adult coloration. A dead, partially decayed adult beetle was also found in another pupal cell which confirmed the identity of the collected material at that time. The dimensions of the bred adults are provided in table 1 and the sizes of the pupal cells constructed by the larvae in the *P. acutifolia* wood are provided in table 2. The *Plumeria* branches measured mostly 5-6 cm in diameter and possessed a bark layer of 1.5-2 mm thick. The head end of the pupae was facing in an upward direction (in relation to the standing tree) and both were resting more or less parallel to the longitudinal axis of the branches. Close examination of the infested wood indicated the following: (a) upon emerging from the eggs (presumably laid by the female beetle under or in the thin bark) the larvae feed upon the vascular cambium layer, chewing into the underlying sapwood of the branches to form irregular, shallow galleries about 1-2 mm deep, usually tightly and completely packed with dry, fine powdery frass behind the larvae; (b) upon completion of feeding, the larvae apparently remain in the sapwood below the bark and form more or less straight pupal chambers approximately parallel with the grain of the wood; (c) during completion of the pupal chamber, the entrance hole is tightly plugged by thin strips of wood (3-7 mm in length) for a length of about 10-25 mm in the tunnel behind the larva; (d) occasionally a few, rounded faecal pellets may be deposited by the larvae in the pupal cells; (e) emergence of the adults is accomplished by gnawing a cylindrical tunnel through the wood and exiting through a circular hole measuring about 7-9 mm in diameter, and (f)

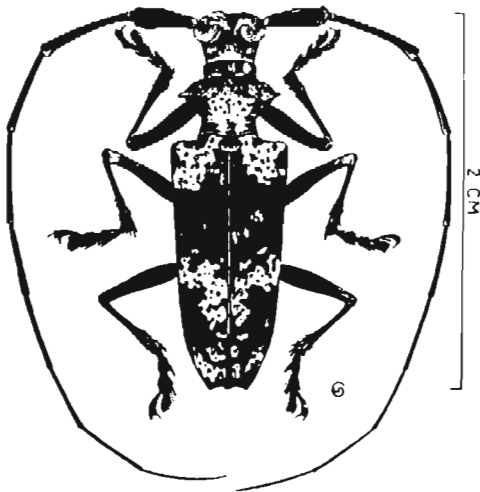


Fig. 1: Adult of *Dihammus tincturatus* Pascoe (from GRAY & WYLIE, 1974: 69).

the central pith area of the wood was not utilized by *D. tincturatus* because in most of the branches, the pith had been completely eaten away by ants and termites. One last instar larva collected on 6 May 1989, from a *P. acutifolia* branch (4.5-5 cm diameter) pupated in its cell on 12 May 1989 and the adult emerged on 3 June 1989, after spending 22 days in the pupal stage; the adult took 5 days to reach full adult coloration. The dimensions of the adult are provided in table 1.

On 28 May 1989, one pupa was cut from the end of a fallen log of rubber tree [*Hevea brasiliensis* (Willd. ex A. Juss.) M. A. (*Euphorbiaceae*)]. The log measured about 13-15 cm in diameter and was situated amongst low undergrowth vegetation in an old rubber plantation near Passam. The pupa was situated about 5 mm below the bark layer in the sapwood in a pupal cell measuring 63 mm long, 12-

13 mm wide and 8-9 mm high. The adult emerged on 5 June and took 6 days to reach full adult coloration. The dimensions of this specimen are provided in table 1.

On 15 July 1989, another pupa was collected from a rotten log of *H. brasiliensis* in the same rubber plantation. The specimen was preserved in alcohol and its size measurements are provided in table 3.

On 17 September 1989, a teneral adult was collected from the base of a dead *Ficus* sp. (*Moraceae*) in rainforest hilly country near Passam. The trunk of the tree measured 14-16 cm in diameter at and near the base where the beetle infestation was present. The pupal cell measured about 35 mm long, 7-10 mm wide and 6-8 mm high and was situated about 10 mm below the bark layer in the sapwood of the tree. This area was also heavily infested with termites. The adult was alive and active once exposed from the dead timber. Two larvae were also collected from the dead wood and are preserved in alcohol. The dimensions of the adult are provided in table 1.

On 27 September 1989, 3 last instar larvae, 2 earlier instar larvae and one pupa were collected from the dead branches (8-10 cm diameter) of *Plumeria acutifolia* Poir. (*Apocynaceae*) near the rubber plantation at Passam. The branches had been cut at least 10 months earlier from surrounding living trees growing in gardens. The larval and pupal specimens were preserved in alcohol for further study and the pupal measurements are provided in table 3. Sizes of some pupal cells measured are provided in table 2.

DISCUSSION

Dihammus tincturatus adults are mostly nocturnal and in the Passam study, they have not been observed during daylight hours in the field. GRAY & WYLIE (1974) also noted that adults were attracted to houselights at night at Bulolo, Morobe Province, Papua New Guinea. However, in the

Table 1: Size measurements of adult *Dihammus tincturatus* Pascoe collected during 1989 from the Passam area, East Sepik Province, Papua New Guinea (all measurements listed are in mm, + no measurements undertaken due to damaged antennae of these specimens).

Date collected	Sex	Total body length	Pronotal width	Pronotal length	Elytral width at base	Elytral length	Ratio of elytral length to elytral width	Antennal length	Ratio of antennal/body length
23 March	male	20.2	5.2	3.8	5.7	13.8	2.42	36.0	1.78
26 March	male	20.0	5.4	3.6	6.2	14.0	2.26	+	+
10 May	male	19.5	5.2	3.5	6.2	13.7	2.21	33.5	1.72
3 June	male	19.2	4.8	3.2	5.4	13.4	2.48	32.5	1.69
17 September	male	19.5	5.0	4.4	5.4	13.4	2.48	34.5	1.77
Mean		19.7	5.1	3.7	5.8	13.7	2.37	34.1	1.74
Standard Deviation		0.5	0.2	0.4	0.4	0.3	0.13	1.5	0.04
14 May	female	26.2	6.2	5.2	7.2	17.2	2.39	+	+
5 June	female	22.0	6.6	4.5	6.8	15.0	2.21	35.5	1.61
Mean		24.1	6.4	4.9	7.0	16.1	2.30	35.5	1.61
Standard Deviation		3.0	0.3	0.5	0.3	1.6	0.13	+	+

Table 2: Size measurements of pupal cells of *Dihammus tincturatus* Pascoe from dead main stems and branches of *Plumeria acutifolia* Poir. (*Apocynaceae*) collected during 1989 from the Passam area, East Sepik Province, Papua New Guinea (all measurements listed are in mm).

Date	Diameter of wood	Pupal cell			Life-stage present
		Length	Width	Height	
6 May	52-55	52	10-15	7-8	Pupa
	37-42	44	16-18	7-8	Larva
	36-38	72	13-15	5-6	Larva
	50-52	55	12-16	5-6	Pupa
	32-35	57	8-12	5-7	Larva
	36-40	61	6-7	8-9	Larva
27 September	45-46	82	15-17	5-6	Larva
	32-35	42	8-10	10-12	None
	15-16	40	10-13	10-12	Pupa
	23-25	45	8-10	10-12	None

Table 3: Size measurements of pupae of *Dihammus tincturatus* Pascoe collected during 1989 from the dead wood of *Hevea brasiliensis* (Willd. ex A. Juss.) Muell. Arg. (*Euphorbiaceae*) and *Plumeria acutifolia* Poir. (*Apocynaceae*) from the Passam area, East Sepik Province, Papua New Guinea (all measurements listed are in mm, N.B. all specimens are preserved and housed in the collections of the author).

Date	Sex	Head		Pronotum		Body Length	Abdominal Width	Host
		Length	Width	Length	Width			
6 May	female	5.6	5.0	4.5	7.0	24.8	7.8	<i>P. acutifolia</i>
15 July	male	3.8	3.6	3.8	5.6	21.6	5.8	<i>H. brasiliensis</i>
27 September	female	5.5	4.8	4.6	6.2	25.4	8.0	<i>P. acutifolia</i>
Mean		4.9	4.5	4.3	6.3	23.9	7.2	
Standard Deviation		1.0	0.8	0.4	0.7	2.0	1.2	

Watut Valley, Morobe Province, adults have been collected on the leaves of a shrub, and at Kui and Kar Kar Island, Madang Province on fallen logs, presumably during the daytime (GRAY & WYLIE,

1974). Further observations are needed on the behaviour of the adults.

The larvae appear to require at least one year for development in dead wood, since all of the host logs/branches of *Spathodea*, *Hevea* and *Plumeria* examined in the Passam area, had been cut from living material about 9-12 months earlier and had remained rotting on the ground with developing larvae over that time. The diameter of the dead wood utilized by *D. tinctoratus* varied with the host plant species but was generally between 4 and 15 cm, viz. 4-5 cm for *Spathodea campanulata*, 4.5-6 cm for *Plumeria acutifolia*, 13-15 cm for *Hevea brasiliensis* and 14-16 cm for *Ficus* sp. It should be noted that the maximum diameter of trunks/major branches of these plant species is much greater than that of the logs/branches utilized by *D. tinctoratus*, viz. maximum trunk diameter of living *S. campanulata* trees is about 40-50 cm, for *P. acutifolia* 10-15 cm, for *H. brasiliensis* 30-40 cm and for *Ficus* sp. 15-20 cm. GRAY & WYLIE (1974) also noticed that *D. tinctoratus* often infests the smaller, moribund stems and fallen branches (less than 15 cm in diameter at breast height) of *Araucaria cunninghamii* Ait. ex D. Don (*Araucariaceae*) in the Bulolo district, Morobe Province. Also GRAY & WYLIE (1974) reared many adults of *D. tinctoratus* from the small, fallen stems of *Pinus patula* Schlecht. & Cham. (*Pinaceae*), so it does appear likely that this beetle prefers the smaller diameter branches/stems of the host plants for development. In addition, the larvae of *D. tinctoratus* are not deep borers; the pupal cells examined at Passam were usually constructed only 5-10 mm below the bark layer of the host wood.

Although there have been relatively few adult specimens examined in the present study, it is evident that male *D. tinctoratus* are smaller than females (table 1). There is also some evidence for size differences between the two sexes in the pupae (table 3). However, sexual dimorphism in colour pattern was not detected.

The adults were noted to stridulate vigorously when handled and to bite fiercely.

A summary of larval host plants for some *Dihammus* species is provided in table 4. Of the many species in the genus (well over 50), only two have 7 or more larval hosts recorded for them, viz. *D. tinctoratus* Pascoe and *D. vastator* (Newman). For both these species, it is somewhat evident that in natural plant communities, *Ficus* spp. (*Moraceae*) are the preferred hosts and in human-influenced / disturbed habitats, these *Dihammus* shift their preferences to other plants belonging to non-related plant families. Like most *Ficus* spp., many of these alternative food plants contain milky latex under the bark, e.g. *Hevea* (*Euphorbiaceae*), *Plumeria* (*Apocynaceae*) and *Artocarpus* (*Moraceae*) which contain sugars and nutrients necessary for the development of these large beetles. Other plants such as *Anisoptera* (*Dipterocarpaceae*), *Pinus* (*Pinaceae*), *Araucaria* (*Araucariaceae*) and *Spathodea* (*Bignoniaceae*) have vertical gum canals in the wood which exude strong-smelling, dark-coloured resin upon injury to the stems to which the adults may be attracted. It appears that it is this latex or resin which dries in the dead wood which is utilized by the larvae of *D. tinctoratus* and other species for development.

The biology and host plants of *Dihammus* species, although they are better known than those of other tropical *Lamiinae*, are still poorly known and it is most likely that a broader larval host list will be compiled in the future for most or all of the species once further detailed field work is undertaken.

ACKNOWLEDGEMENTS

I would like to thank Dr F. R. Wylie, Queensland Forest Service, Indooroopilly, Brisbane, Queensland, Australia, for valuable assistance in obtaining references on the Papua New Guinea fauna and to Mr M. De Baar of the same Department for allowing me to examine the beetle collections in his care. Thanks are also expressed to Mr C. E. Chadwick of Sydney, New South Wales, Australia for the FROGGATT reference. Finally I would like to thank my wife Vilma for much needed assistance during our 9-month stay in Papua New Guinea during 1989.

Table 4: Distribution, host plant preferences and references for some *Dihammus* species from the Pacific area (? indicates an unconfirmed/doubtful record; * indicates an introduced, non-indigenous plant species. ** A full reference list of host plants for *D. vastator* (Newman) is not provided here; a more extensive review of the biology, host plants and life-stages of this *Dihammus* and other species will be provided elsewhere by the author at a later date).

Species	Distribution	Host plants	References
<i>Dihammus acanthias</i> (Pascoe)	Australia (New South Wales)	<i>Ficus</i> sp. (<i>Moraceae</i>)	WEBB <i>et al.</i> (1988)
<i>Dihammus aestheticus</i> (Olliff)	Australia (Queensland)	<i>Ficus</i> sp. (<i>Moraceae</i>) <i>Flindersia brayleyana</i> F. Muell. (<i>Moraceae</i>)	WEBB (1987) HOCKEY & DE BAAR (1988)
<i>Dihammus argentatus</i> (Aurivillius)	Australia (New South Wales)	* <i>Eupatorium adenophorum</i> Spreng. (<i>Asteraceae</i>)	DUFFY (1963), WEBB (1987)
<i>Dihammus artius</i> (Olliff)	Australia (New South Wales)	* <i>Eupatorium adenophorum</i> Spreng., <i>Helichrysum diosmifolium</i> (Vent.) Sweet (<i>Asteraceae</i>)	WEBB (1987)
<i>Dihammus australis</i> (Boisduval)	Australia (Queensland), Papua New Guinea, Irian Jaya and other Pacific Islands	<i>Terminalia kaernbachii</i> Warb. (<i>Combretaceae</i>) * <i>Theobroma cacao</i> L. (<i>Sterculiaceae</i>) <i>Araucaria cunninghamii</i> Ait. ex D. Don (<i>Araucariaceae</i>), <i>Anisoptera polyandra</i> Bl. (<i>Dipterocarpaceae</i>)	DUFFY (1963) SZENT-IVANY (1961) GRAY & WYLIE (1974)
<i>Dihammus fasciatus</i> (Montouzier)	Australia (Queensland), Solomon Islands, Papua New Guinea, Lord Howe Island, Woodlark Island	<i>Artocarpus altilis</i> (Park.) Fosberg ? <i>Ficus watkinsiana</i> F. M. Bail. <i>Ficus</i> sp. (<i>Moraceae</i>)	GRESSITT (1956) WEBB (1987), HOCKEY & DE BAAR (1988) HOCKEY & DE BAAR (1988)
<i>Dihammus holotephrus</i> (Boisduval)	Australia (Queensland, Northern Territory), New Hebrides, Western Samoa, Woodlark Island	* <i>Theobroma cacao</i> L. (<i>Sterculiaceae</i>) <i>Eucalyptus tessellaris</i> F. Muell. (<i>Myrtaceae</i>), ? <i>Alpinia</i> sp. (<i>Zingiberaceae</i>)	DUMBLETON (1951), DUFFY (1963) WEBB (1987)
<i>Dihammus mixtus</i> (Hope)	Australia (Queensland, Northern Territory)	<i>Excoecaria agallocha</i> L. (<i>Euphorbiaceae</i>)	DUFFY (1963)
<i>Dihammus tincturatus</i> Pascoe	Papua New Guinea, Irian Jaya	* <i>Pinus patula</i> Schlecht. & Cham. (<i>Pinaceae</i>), <i>Araucaria cunninghamii</i> Ait. ex D. Don (<i>Araucariaceae</i>), <i>Anisoptera thurifera</i> (Blanco) Bl. (= <i>A. polyandra</i> Bl.) (<i>Dipterocarpaceae</i>), * <i>Hevea brasiliensis</i> (Willd. ex Adr. Juss.) Muell. Arg. (<i>Euphorbiaceae</i>), * <i>Spathodea campanulata</i> Beauv. (<i>Bigoniaceae</i>), * <i>Plumeria acutifolia</i> Poir. (<i>Apocynaceae</i>), <i>Ficus</i> sp. (<i>Moraceae</i>)	GRAY & WYLIE (1974) HAWKESWOOD (this paper)

** <i>Dihammus vastator</i> (Newman)	Australia (Queensland, New South Wales, Victoria, South Australia), Lord Howe Island, Samoa, Philippines	<i>Ficus</i> sp. (<i>Moraceae</i>), * <i>Wistaria</i> sp. (<i>Fabaceae</i>) * <i>Ficus elastica</i> Roxb. (<i>Moraceae</i>), <i>Pittosporum undulatum</i> Vent. (<i>Pittosporaceae</i>) <i>Elaeocarpus</i> sp. (<i>Elaeocarpaceae</i>), * <i>Pinus elliotii</i> Engelm. (<i>Pinaceae</i>), * <i>Salix</i> sp. (<i>Salicaceae</i>)	FROGGATT (1930) WEBB <i>et al.</i> (1988) HOCKEY & DE BAAR (1988)
<i>Dihammus</i> sp. (near <i>Dihammus trigonus</i> Gressitt)	Papua New Guinea	* <i>Theobroma cacao</i> L. (<i>Sterculiaceae</i>)	SZENT-IVANY (1961)
<i>Dihammus</i> sp. (unidentified)	Solomon Islands	<i>Eucalyptus deglupta</i> Bl. (<i>Myrtaceae</i>)	BIGGER (1980, 1982)

REFERENCES

- BIGGER M., 1980 - Forest pests of the Solomon Islands. No. 2. *Dihammus* sp. on *Eucalyptus deglupta* - *Forestry Division, Ministry of Natural Resources, Honiara*: 1-2.
- _____, 1982 - Insect pests associated with forestry plantations in the Solomon Islands - *Comm. For. Rev.*, 61: 249-257.
- DUFFY E. A. J., 1963 - A monograph of the immature stages of Australasian timber beetles (*Cerambycidae*) - *British Museum of Natural History, London*.
- DUMBLETON L. J., 1951 - List of insect pests in Western Samoa and Cook Islands - Submitted to P.A.Q. Conference, Suva (paper not seen, cited from DUFFY, 1963).
- FROGGATT W. W., 1930 - The Fig Tree Longicorn beetle - *Aust. Nat.*, 8: 6-8.
- GRAY B. & WYLIE F., 1974 - Forest tree and timber insect pests of Papua New Guinea. II - *Pacific Insects*, 16: 67-115.
- GRESSITT J. L., 1952 - Longicorn beetles from New Guinea and the South Pacific (*Coleoptera, Cerambycidae*). Part III - *Ann. Ent. Soc. Amer.*, 45: 44-58.
- _____, 1956 - Insects of Micronesia. *Coleoptera, Cerambycidae* - *Insects of Micronesia*, 17: 61-183.
- HAWKESWOOD T. J. & DAUBER D., 1990 - Observations on *Ceresium pachymerum* (Pascoe) (*Coleoptera: Cerambycidae*) from Papua New Guinea - *Bull. Annls. Soc. R. Belge Ent.*, 126: 131-136.
- HOCKEY M. J. & DE BAAR M., 1988 - New larval foodplants and notes from some Australian *Cerambycidae* (*Coleoptera*) - *Aust. Ent. Mag.*, 15: 59-66.
- SZENT-IVANY J. J. H., 1961 - Insect pests of *Theobroma cacao* in the Territory of Papua New Guinea - *Papua New Guin. Agric. Gaz.*, 13: 127-147.
- WEBB G. A., 1987 - Larval host plants of *Cerambycidae* (*Coleoptera*) held in some Australian insect collections - *Forestry Commission of New South Wales Technical Paper No. 38*: 1-19.
- WEBB G. A., WILLIAMS G. A., DEKEYSER R., 1988 - Some new and additional larval host records for Australian *Cerambycidae* (*Coleoptera*) - *Aust. Ent. Mag.*, 15: 95-104.

Mailed 27. VII. 1990