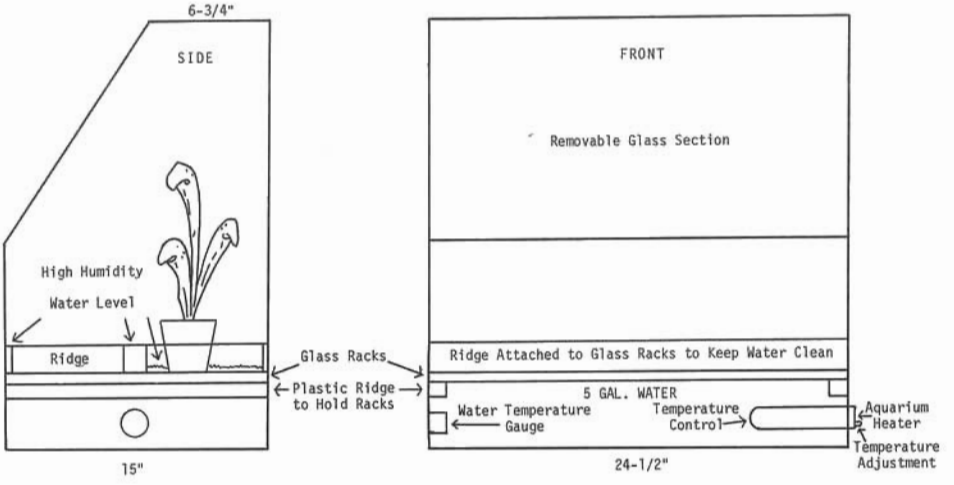

other pitchers do very well. If you use tap water in the main body of water, do not allow this to overflow into trays.

Parts List: 1) glass, ¼ inch, 2) silicone glue, 3) aquarium heater, 4) two temperature gauges (water and air) 5) small plexiglass strips.

Additional Notes: When building, follow same procedures as you would to build an aquarium. This chamber is excellent for sundew cuttings. By pressing a leaf cutting tentacles down in soil, I've achieved good results. Also, one can use small pots and start seedlings or cuttings of other than CP and remove from chamber. I have had my chamber in operation for over a year, and nothing has gone dormant, although a slower growth rate has been noted.

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"A Crab Spider Associate of *Nepenthes rafflesiana*"

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In 1975 I had the opportunity to observe the activities of the crab (thomisid) spider, *Misumenops nepenthicola* (Pocock), in the Islamic Sultanate of Brunei (in northwestern Borneo). This spider was found in association with an Old-World pitcher plant, *Nepenthes rafflesiana* Jack., found growing on the dry hillside along the Brunei River. Such an association has been reported from the nearby island of Labuan by Pocock (1898) and in Singapore by Fage (1928) and Bristowe (1939). In these studies three different species of *Nepenthes* are mentioned. Pocock had the host plant tentatively identified as *"Nepenthes phyllamphora"*, but due to poor and inadequate material this identification should be con-

sidered highly doubtful. But Fage positively identified *N. gracilis* Korth. as the associated plant while Bristowe reports a less common association of the spider with *N. rafflesiana* in Singapore. The spider is found resting on the smooth inner surface of the pitcher portion of the plant above the liquid contents. Its dark maroon-brown color is cryptic with respect to similarly colored pigmentation spots on the pitcher plant. My observations confirmed the accuracy of Pocock's and Bristowe's description of the spider's habits, including its remarkable escape behavior in which the spider drops into the digestive fluid held by the pitcher and emerges (up to two minutes later) apparently unaffected.

The complex adaptations to insectivory in pitcher plants are associated with their ability to thrive in nutrient poor soils—obtaining sufficient supplementary nutrients, especially nitrates, from insects which they have attracted, trapped and digested (Heslop-Harrison, 1976). On several occasions I observed the spider capturing prey. In each case a fly entered the pitcher and fell into the fluid. The spider moved toward the struggling prey of the plant and picked it off the surface of the fluid. Thus it was depriving the plant of a source of nutrition and represents a clear case of kleptoparasitism. Kleptoparasitism is a symbiotic association in which one organism (the kleptoparasite) preys on whole organisms that have been trapped, for later consumption, by another (the host). A kleptoparasite exploits the trapping capabilities of its host and consumes food that would otherwise be used by the host. If the spider sometimes captures an insect before it actually is caught in the fluid, as was the method reported by Bristowe, the spider would still be exploiting the chemical the pitcher plant uses to attract insect prey and still could be considered a kleptoparasite. An opposite sort of symbiosis was reported by Bristowe in which the spider "assists" the plant by knocking distasteful (to the spider) insects into the fluid—a case of mutualism (an association where both spider and plant are benefited). Also, within the microcosm of a single pitcher it is likely that the spider returns some nutrients "stolen" from the plant via its excretion into the pitcher. More careful and quantitative studies would have to be made before one could establish whether the plant suffers a net loss or gain of nutrients by this association.

In many pitcher plants certain dipterans (predominantly mosquitoes) breed in the fluid (Barr & Chellapah, 1963). I was not able to establish whether the spider also preys upon these insects as they emerge from their pupal stage. If it does, it would be a simple case of predation. Those aquatic larvae breeding in the pitcher could be considered ordinary parasites of the plant drawing nutrients from the fluid contents.

Two other spiders have been reported in association with *Nepenthes*: *Thomisus nepenthiphilus* in Sumatra and *Theridion decaryi* in Madagascar (Fage, 1930).

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