Some notes on Epipactis helleborine (L.) Crantz ssp. neerlandica (Vermeulen) Buttler and Epipactis renzii K. Robatsch

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Key words:

Epipactis helleborine, E. helleborine ssp. neerlandica, E. renzii, E. helleborine ssp. neerlandica var. renzii, autogamy.

Samenvatting


Zusammenfassung


1. Introduction

Epipactis helleborine is a species, well known for its broad ecological amplitude as well as for the great variety in shape and form under which it appears. During the last few years there is a tendency for splitting up E. helleborine in smaller entities, based on morphological, ecological or pollination biological criteria. The ecological viewpoint has lead to the description of species or the evolution of the originally given rank. Newly described or rediscovered spe-
The differences between the taxa are mainly morphological, and concern above all the habitus of the plant. On the whole the form of the flowers and the gynostemium is the same, with only one exception. A variety of *Epipactis helleborine* ssp. *neerlandica* that grows in an extreme biotope and that shows a change in column structure, was described as *E. renzi* (K. Robatsch 1988). We will return to this taxon later on.

2. *Epipactis helleborine* ssp. *neerlandica*

*Epipactis helleborine* ssp. *neerlandica* was originally described as a variety of *E. helleborine* (Vermeulen 1949), then raised to the rank of subspecies (Buttle 1986 in Greuter, W. & Th. Raus ed.) and finally given the specific rank (Delforge, Devillers-Terschuren & Devillers 1991). Little has been published about *E. helleborine* ssp. *neerlandica*, and the elevations of the rank were published without comments.

Kapteyn den Boumeester (1989) critically examined the characteristics of *Epipactis helleborine* ssp. *neerlandica* as given by Vermeulen (1949) as well as some newly added characteristics (Buttler 1986, Kreutz 1987). These characteristics were also adopted by Delforge (1994). In their preliminary key *Salix repens-scrub* in the Waterleiding dunes.

We tend to regard all taxa as subspecies of *Epipactis helleborine*, because they are quite distinct in the center of their area of distribution, but there can be found transitional stages towards the nominate species.

The uncertainty about what really is *Epipactis helleborine* ssp. *neerlandica* is reflected in the description of a finding of *E. helleborine* ssp. *neerlandica* in the salix dunes of Holland.

### Table 1. Characteristics of *E. helleborine* ssp. *neerlandica.*

<table>
<thead>
<tr>
<th></th>
<th><em>E. helleborine</em> ssp. <em>neerlandica</em></th>
<th><em>Epipactis helleborine</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cl., Kl. &amp; Wie.</td>
<td>Tyteca</td>
</tr>
<tr>
<td>Plant height</td>
<td>(14) 24-44 (50)</td>
<td>19-39</td>
</tr>
<tr>
<td>Height 1st leaf-soil</td>
<td>(0.3) 4.4-11.6 (16.4)</td>
<td>0.6-3.6</td>
</tr>
<tr>
<td>Number of leaves</td>
<td>5-7</td>
<td>5-9</td>
</tr>
<tr>
<td>Length 2nd leaf</td>
<td>(3.4) 4.2-2.6 (7.2)</td>
<td>3.6-5.2</td>
</tr>
<tr>
<td>Width 2nd leaf</td>
<td>(2) 2.2-3.6 (4.2)</td>
<td>2.2-3.2</td>
</tr>
<tr>
<td>Length largest leaf</td>
<td>(3.9) 5.1-8.3 (11.6)</td>
<td>4.3-6.9</td>
</tr>
<tr>
<td>Width largest leaf</td>
<td>(2) 2.1-3.9 (5.3)</td>
<td>2.1-3.5</td>
</tr>
<tr>
<td>Inflorescence length</td>
<td>(3.6) 5.8-15.4 (23.3)</td>
<td>7-17</td>
</tr>
<tr>
<td>Number of flowers</td>
<td>(10) 15-34 (44)</td>
<td>12-44</td>
</tr>
<tr>
<td>Length of 1 st bract</td>
<td>(1.4) 1.6-2.8 (4.2)</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Intervals indicate the mean plus or minus 1 standard deviation, the values between brackets are the lowest and highest value measured.
Table 3. Comparison between *E. helleborine* and *E. helleborine* ssp. *neerlandica*.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>average</td>
<td>st.dev.</td>
</tr>
<tr>
<td>Plant height</td>
<td>60.9</td>
<td>17.8</td>
</tr>
<tr>
<td>Height 1st leaf-soil</td>
<td>9.4</td>
<td>3.6</td>
</tr>
<tr>
<td>Number of leaves</td>
<td>7.7</td>
<td>1.2</td>
</tr>
<tr>
<td>Length 2nd leaf</td>
<td>10.3</td>
<td>2.2</td>
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</tr>
<tr>
<td>Inflorescence length</td>
<td>16.7</td>
<td>4.3</td>
</tr>
<tr>
<td>Number of flowers</td>
<td>36.2</td>
<td>12.4</td>
</tr>
<tr>
<td>Length of 1st bract</td>
<td>4.9</td>
<td>1.0</td>
</tr>
</tbody>
</table>

In table 2 we compare the plants of the typical *neerlandica*-biotopes (open sand plains, *Salix repens*-scrub) with those found in more transitional biotopes (pine forests).

Table 2 demonstrates, that the plants in pine woods and those growing in sand plains and *Salix repens*-scrub differ above all in plant height, length and width of the largest leaf. This conclusion is quite obvious, because plants growing in the shade of trees need a larger leaf surface to ensure an optimal photosynthesis. A quality, not to be found in the typical *E. helleborine* ssp. *neerlandica*: height 40 - 90 cm; leaves 4-9 cm long, 2-6 cm large; number of flowers 25-60; bracts up to 6 cm long and 2 cm large.

In order to be able to delimitate the typical *Epipactis helleborine* ssp. *neerlandica*, we measured 25 plants from different biotopes. The data were collected from different localities in the Oostduinen and the Waterleidingduinen, two dune complexes between Scheveningen and Haarlem. In table 1 we compare our findings with those of Tyteca (1995).

When comparing our findings with those of Tyteca, there are above all two characters that differ: the length of the second and of the largest leaf, and the height first leaf - soil. A possible explanation is that Tyteca only examined plants growing in *Salix repens*-scrub, being the most typical (Tyteca & Dufrêne 1994), whereas we also examined plants in pine woods.

The character: height first leaf - soil seems of very little value, as it is influenced by the herbs in which the plants grow, or by the absence of surrounding vegetation (sand plains). The influence of the biotope is reflected in the values that were obtained, varying from 0.3 up to 16.4 cm!

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Epipactis helleborine ssp. neerlandica
3 augustus
pine wood, Berkheide - Katwijk
papilles on the leaf margin (125x)

Epipactis helleborine
25 juli 1997
park, The Hague
papilles on the leaf margin (125x)

Linksboven:
Epipactis helleborine ssp. neerlandica autogamous; pollinies desintegrating.
Pollen grains falling left and right of the viscidium onto the stigma tic surface.
Noordwijkerhout, 16-8-1997
(Jean Claessens)

Rechtsboven:
Epipactis helleborine ssp. neerlandica autogamous; anther cap dried out and flattened.
Noordwijkerhout, 16-8-1997
(Jean Claessens)

Linksmidden:
Epipactis helleborine ssp. neerlandica Gymnostemium, old stage, perianth and anther cap dried out. Desintegrated pollinies are lying in the clinandrium as well as scattered over the sigmatic surface.
Noordwijkerhout, 16-8-1997
(Jean Claessens)

Linksonder:
Epipactis helleborine ssp. neerlandica Plant growing in plain sand flowers partially autogamous Detail of autogamous flower Wassenaar, 16-8-1997
(Jean Claessens)
The plants that grow in Salix repens-scrub are often difficult to find, because their colour shows a large similarity with that of Salix repens: both show a dull, greyish-green colour. Characteristic are also the firm gutter-shaped, grooved sloping leaves that are often more or less undulate and stem-embracing. It is obvious that these characteristics are an adaptation to the extreme biotope in which Epipactis helleborine ssp. neerlandica grows. *E. helleborine* ssp. neerlandica distinguishes itself in its phenology (late flowering: august up to October).

*Epipactis helleborine* ssp. neerlandica is known up to now to grow with certainty in Holland, Belgium, France (Pas de Calais) and Denmark (Hansen 1963). Findings from Germany are to be examined.

3. Autogamy

*Epipactis helleborine* ssp. neerlandica is normally well visited and pollinated. Up to now only pollinators of the genus *Dolichovespula* were observed (Kapteyn den Boumester 1989; Peterek & Todt 1991).

The summer of 1987 was extremely hot and dry, and these extreme conditions caused autogamy in *Epipactis helleborine* ssp. neerlandica. We were able to observe this phenomena in several plants of different growing places. The tetrads composing the pollinia lost their coherence and fell left and right of the viscidium onto the stigmatic surface (see color photo's). A similar process happens e. g. in *Epipactis helleborine* ssp. orbicularis. In more temperate regions this taxon is autogamous and well visited by insects (Wucherprennig 1993). In xerophilous regions it is facultative autogamous even before anthesis (Clausens & Kleyen 1997).

Other reports of autogamy in *Epipactis helleborine* are to be found in e. g. Hagerup (1952), Reineke (1987), Franz (1995) or Delforge (1996). Autogamy only takes place incidentally in *Epipactis helleborine* ssp. neerlandica, but our observations show that even a plant, well adapted to extreme conditions, can change its mode of pollination if required. Here we have an example of a taxon that moves over towards autogamy, but there are also reports of cases where exactly the opposite takes place: now and then plants of *E. muellerii* or *E. leptochila* are found, that possess a well-developed and functional viscidium (Reinhard 1977). In fact, both autogamous and autogamous flowers can be found on one plant. This was also observed in *E. helleborine* (Delforge 1996). Due to Darwin's views, autogamy was for a long time considered to be unnatural. But meanwhile there have been numerous reports of autogamy in the orchid family (Reinhard 1977). Most orchids are capable of autogamy under certain conditions; the harder the conditions are (biotope, presence of pollinators), the sooner a plant turns to autogamy as a survival or a conquering strategy. Independence of pollinators offers an opportunity to conquer an ecological niche.

4. *Epipactis renzii*

As mentioned before, a deviant variety of *Epipactis helleborine* ssp. neerlandica was described as *E. renzii* (K. Robatsch 1988). In his introduction the author questions himself whether changes in the construction of the gynostemium, that cause obligatory or facultative autogamy, justify the description at the specific rank. An other objection, as pointed out by the author, lies in the fact that *E. renzii* and *E. helleborine* ssp. neerlandica show great concordance as to their vegetative appearance.

In fact, both taxa actually grow in the same region, *Epipactis renzii* being limited to the extreme north of Jutland (Denmark), in a region called the “Danish Sahara”. The constantly moving sand dunes and omnipresent winds constitute for insects as well as for plants extremely hostile conditions. Therefore it is not surprising that *E. renzii* has changed to autogamy. This has not only affected the coherence of the pollinia but also the construction of the gynostemium. The clinandrium is reduced, so that in combination with a large filament, the anther is brought in a position above the stigmatic surface. Thus the pollinia can easily contact the stigma.

There are more cases known where the clinandrium is incompletely developed or disintegrated, as described in e. g. King & Pantling 1898 or in Kirchner 1922a. Catling (1990) states that “in most auto-pollinated orchids, the rostellum (= viscidium remark authors) either does not develop, develops incompletely, or in a few cases disintegrates during flowering, allowing the pollinia and stigma to come in contact”.

There are many examples of species that can be both pollinator-dependant or auto-pollinating, depending on various factors of the natural environment. Well known is the example of the genus *Viola*, where during spring normal chasmogamic flowers are produced, but autogamous as well as cleistogamous flowers are formed during summer. Among the tropical orchids, *Dendrobium densiflorum* is capable of producing normal chasmogamic flowers as well as more or less cleistogamic ones, both types growing on the same plant at the same time (Uphof 1968). According to the same author “a characteristic of the cleistogamic orchid flower is a very rudimentary rostellum or its absence”. Schlechter (1992) gives a striking example of the changes in the structure of the gynostemium, caused by cleistogamy: the tropical orchid *Encyclia odoratissima* grows in two varieties. The variety *odoratissima* is autogamous and possesses a monandrous gynostemium, whereas the autogamous and Cleistogamous variety *serriana* shows a triandrous gynostemium.

The changes in the structure of the gynostemium as described above, can be regarded as minor, since they do not involve the creation of an entirely new structure, but only the loss of a structure or the appearance of a primitive condition (Catling 1990). Autogamy is most frequent in relatively primitive groups (Dressier 1993), so it is not surprising to find many autogamous forms among the genus *Epipactis*. Drought and poor nutrition can cause autogamy and even Cleistogamy (Uphof 1968), and are in the case of *E. renzii* factors that, together with the quasi-absence of pollinators can cause autogamy. In this process structural changes of the gynostemium are quite logical and of little value. Species growing near the borders of their range of distribution or growing in an area where insect pollinators are scarce, may reverse to autogamy as a means of survival (Van der Pijl & Dodson 1966, Proctor & Yeo 1973), whereas they have autogamous forms in other areas.

During the last few years new species have been described mostly on the basis of a different column morphology: most plants described were autogamous. It seems to us that too much weight is put upon these changes, whereas there are many examples of changes of column structure within species.

Therefore it seems us more appropriate to describe the taxon from the “Danish Sahara” as a variety of *Epipactis helleborine* ssp. neerlandica.


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