

Current Status of the Taxonomy of *Hypsipyla* Ragonot (Pyralidae: Phycitinae)

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Abstract

The current taxonomic knowledge about *Hypsipyla* Ragonot is summarised, the gaps in knowledge are identified and an outline is given about how these questions should be addressed. Eleven species of *Hypsipyla* are currently recognised, four from the New World and seven from the Old World. The taxonomy of the New World fauna is well documented, with biological information available on the main pest species *Hypsipyla grandella* (Zeller) as well as on *Hypsipyla ferrealis* (Hampson) and two species of the related genus *Sematoneura* Ragonot, all feeding on Meliaceae. The taxonomy of the Old World species of *Hypsipyla* is poorly understood, with several species known only from the types, and the status of the different populations of the pest species *Hypsipyla robusta* (Moore) remains unresolved. Two closely related genera (*Catopyla* Bradley, 1968, and *Eugyroptera* Bradley, 1977) with larvae feeding on Meliaceae have been described from Nigeria. In Australia, *H. robusta* or a very closely related species has been reared from fruit of the meliaceous mangrove *Xylocarpus granatum* König. Ideally, Old World *Hypsipyla* should be revised using a combination of morphological and molecular methods, and based on comprehensive, reared material from Africa, Asia and Australia, including information on biology and pheromones.

THE TAXONOMY of *Hypsipyla* Ragonot was last summarised in a world-wide context by Entwistle (1967) in a review on shoot, fruit and collar borers of the Meliaceae for the Ninth British Commonwealth Forestry Conference, and by Bradley (1968) in the introduction to the description of two new African genera closely related to *Hypsipyla*. Both authors concluded that the New World fauna was reasonably well documented but that *Hypsipyla* in the Old World was in urgent need of study. Taxonomic studies on *Hypsipyla* and related phycitines feeding on Meliaceae have since been published for Costa Rica (Becker 1974a, b), but no progress has been made with respect to the Old World fauna of *Hypsipyla*. The current state of knowledge about *Hypsipyla* in the Oriental and Australian regions is reviewed here in the light of the taxonomic studies in Africa and Costa Rica, biological information about the pest species and unpublished observations from Australia.

Ragonot (1888) proposed the genus *Hypsipyla* for an Indian species, *Hypsipyla pagodella* Ragonot, 1888 (Figure 1), in a brief description without any biological information. However, Moore [1886] had already described the same species as *Magiria robusta* (in his 'Lepidoptera of Ceylon') (Figure 2) based on material from Sri Lanka and provided colour figures (Figure 3) of adult, larvae and pupae, and ended the description with the biological information 'larva feeds within the branchlets of mahogany'. Just a few years later, Olliff (1890) described *Epicrocis terebrans* Olliff, 1890, from Australia as 'a species of moth destructive to red cedar (*Toona ciliata* M. Roemer) and other timber trees', giving drawings of adult, wing venation and immature stages (Figure 4). In his world-wide monograph on the Phycitinae, Ragonot (1893) synonymised *pagodella* with *robusta*, included the New World species *Hypsipyla grandella* (Zeller 1848) in the genus and named a new species from Madagascar, *Hypsipyla scabrusculella* Ragonot, 1893, and provided coloured figures of all three species.

During the next 50 years, a number of additional species were described in scattered publications

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(Table 1), either as *Hypsipyla* or later to be referred to that genus, but there was no taxonomic review of the genus during that time. In his still exemplary volume *American Moths of the Subfamily Phycitinae* Heinrich (1956) revised *Hypsipyla* based on the four New World species and *pagodella*, the Indian type species of the genus. He pointed out that the genus *Sematoneura* Ragonot, 1888, is closely related and difficult to distinguish from *Hypsipyla*.



Figure 1. Female syntype of *Hypsipyla pagodella* Ragonot from India in the Paris Museum.



Figure 2. Female holotype of *Magiria robusta* Moore from Sri Lanka in The Natural History Museum, London.

The next round of revisions was prompted by field studies on the pest species of the genus, by life history studies on shoot and fruit borers in Meliaceae in Nigeria (Roberts 1966, 1968) and Costa Rica (Becker 1974b). A survey of Meliaceae, especially

their fruit, and comprehensive rearing of material led in both cases to the discovery of new species in genera closely related to *Hypsipyla* that feed on Meliaceae in a manner similar to *Hypsipyla*. From Nigeria, Bradley (1968) described two new genera with one species each, *Catopyla disorphaea* Bradley, 1968, and *Gyroptera robertsi* Bradley, 1968, the latter renamed *Eugyroptera robertsi* (Bradley 1968) as *Gyroptera* Bradley was found to be a junior homonym. Becker (1974a, b) reported from Costa Rica that *Sematoneura atrovynosella* Ragonot, 1888, the type species of the genus, is a fruit borer of *Cedrela tonduzii* C. de Candolle, and he described a new species, *Sematoneura grijpmai* Becker, 1974, from the fruit of *Cedrela odorata* L.

These field studies confirmed that there is one main pest species in each region, *grandella* in the New World and *robusta* in Africa, both of which attack a wide range of Meliaceae and feed in shoots as well as fruits, with *robusta* also found in flowers, and in bark in Nigeria (Roberts 1966, 1968). Other species of *Hypsipyla* may have a much narrower host range, with *ferrealis* in Costa Rica only found in fruit of *Carapa guianensis* Aublet (Becker 1974b). The status of *albipartalis* in Africa is not clear as despite reports of damage by this species from several east African countries, the single female type from the Congo in the Natural History Museum, London, is the only specimen available (Bradley 1968). Unlike observations from India (Beeson 1919, 1941) and Indonesia (Kalshoven 1926), where larvae are only occasionally recorded feeding on bark (Kalshoven 1926), in Nigeria *robusta* is commonly found boring in bark (Roberts 1966, 1968). Based on this contrast in biology, together with a different position of the signum in the female genitalia of the Nigerian population, Bradley (1968) suggested that *robusta* might comprise several geographic races or subspecies. This has not yet been resolved.

The Oriental/Australian species of *Hypsipyla* have not been revised since Ragonot's monograph in

Table 1. Species described as or later referred to *Hypsipyla*. The country from which the species was originally described and the reference for the original descriptions are included.

Oriental/Australian Regions	Africa	New World
<i>robusta</i> (Moore, [1886]); Sri Lanka	<i>robusta</i> (Moore [1886]); Sri Lanka	<i>grandella</i> (Zeller, 1848); Brazil
<i>pagodella</i> Ragonot, 1893; India	<i>pagodella</i> Ragonot, 1893; India	<i>cnabella</i> Dyar, 1914; Mexico
<i>terebrans</i> (Olliff, 1890); Australia	<i>terebrans</i> (Olliff, 1890); Australia	<i>dorsimacula</i> (Schaus, 1913); Costa Rica
<i>scabrusculella</i> Ragonot, 1893;	<i>scabrusculella</i> Ragonot, 1893;	<i>fluviatella</i> (Schaus 1913); Costa Rica
Madagascar	Madagascar	<i>ferrealis</i> (Hampson, 1929); Costa Rica
<i>elachistalis</i> Hampson, 1903; Sri Lanka	<i>albipartalis</i> (Hampson, 1910); Congo	
<i>rotundipex</i> Hampson, 1903; Sikkim	<i>ereboneura</i> Meyrick, 1939; Congo	
<i>debilis</i> Caradja, 1933; China		
<i>swezeyi</i> Tams, 1935; Samoa		

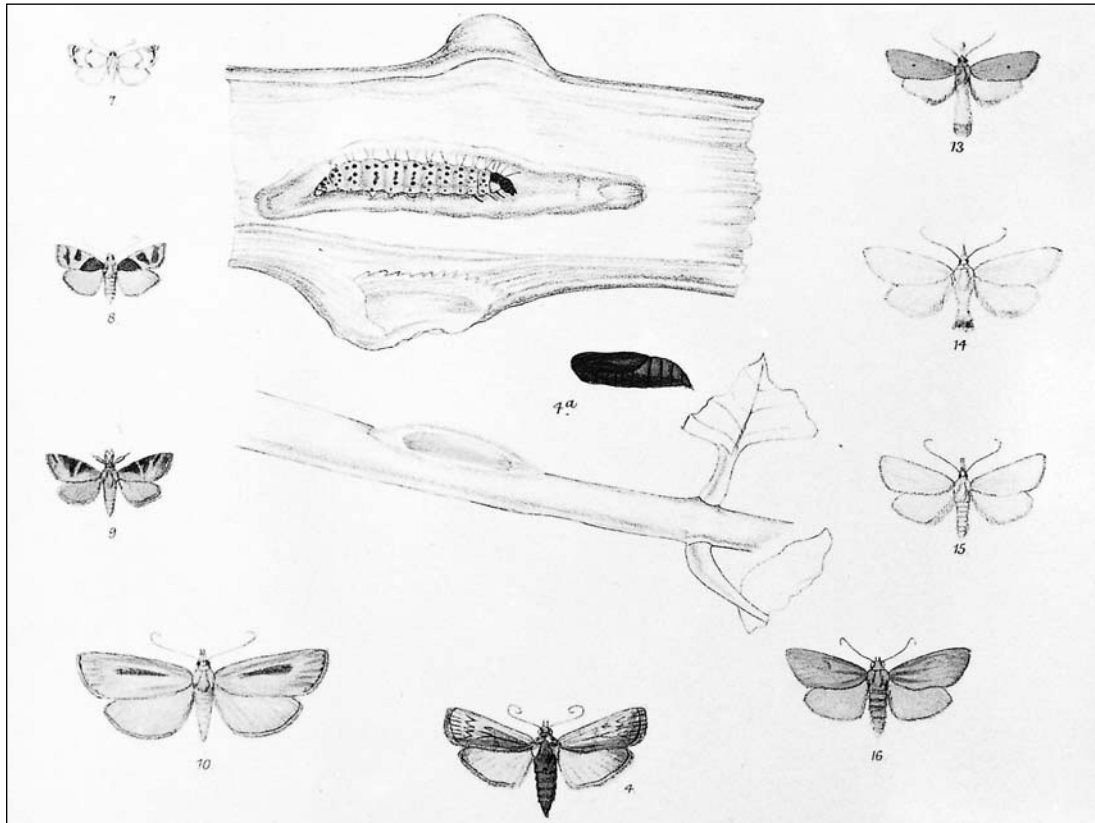


Figure 3. Original illustrations of adults and immature stages of *robusta* (numbered 4 and 4a above) in 'Lepidoptera of Ceylon' by Moore [1886].

1893. No information is available beyond the original description and the type material on the four species described since 1893 from the Oriental region and assigned by Bradley (1968) to *Hypsipyla* (Table 1). It is by no means clear that they are all correctly placed in *Hypsipyla*, or that others should not be included. The task is further complicated since several of the remaining types of *Hypsipyla* species are single females whose genitalia provide only very limited diagnostic characters. In Australia, *robusta* or an extremely similar-looking species has recently been reared by Paul Dixon (Australian Institute of Marine Science, Townsville) from fruit of the meliaceous mangrove *Xylocarpus granatum* König (Figure 5), leading to questions about a possible sister species to *robusta* or an alternative host for *robusta*. Adults of *Hypsipyla* are rarely encountered in the field, a fact already commented on by Beeson (1919) and confirmed by Paul Dixon (pers. comm.), and specimens are generally scarce in collections. The material available at present, even if

assembled from numerous museums, is insufficient to allow a satisfactory revision of the genus. Bradley (1968) concluded his remarks on the taxonomy of *robusta* by saying that taxonomic progress will depend on adequate series becoming available, with associated biological information. It is important that collaboration across several continents be established, to provide at last the material necessary to resolve the taxonomy of *Hypsipyla*.

A comprehensive revision of *Hypsipyla* in the Oriental/Australian region will have to address the following three questions. Firstly, the types of all species from the Oriental, Australian and African regions possibly associated with *Hypsipyla* will have to be examined to establish their identity. Several are females and an effort will have to be made to find males from close localities since their genitalia provide the taxonomically most meaningful information. Secondly, extensive collections of reared material from a wide range of Meliaceae will have to be studied, from both fruits and shoots, to establish

whether other closely related genera live on Meliaceae in the Oriental and Australian regions. Thirdly, to resolve the identity of the different populations of *robusta*, adequate material will have to be compared throughout the range of the species, from Africa, Madagascar, throughout Asia and Australia. Morphological studies may well have to be complemented with molecular and/or pheromone studies. In Australia in particular, biological observations and possibly a study of molecular markers will be required to establish the status of the population in fruits of *X. granatum*.

biological or integrated control of *robusta*. It is of importance to know whether the population in *X. granatum* fruit in Australia is the same as the one in shoots of *T. ciliata*, and whether the moths move between the two hosts. We have to know how different the populations of *robusta* on the different continents are if we want to use parasitoids or other organisms for biological control. We should also be aware as to whether there are species of other genera related to *Hypsipyla* living in Meliaceae in the Oriental and Australian regions. Phycitines are a notoriously difficult group that have long defied taxonomists, and *Hypsipyla* is no exception. The species, and often genera, look superficially very similar and the differences even in the genitalia may be minimal. However, a concerted approach combining morphological and molecular studies with information on biology and pheromones, based on long series from different populations across an adequate area, has a good chance of resolving the taxonomy of *Hypsipyla*, especially in the Old World where knowledge about the genus is particularly deficient.

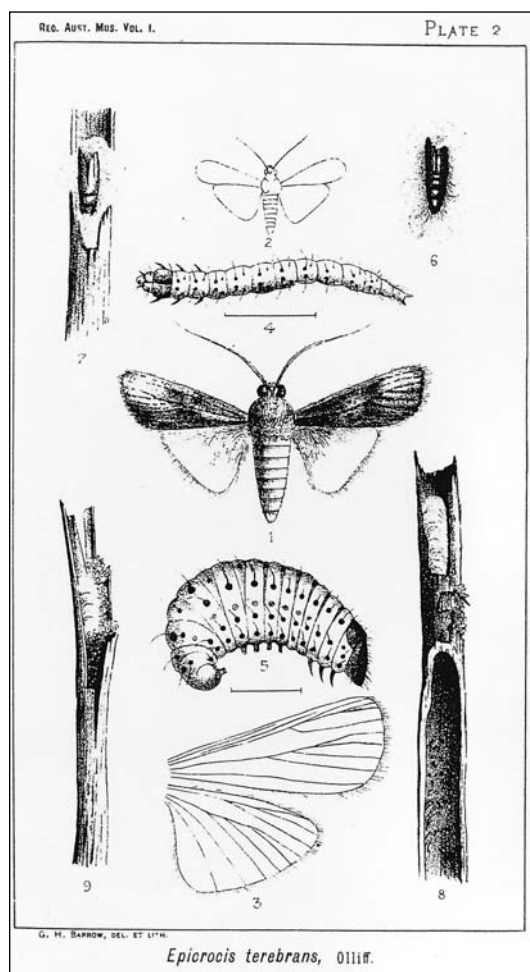


Figure 4. Original illustrations by Olliff (1890) of adults and immatures of *Epicrocis terebrans* Olliff from Australia.

The need to adequately understand the relationships of the various species of *Hypsipyla* and their biology is obvious if we want to consider any sort of



Figure 5. Cross-section of seed of *Xylocarpus granatum* König with cocoons and adult of *Hypsipyla* sp. from Crystal Creek, Daintree River (coll. Paul Dixon).

Acknowledgments

Grateful thanks are due to Mr M. Shaffer of The Natural History Museum, London, and Dr Joel Minet of the Muséum National d'Histoire Naturelle, Paris, for providing access to types of *Hypsipyla* and to Mr Paul Dixon of the Australian Institute of Marine Science, Townsville, for material of *Hypsipyla* sp. on *Xylocarpus* spp. and information on this species. I also thank the following colleagues of CSIRO Entomology for their help: Ms Manon Griffiths for supplying much of the taxonomic literature on *Hypsipyla*, Ms K.L. Smith for photography, and

Mr E.D. Edwards and Dr R.B. Floyd for helpful comments on the manuscript. Initial research on *Hypsipyla* was supported by Australian Biological Resources Studies, and a travel grant by RIRDC allowed my participation at the Workshop.

References

- Becker, V.O. 1974a. Studies on the shoot borer *Hypsipyla grandella* (Zeller) (Lep., Pyralidae). XXVI. A new genus and three new species of Microlepidoptera (Pyralidae and Gracillariidae) associated with *Carapa*, *Cedrela* and *Swietenia* in Costa Rica. *Turrialba*, 24(3): 332–335.
- Becker, V.O. 1974b. Microlepidópteros asociados con *Carapa*, *Cedrela* y *Swietenia* en Costa Rica. In: Whitmore, J.L., ed. Studies on the shoot borer *Hypsipyla grandella* (Zeller) (Lep., Pyralidae). Volume II. Turrialba, Costa Rica, IICA, Miscellaneous publications 101. 139 p.
- Beeson, C.F.C. 1919. The life history of the toon shoot and fruit borer, *Hypsipyla robusta* (Moore) (Lepidoptera; Pyralidae; Phycitinae) with suggestions for its control. *The Indian Forest Records*, 7 (7): 146–216.
- Beeson, C.F.C. 1941. The Ecology and Control of the Forest Insects of India and Neighbouring Countries. Vasant Press, Dehra Dun, India. 767 p.
- Bradley, J.D. 1968. Description of two new genera and species of Phycitinae associated with *Hypsipyla robusta* (Moore) on Meliaceae in Nigeria (Lepidoptera, Pyralidae). *Bulletin of Entomological Research*, 57: 605–613, pl. xxix–xxxi.
- Caradja, A. 1933. In: Caradja, A. and Meyrick, E., *Materialien zu einer Microlepidopteren-Fauna Kwangtung*. Deutsche Zeitschrift Iris, Dresden 47: 123–167.
- Dyar, H.G. 1914. Descriptions of new species and genera of Lepidoptera from Mexico. *Proceedings of the United States National Museum*, 47: 365–409.
- Entwistle, P.F. 1967. The current situation on shoot, fruit and collar borers of the Meliaceae. Oxford, Commonwealth Forestry Institute, 15 + iv p.
- Hampson, G.F. 1903. The moths of India. Supplementary paper to the volumes in 'The Fauna of British India'. Series II. Part IX. *The Journal of the Bombay Natural History Society*, 15: 19–37.
- Hampson, G.F. 1910. Zoological collections from Northern Rhodesia and adjacent territories: Lepidoptera Phalaenae. *Proceedings of the Zoological Society of London* 1910, 388–510.
- Hampson, G.F. 1929. XXXVIII. Five new species of Phycitinae (Lepidoptera, Pyralidae). *Annals and Magazine of Natural History Series* 10, Vol. 4, 351–353.
- Heinrich, C. 1956. American Moths of the Subfamily Phycitinae. *United States National Museum Bulletin* 207, i–viii, 1–581.
- Kalshoven, L.G.E. 1926. Beschadigungen, ziekten en plagen van mahonie (*Swietenia mahagoni* en *S. macrophylla*), aangeplant op Java. *Mededeelingen van het Instituut voor Plantenziekten* 69, 126 p.
- Meyrick, E. 1939. New Microlepidoptera, with notes on others. *Transactions of the Royal Entomological Society London*, 89: 47–62.
- Moore, F. 1884–87. *The Lepidoptera of Ceylon*, 3. London, L. Reeve & Co., xv + 578 p.
- Olliff, S. 1890. *Records of the Australian Museum*, 1: 32–35.
- Ragonot, E.L. 1888. *Nouveaux genres et espèces de Phycitidae et Galleriidae*. Paris, publié par l'auteur, 52 p.
- Ragonot, E.L. 1893. *Monographie des Phycitinae et des Galleriinae*. Vol. VII in: Romanoff, N.M. ed. *Mémoires sur les Lépidoptères*. Saint-Petersbourg, 658 p.
- Roberts, H. 1966. A survey of the important shoot, stem, wood, flower and fruit boring insects of the Meliaceae in Nigeria. *Nigerian Forestry Information Bulletin* (N. S.) 15, 38 p.
- Roberts, H. 1968. An outline of the biology of *Hypsipyla robusta* (Moore), the shoot borer of the Meliaceae (mahoganies) of Nigeria, together with brief comments on two stem borers and one other lepidopteran fruit borer also found in Nigerian Meliaceae. *Commonwealth Forestry Review*, 47: 225–232.
- Schaus, W. 1913. New species of Heterocera from Costa Rica. XX. *Annals and Magazine of Natural History Series* 8, Vol. 11, 234–262.
- Tams, W.H.T. 1935. *Lepidoptera, Heterocera. Insects of Samoa and other Samoan terrestrial Arthropoda Part III, Fasc. 4*, 169–290.
- Zeller, P.C. 1848. *Exotische Phyciden*. *Isis van Oken* 41, 857–890.