= Nepenthes rajah =

Nepenthes rajah / n??p?n?i?z ?r??d?? / is an insectivorous pitcher plant species of the Nepenthaceae family . It is endemic to Mount Kinabalu and neighbouring Mount Tambuyukon in Sabah , Malaysian Borneo . Nepenthes rajah grows exclusively on serpentine substrates , particularly in areas of seeping ground water where the soil is loose and permanently moist . The species has an altitudinal range of 1500 to 2650 m a.s.l. and is thus considered a highland or sub @-@ alpine plant . Due to its localised distribution , N. rajah is classified as an endangered species by the IUCN and listed on CITES Appendix I.

The species was collected by Hugh Low on Mount Kinabalu in 1858 , and described the following year by Joseph Dalton Hooker , who named it after James Brooke , the first White Rajah of Sarawak . Hooker called it " one of the most striking vegetable productions hither @-@ to discovered " . Since being introduced into cultivation in 1881 , Nepenthes rajah has always been a much sought @-@ after species . For a long time , the plant was seldom seen in private collections due to its rarity , price , and specialised growing requirements . However , recent advances in tissue culture technology have resulted in prices falling dramatically , and N. rajah is now relatively widespread in cultivation .

Nepenthes rajah is most famous for the giant urn @-@ shaped traps it produces , which can grow up to 41 cm high and 20 cm wide . These are capable of holding 3 @.@ 5 litres of water and in excess of 2 @.@ 5 litres of digestive fluid , making them probably the largest in the genus by volume . Another morphological feature of N. rajah is the peltate leaf attachment of the lamina and tendril , which is present in only a few other species .

The plant is known to occasionally trap vertebrates and even small mammals , with drowned rats having been observed in the pitcher @-@ shaped traps . It is one of only two Nepenthes species documented as having caught mammalian prey in the wild , the other being N. rafflesiana . N. rajah is also known to occasionally trap small vertebrates such as frogs , lizards and even birds , although these cases probably involve sick animals and certainly do not represent the norm . Insects , and particularly ants , comprise the staple prey in both aerial and terrestrial pitchers .

Although Nepenthes rajah is most famous for trapping and digesting animals , its pitchers are also host to a large number of other organisms , which are thought to form a mutually beneficial (symbiotic) association with the plant . Many of these animals are so specialised that they cannot survive anywhere else , and are referred to as nepenthebionts . N. rajah has two such mosquito taxa named after it : Culex rajah and Toxorhynchites rajah .

Another key feature of N. rajah is the relative ease with which it is able to hybridise in the wild . Hybrids between it and all other Nepenthes species on Mount Kinabalu have been recorded . However , due to the slow @-@ growing nature of N. rajah , few hybrids involving the species have been artificially produced yet .

= = Etymology = =

Joseph Dalton Hooker described Nepenthes rajah in 1859 , naming it in honour of Sir James Brooke , the first White Rajah of Sarawak . In the past , the Latin name was written as Nepenthes Rajah , since it derives from a proper noun . However , this capitalisation is considered incorrect today . ' Rajah Brooke 's Pitcher Plant ' is an accurate , but seldom @-@ used common name . N. rajah is also sometimes called the ' Giant Malaysian Pitcher Plant ' or simply ' Giant Pitcher Plant ' , although the binomial name remains by far the most popular way of referring to this species . The specific epithet rajah means " King " in Malay and this , coupled with the impressive size of its pitchers , has meant that N. rajah is often referred to as the " King of Nepenthes " .

= = Plant characteristics = =

Nepenthes rajah , like virtually all species in the genus , is a scrambling vine . The stem usually grows along the ground , but will attempt to climb whenever it comes into contact with an object that

can support it . The stem is relatively thick (? 30 mm) and may reach up to 6 m in length , although it rarely exceeds 3 m . N. rajah does not produce runners as some other species in the genus , but older plants are known to form basal offshoots . This is especially common in plants from tissue culture , where numerous offshoots may form at a young age .

= = = Leaves = = =

Leaves are produced at regular intervals along the stem . They are connected to the stem by sheathed structures known as petioles . A long , narrow tendril emanates from the end of each leaf . At the tip of the tendril is a small bud which , when physiologically activated , develops into a functioning trap . Hence , the pitchers are modified leaves and not specialised flowers as is often believed . The green structure most similar to a normal leaf is specifically known as the lamina or leaf blade .

The leaves of N. rajah are very distinctive and reach a large size . They are leathery in texture with a wavy outer margin . The leaves are characteristically peltate , whereby the tendril joins the lamina on the underside , before the apex . This characteristic is more pronounced in N. rajah than in any other Nepenthes species , with the exception of N. clipeata . However , it is not unique to these two taxa , as mature plants of many Nepenthes species display slightly peltate leaves . The tendrils are inserted ? 5 cm below the leaf apex and reach a length of approximately 50 cm . Three to five longitudinal veins run along each side of the lamina and pennate (branching) veins run towards the margin . The lamina is oblong to lanceolate @-@ shaped , ? 80 cm long and ? 15 cm wide .

= = = Pitchers = = =

All Nepenthes pitchers share several basic characteristics . Traps consist of the main pitcher cup , which is covered by an operculum or lid that prevents rainwater from entering the pitcher and displacing or diluting its contents . A reflexed ring of hardened tissue , known as the peristome , surrounds the entrance to the pitcher (only the aerial pitchers of N. inermis lack a peristome) . A pair of fringed wings run down the front of lower traps and these presumably serve to guide terrestrial insects into the pitchers ' mouth . Accordingly , the wings are greatly reduced or completely lacking in aerial pitchers , for which flying insects constitute the majority of prey items .

Nepenthes rajah , like most species in the genus , produces two distinct types of traps . " Lower " or " terrestrial " pitchers are the most common . These are very large , richly coloured , and ovoid in shape . In lower pitchers , the tendril attachment occurs at the front of the pitcher cup relative to the peristome and wings . Exceptional specimens may be more than 40 cm in length and hold 3 @.@ 5 litres of water and in excess of 2 @.@ 5 litres of digestive fluid , although most do not exceed 200 ml .

The largest recorded pitcher of N. rajah , measuring 41 cm , was found on March 26 , 2011 , during a trip to Mesilau organised by The Sabah Society . The trap was discovered next to a steep sidepath of the Mesilau nature trail and was measured by Alex Lamb , son of Anthea Phillipps and Anthony Lamb , who were also on the trip . It was collected for preservation at Mesilau Headquarters . Another trap measuring 40 cm was spotted on the same day . The previous record for a N. rajah pitcher was 38 cm .

The lower pitchers of N. rajah are probably the largest in the genus by volume , rivaled only by those of N. merrilliana , N. truncata and the giant form of N. rafflesiana . These traps rest on the ground and are often reclined , leaning against surrounding objects for support . They are usually red to purple on the outside , whilst the inside surfaces are lime green to purple . This contrasts with all other parts of the plant , which are yellow @-@ green . The lower pitchers of N. rajah are unmistakable and for this reason it is easy to distinguish it from all other Bornean Nepenthes species .

Mature plants may also produce " upper " or " aerial " pitchers , which are much smaller , funnel @-@ shaped , and usually less colourful than the lowers . The tendril attachment in upper pitchers is normally present at the rear of the pitcher cup . True upper pitchers are seldom seen , as the

stems of N. rajah rarely attain lengths greater than a few metres before dying off and being replaced by off @-@ shoots from the main rootstock .

Upper and lower pitchers differ significantly in morphology , as they are specialised for attracting and capturing different prey . Pitchers that do not fall directly into either category are simply known as " intermediate " pitchers .

The peristome of N. rajah has a highly distinctive scalloped edge and is greatly expanded , forming an attractive red lip around the trap 's mouth . A series of raised protrusions , known as ribs , intersect the peristome , ending in short , sharp teeth that line its inner margin . The inner portion of the peristome accounts for around 80 % of its total cross @-@ sectional surface length in this species . Two fringed wings run from the tendril attachment to the lower edge of the peristome .

The huge , vaulted lid of N. rajah , the largest in the genus , is another distinguishing characteristic of this species . It is ovate to oblong in shape and has a distinct keel running down the middle , with two prominent lateral veins . The spur at the back of the lid is approximately 20 mm long and unbranched .

Nepenthes rajah is noted for having very large nectar @-@ secreting glands covering its pitchers . These are quite different from those of any other Nepenthes and are easily recognisable . The inner surface of the pitcher , in particular , is wholly glandular , with 300 to 800 glands / cm ² .

= = = Flowers = = =