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# Notes on African Lepidoptera – foodplant relationships as phyletic clues

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## ABSTRACT

SPICHIGER, R., R. VUATTOUX & V. SAVOLAINEN (1997). Notes on African Lepidoptera – foodplant relationships as phyletic clues. *Candollea* 52: 113-117. In English, English and French abstracts.

By their diet, oligophagous *Sphingini* and *Philampelini* segregate asterid foodplants into two distinct groups, viz. one containing Dahlgren's *Solaniflorae*, *Lamiiflorae* and *Asteriflorae*, and a second one made up of *Gentianiflorae*. The supposed relationship of *Araliaceae* and *Icacinaceae* with asterids is also supported in this indirect way. The circumscription of the Malvifloran lineage sensu Thorne and Dahlgren, and of Thorne's *Rutanae*, coincides with the feeding habit of polyphagous *Smerinthini* and *Charaxinae*. The neighbourhoods *Malvales/Sapindales* (*Smerinthini*), and *Vitaceae/Dilleniaceae* (*Chaerocampini*), respectively, proposed by Chase & al. are also supported by this phagotaxonomy.

## RÉSUMÉ

SPICHIGER, R., R. VUATTOUX & V. SAVOLAINEN (1997). Notes sur les Lépidoptères africains – indications phylétiques sur leur relation alimentaire. *Candollea* 52: 113-117. En anglais, résumés anglais et français

Le régime alimentaire des *Sphingini* et *Philampelini* oligophages sépare deux groupes astériidiens: d'une part les *Solaniflorae*, *Lamiiflorae* et *Asteriflorae* selon Dahlgren, d'autre part les *Gentianiflorae*. L'appartenance des *Araliaceae* et *Icacinaceae* aux astérides est aussi corroborée. Le concept malviflorien sensu Thorne et Dahlgren ainsi que les *Rutanae* de Thorne s'accorde avec le spectre trophique des *Smerinthini* et *Charaxinae* polyphages. Les groupements des *Malvales/Sapindales* (*Smerinthini*) et des *Vitaceae/Dilleniaceae* (*Chaerocampini*) proposés par Chase & al. sont aussi corroborés par cette phagotaxonomie.

**KEY-WORDS:** LEPIDOPTERA foodplants – Angiosperm phylogeny.

## 1. Introduction

As observed by THORNE (1983), insects are pragmatic, but excellent phytochemists. Their food choices are the result of a long coevolution with plants. From oligophagous insects we can get very useful information about plants containing similar biochemicals (THORNE,

| CRONQUIST<br>1988         | DAHLGREN<br>1983               | THORNE<br>1992                              | CHASE & al.<br>OLMSTEAD & al.<br>DUVALL & al.<br>1993 | Foodplants<br>VUATTOUX<br>1978, 1989            | Consumers    |
|---------------------------|--------------------------------|---|---|---|--------------|
| Asteridae                 | Solaniflorae                   | Solananae                                   | Solanaceae  | Solanaceae                                      | SPHINGINI    |
| Rosidae<br>Magnoliidae    | Lamiiflorae                    | Gentiananae<br>(Scrophulariales)            | Boraginaceae<br>Scrophulariaceae                      | Convolvulaceae<br>Boraginaceae                  |              |
| Rosidae                   | Asteriflorae                   | Asteranae                                   | asterid I+II  | Pedaliaceae                                     |              |
| Magnoliidae               | Araliiflorae<br>Magnoliiflorae | Cornanae<br>Annoniflorae                    | Asteraceae<br>Araliaceae<br>Annonaceae                | Acanthaceae<br>Verbenaceae<br>Lamiaceae         |              |
| Asteridae                 | Gentianiflorae                 | Gentiananae<br>(Gentianales)                | asterid I   | Apocynaceae<br>Periplocaceae<br>Rubiaceae       | PHILAMPELINI |
| Rosidae<br>Hamamelidae    | Corniflorae<br>Malviflorae     | Cornanae<br>Malvanae                        | Loganiaceae<br>Icacinaeae<br>Moraceae                 | Leguminosae<br>Dichapetalaceae<br>Euphorbiaceae |              |
| Rosidae                   | Fabiflorae                     | Rutanae                                     | Rosid II  | Dipterocarpaceae<br>Tiliaceae                   | SMERINTHINI  |
| Dilleniidae               | Malviflorae                    | Malvanae                                    | Sterculiaceae<br>Bombacaceae<br>Moraceae              | Ulmaceae<br>Sapindaceae<br>Oleaceae             |              |
| Hamamelidae<br>Rosidae    | Rutiflorae<br>Gentianiflorae   | Rutanae<br>Gentiananae<br>(Scrophulariales) | Bignoniaceae  | Bignoniaceae                                    |              |
| Asteridae<br>Commelinidae | Lamiiflorae<br>Commeliniflorae | Commelinanae                                | asterid I   | Poaceae   |              |

| Rosidae<br>Dilleniidae<br>Caryophyllidae<br>Rosidae<br>Liliidae | Santaliflorae<br>Theiflorae<br>Caryophylliflorae<br>Myrtiflorae<br>Liliiflorae | Cornanae<br>Theanae<br>Caryophyllanae<br>Myrtanae<br>Lilianae | rosid III<br><br>monocot | Vitaceae<br>Dilleniaceae<br>Nyctaginaceae<br>Onagraceae<br>Dioscoreaceae<br>Taccaceae<br>Orchidaceae<br>Araceae | CHAEROCAMPINI                             |
|---|--|---|--------------------------|---|---|
| Arceidae  | Ariflorae  | Aranae  |                          |   |   |
| Rosidae   | Fabiflorae<br>Rutiflorae<br>Malviflorae  | Rutanae<br>Malvanae   | rosid I                  | Leguminosae<br>Sapindaceae<br>Rhamnaceae<br>Ulmaceae  | CHARAXINAE<br><i>C. tirdates tirdates</i> |
| Hamamelidae   |  |   |                          |   |   |
| Rosidae   | Fabiflorae<br>Rutiflorae   | Rutanae<br>Geranianae   | rosid I                  | Leguminosae<br>Erythroxylaceae<br>Euphorbiaceae   | CHARAXINAE<br><i>C. etesipe etesipe</i>   |
| Dilleniidae   | Malviflorae  | Malvanae  | rosid II                 | Malvaceae<br>Bombacaceae<br>Rhamnaceae  |   |
| Rosidae   |  |   |                          |   |   |
| Rosidae   | Rutiflorae<br>Fabiflorae<br>Malviflorae  | Rutanae<br>Malvanae<br>Commelinanae                           |                          | Sapindaceae<br>Leguminosae<br>Dichapetalaceae<br>Marantaceae  | CHARAXINAE<br><i>C. laodice laodice</i>   |
| Zingiberidae  | Zingiberiflorae  |   |                          |   |   |

Table 1. – Correlations between African Lepidoptera (upper line) and foodplant taxa classified according to different authors (lines below). Bold lines indicate phagotaxonomic relationships.

1983). This paper aims at comparing the pragmatic classification of some caterpillars with recent botanical classifications in order to point out correlations.

## 2. Material and method

*Lepidoptera* caterpillars have been bred successfully for more than 15 years on their particular foodplants at the Tropical Ecology Institute of Lamto in Ivory Coast. Thus, the feeding is strictly limited to the plants on which the larvae have been found. The list of consumers and foodplants, as well as the detailed methods, can be found in VUATTOUX (1978) and VUATTOUX & al. (1989). The *Sphingidae* have been determined by J. Pierre (Museum of Paris), the *Charaxinae* (*Nymphalidae*), by M. J. Plantrou, and the foodplants by L. Aké Assi, specialist of the West African flora.

## 3. Results and discussion

Table 1 presents for each group of *Lepidoptera* the phylogenetic placement of the consumed plants according to various classifications.

The upper line indicates the tribes (*Sphingidae*) or some subspecies (*Charaxinae*) of the phytophagous *Lepidoptera*. The second one gives the plant families that are eaten by the above-listed caterpillars. The other lines indicate the taxonomic placement of each family in the recent classification systems, i.e. their belonging to superorders according to DAHLGREN (1983), THORNE (1992) and to subclasses according to CRONQUIST (1988). Furthermore, the results based on *rbcL* sequencing have been taken into account (CHASE & al., 1993; DUVALL & al., 1993; OLMSTEAD & al., 1993).

With the exception of some atypical taxa (*Annonaceae*, *Moraceae*), all foodplants of the *Sphingini* and *Philampelini* belong to the asterid phylum. The amazing occurrence of *Moraceae* as foodplants of *Philampelini* could maybe due to the presence of latex, a character which is shared with the *Apocynaceae*. Nevertheless, this "incident" has still to be explained.

The fact that *Icacinaceae* and *Araliaceae* are eaten by these latter caterpillars could support their asterid status as emphasized by OLMSTEAD & al. (1993) and CHASE & al. (1993).

The above-mentioned asterid families are not all eaten by species of the same tribes of *Sphingidae*. *Gentianiflorae* sensu Dahlgren are eaten only by *Philampelini*, whereas *Solaniflorae*, *Asteriflorae* and *Lamiiflorae* are foodplants of *Sphingini*. It is an argument in favour of Dahlgren's classification; he divides *Gentiananae* sensu Thorne into *Lamiiflorae* and *Gentianiflorae* sensu stricto. Chase and Olmstead point out a lineage comprising *Gentianaceae-Rubiaceae-Apocynaceae-Loganiaceae-Asclepiadaceae* which corresponds to Dahlgren's *Gentianiflorae* and which is clearly distinct from the other asterid clades.

*Smerinthini* are more polyphagous. Their foodplant families belong to lineages which correspond to *Malvanae/Malviflorae* sensu Thorne and Dahlgren (i.e. *Malvales*, *Urticales*, *Erythroxylaceae*, *Euphorbiaceae*, *Dichapetalaceae*), to *Rutanae* sensu Thorne (i.e. *Leguminosae* and *Sapindaceae*), to *Gentianiflorae* sensu Dahlgren, and to monocots. Furthermore the diet of *Smerinthini* could support the *Sapindales-Malvales* clade of CHASE & al. (1993), as do African *Nymphalidae* (*Euphaedra*) which consume *Sapindaceae*, *Anacardiaceae* and *Sterculiaceae* (HECQ & VUATTOUX, 1989).

The choice of foodplants of *Chaerocampini* supports the unexpected relationships of *Vitaceae* (*Leeaceae*) and *Dilleniaceae* which was pinpointed by CHASE & al., (1993). We can also note that these two families appear to be sisters of some caryophyllids (CHASE & al., 1993) as *Nyctaginaceae* are also eaten by *Chaerocampini*.

The feeding habit of *Charaxinae* (*Charaxes tiridates tiridates*) supports the belonging of *Rhamnaceae* and *Erythroxylaceae* to a Malvifloran lineage, whereas that of *Charaxinae* (*C. etesipe* and *C. laodice*) and *Smerinthini* supports the relationships between *Dichapetalaceae*, *Erythroxylaceae* and *Euphorbiaceae*; this is also suggested by CHASE & al. (1993) and Savolainen (unpubl.).

The above-mentioned observations are to be considered with caution, especially those based on polyphagous diets. They are not strengthened by statistically tested experiments. Some atypical occurrences (viz. *Moraceae* and *Annonaceae* and other consumed plants close to asterids) have still to be explained. Nevertheless, these data are based on long-term observations and provide interesting phyletic clues in an original way.

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