

A NOTE ON THE POLLINATION OF NOCTURNALLY FLOWERING SPECIES OF NYMPHAEA

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During field studies of Nymphaeaceae in Surinam for a subsequent taxonomic treatment of the family in regional floras, one of us (J. M. C.) collected beetles in the flowers of the night-blooming *Nymphaea blanda* var. *fenzliana* and *N. rudgeana*, which insects were identified by J. Krikken of the Leyden Museum of Natural History (RMNH) as *Cyclocephala castanea* (Olivier) (Scarabaeidae-Dynastinae), which identification was confirmed by the monographer of the tribe Cyclocephalini, Dr. S. Endrödi. Later the same beetle was repeatedly found in *N. rudgeana* by P. A. T., and it appeared that specimens had been collected in Surinam in a nocturnally flowering species of *Nymphaea* much earlier by Dr. D. C. Geijskes (material in RMNH). The anthecological syndrome of the *Nymphaea* flowers in question must resemble that of *Victoria amazonica* rather closely (compare PRANCE & ARIAS 1975 for details and references). The production of heat by the *Nymphaea* flowers has not been recorded so far, but an elevation of the temperature in the flower during the first evening of anthesis is to be expected, since it is known from, e.g., several Araceae with a comparable syndrome, and also from *Victoria cruziana* (see VALLA & CIRINO 1972), even in cultivation (B. J. D. Meeuse, pers. comm.). The pollination strategy of the two *Nymphaea* species must, therefore, also be very much the same as in *Victoria amazonica*. In the latter, the evaporation of volatile substances begins during the evening of the first day of anthesis and the odour attracts beetles which are trapped when the flower starts to close during early morning (before sunrise). During the evening of the second day of flowering no scent is released and the beetles fly away loaded with pollen (the anthers only begin to open by the time the beetles start to leave, which results in cross-pollination). The smell is described by PRANCE & ARIAS as fruity ("reminiscent of a mixture of butter-scotch and pineapple"). The odour emitted by *N. blanda* was recorded by J. M. C. as sweet and fruity but with a pungent, phenolic admixture ("like xylene"), and that of *N. rudgeana* as resembling that of aniseed. The flowers of *N. blanda* var. *fenzliana* are almost certainly only open during two consecutive nights (as in the two species of *Victoria*), but those of *N. rudgeana* for two or sometimes three nights. The flowers of the latter species are interesting in that the heat production and odour emittance may conceivably be repeated in the same flower, but this needs investigation. Beetles are nearly always found trapped in the flowers of *N. rudgeana* closed after the first night of anthesis, sometimes in appreciable numbers, and if this is the case, they are almost invariably specimens of *Cyclocephala castanea* (Oliv.), but not infrequently

another, smaller beetle was gathered which was identified as *Cyclocephala verticalis* Burmeister. The third nocturnally flowering species of *Nymphaea* in Surinam is *N. amazonum* which is also in anthesis during two consecutive evenings and emits a phenolic smell ("xylene- or petrol-like", J.M.C.). So far only *C. verticalis* was found in the flowers (by P.A.T.). The effectiveness of a possible cantharophily must be ascertained: one could, for instance, cage in some flowers to prevent insect visits and check the seed setting. The most important conclusion that can be drawn is that *Cyclocephala castanea*, reputed to be the principal or perhaps sole pollinator of *Victoria amazonica* on mostly circumstantial evidence (compare STAEGER 1900), is in fact a regular visitor of at least one nocturnally blooming species of *Nymphaea* (*N. rudgeana*), whereas the giant water lily is apparently constantly pollinated by another species of beetle (viz., by *C. hardyi*) and only on rare occasions attracts *C. castanea*. *Victoria amazonica* is also visited by *C. verticalis* but not throughout the year. The phytogeographical range of the species of *Nymphaea* extends southwards into Brazil and beyond, so that they occur sympatrically with *Victoria* in, e.g., Amazonia. There is apparently a rather clear-cut niche differentiation in that the *Nymphaea* species are not visited by *C. hardyi* as far as can be ascertained, whereas *V. amazonica* is normally only pollinated by the latter coleopteron. Conceivably a difference in the emitted scent is responsible for the unequal rates of attraction. The "secondary" pollinator *Cyclocephala verticalis* does not seem to be so exclusive in its behaviour because it was repeatedly collected in at least two species of *Nymphaea* and in *Victoria*.

Further field studies and more cogent experimental evidence are required before definite conclusions regarding the anthecology can be drawn. Attraction experiments with both nymphaeid genera and both the larger species of *Cyclocephala* should preferably be undertaken in an area where such *Nymphaea* species (more particularly: *N. rudgeana*) and *Victoria* are found sympatrically. At the same time a more detailed investigation should be undertaken of the pollination of *N. amazonum*, the first point to be settled being the constancy and possible exclusiveness of its being visited by *C. verticalis* as an indication of a certain degree of niche specialisation.

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