

Pyrrolizidine alkaloids in Apocynoideae

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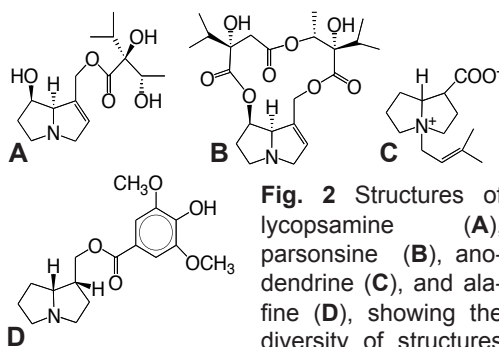
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Although the available phytochemical data on species of the Apocynoideae with respect to PAs is very limited, as is knowledge on lepidopteran associations with these plants, there is great potential to provide data of value to the current discussions on the taxonomy of Apocynoideae. By using 'PA-insects' as bioindicators of 1,2-dehydropyrrolizidine ester alkaloids and their N-oxides, in combination with targeted phytochemical studies, it is possible to identify phyletic relationships within the Apocynoideae. Adding chemoecological data to morphological and molecular approaches may assist understanding of the phylogenies of both certain apocynads and certain Lepidoptera as well as of insect-plant relationships.

PAs in Apocynoideae

PAs are secondary plant compounds, typical of many Asteraceae (e.g. *Senecio*), Boraginaceae (e.g. *Heliotropium*) and Fabaceae (*Crotalaria*). In the Apocynaceae PAs have, so far, only been reported from species of *Parsonsia* and *Prestonia* (Echiteae). However, in the literature there are hints that PAs occur in *Echites*, *Alafia*, *Anodendron*, *Aganosma* and others. Thorough chemical studies are, however, missing; thus differences in chemical structures (Fig. 2) cannot yet be interpreted in terms of a pattern and of systematics of the genera. Interestingly, the distribution of PAs in different plant parts seems to vary greatly.

We have started to look in detail into additional species of *Parsonsia* and *Prestonia* and particularly into the



genera *Echites*, *Alafia*, *Aganosma*, and *Holarrhena* and have demonstrated the presence of PAs – thus PAs exhibit a much wider distribution in the Apocynoideae, i.e. outside the Echiteae. Probably, many more will be found. Lepidoptera can be used as bioindicators.

Lepidoptera and PAs

Many lepidopteran larvae utilize 'PA-plants', often specifically. Not many are known to obtain PAs from Apocynoideae (Fig. 1) – however, the subject has not yet gained much attention.

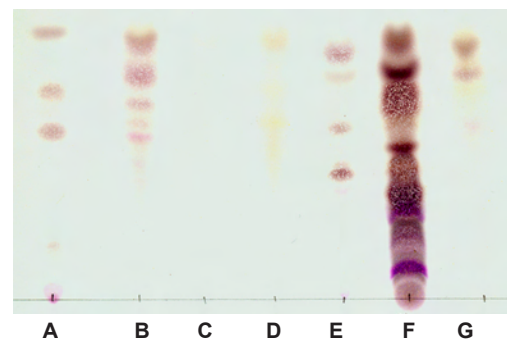
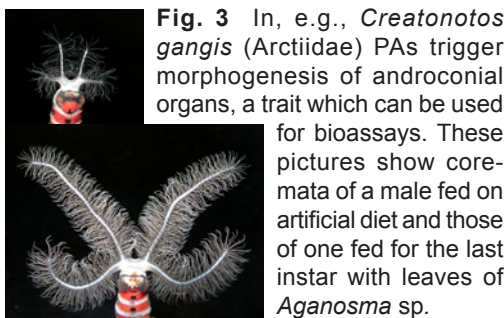


Fig. 4 TLC (thin-layer chromatography) is an appropriate and fairly facile method to check plant material for presence of PAs. Material required simply are air-dried plant parts. These chromatograms (A reference PAs; B-C *Parsonsia buruensis* (leaves, fruit); D-E *Prestonia quinquangularis* (leaves, roots); F *Alafia caudata* (roots); G *Echites* sp. (leaves) exemplify qualitative and quantitative differences in PA-contents between species and organs

PA-pharmacophagous Lepidoptera

(Danainae, Ithomiinae, Arctiinae; Fig. 1) search for and take up PAs independent of nutritional requirements; opportunistically they utilize any source of 1,2-dehydropyrrolizidines. These insects store

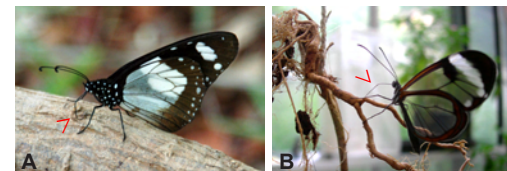


Fig. 5 Males of *Amauris ochlea* (A) and *Greta oto* (B) 'feeding' at dry (PA-containing!) roots of *Alafia* and *Aganosma* sp. respectively

PAs for defense and are usually aposematic in colour and behaviour. As PAs are sealed in cell vacuoles in living plant tissues, PA-pharmacophages visit only dead or damaged plant material (Fig. 5) from which they extract the chemicals by applying a fluid and reimbibing it. Observing these butterflies and moths at withered parts or wounds of Apocynoideae is an effective bioassay for the presence of PAs.

Thanks

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For details see

Boppré M, Kaufmann E, Edgar JA (2005) Lepidopteran associations with and pyrrolizidine alkaloids in Apocynoideae (Apocynaceae). In prep.

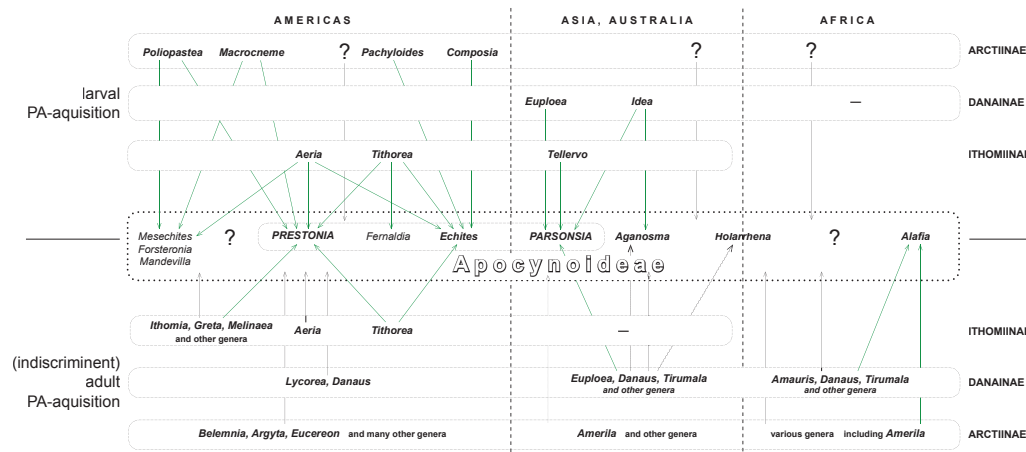


Fig. 1 Relationships between (larval and adult) Lepidoptera and Apocynoideae containing PAs or presumed to do so. *Prestonia* and *Parsonsia* = recognized to contain PAs; *Echites*, *Aganosma*, *Holarrhena*, *Alafia* = newly found to contain PAs; other genera = not yet studied; → recorded associations; —→ presumed associations; ~→ indoor records only; ? = taxa not yet recognized but suspected to be involved