

Aeschynomene indica L. (FABACEAE) IN VIRGINIA—*Aeschynomene indica* L. is an erect annual herbaceous hydrophyte found in such habitats as estuarine marshes, wet meadows, rice fields, and the margins of swamps of the southeastern and south central United States and other warm regions throughout the world (Rudd 1955, Radford et al. 1968, Godfrey and Wooten 1981, Isely 1990). To date we have found no record of *Ae. indica* occurring in Virginia (Harvill et al. 1992; C. Ludwig, pers. comm.); the species was believed to reach its northernmost limit in the central coastal plain of North Carolina, south of Pamlico Sound (Rudd 1955; Radford et al. 1968; J. Massey, pers. comm.). However, on October 23, 1995, J.E. Perry and A. McKenney-Mueller discovered two plants of *Ae. indica* in a created non-tidal wetland at the junction of the Blackwater River and SR 158 in Southampton County, Virginia. Both specimens were mature plants approximately 1.5 meters tall, with flowers and mature fruits present. Both plants were growing in seasonally flooded hydric soil approximately 35 to 40 meters apart. Water depth covering the soil at the time was 35 cm. Vegetation cover estimates were taken for the dominant vegetation within a 5 meter radius of each specimen. Ground cover (vegetation < 0.5 m in height) was recorded as >75% but <95% (mid-point of 83.7%) and was dominated, in decreasing order of cover class, by *Eleocharis obtusa* (Willd.) Schultes (spike rush), *Ludwigia palustris* (L.) Ell. (water primrose) and *Juncus effusus* L. (soft rush). Canopy cover (vegetation > 0.5 m in height) was sparse (less than 2%) and consisted of *Typha latifolia* L. (common cat-tail) and *Scirpus cyperinus* (L.) Kunth (bulrush). There was no woody overstory. Soil from the root zone consisted of a 15 to 20 cm sandy loam surface horizon overlying a bed of medium- to coarse-grained sand. No other plants of *Ae. indica* were found in the surrounding area. A return visit on Sept. 3, 1996, found 62 individuals, nearly all with flowers and fruits. Surrounding dominant vegetation had not changed, nor had the ground cover (>75% but <95%) or canopy cover changed (<2%). The population now covers an area of approximately 100 m².

Table 1. Distinguishing characteristics of three species of *Aeschynomene*. Measurements are in millimeters. Superscripts designate sources of information

Species	Stipe Length	Flower Length	Leaflet Length	Margins and Length of Paired Bracteoles	Fruit Segments Length, Width	Color of Banner of Flower
<i>Ae. virginica</i>	12-25 ^{a,c} 10-25 ^b	8-12(-15) ^b	6-25 ^{b,c}	usually toothed ^{a,b,c} 4 ^a	5-7 4.5-6.5 ^{b,c}	greenish yellow, with distinct red veins ^c
<i>Ae. indica</i>	<10 ^{a,b,c}	7-10 ^{a,b}	2.5-134 ^{b,c}	usually entire ^{a,b,c} 4-5 ^a	4-5 3.5-5.5 ^b	pale orange or reddish orange, veins usually distinct ^c
<i>Ae. rudis</i>	<10 ^{a,b,c}	8-12(-15) ^b	6-25 ^{b,c}	usually toothed ^{a,b,c} 2-4 ^a	5-6 5-6 ^{b,c}	pale orange or reddish orange, veins usually indistinct ^c

^a Isely 1990 (based on Rudd 1955, Carulli and Fairbrothers 1988, and Isley's pers. obs.).

^b Carulli et al. 1988 (based on Rudd 1955, Wilbur 1963, Radford et al. 1968, and pers. obs. of Carulli et al.).

^c Weakley, pers. comm. (based on Isely 1990, Wilbur 1963, and Weakley's pers. obs.).

Taxonomic Considerations

Aeschynomene indica L. is sometimes confused with two other species of joint vetch: *Aeschynomene virginica* (L.) BSP. and *Ae. rudis* Benth. *Aeschynomene virginica* is a rare native species of tidal freshwater habitats in the coastal plain of North Carolina, Virginia, New Jersey and Maryland. All previously known natural occurrences in North Carolina have been extirpated, but in recent years a few fluctuating, transient populations have been found growing as weeds in ditches connected to tidewater and in cultivated fields drained by such ditches (A. Weakley, pers. comm.).

Aeschynomene rudis, in contrast, is a species native to South America (Carulli et al. 1988). It has a spotty distribution on the coastal plain of the United States as an introduced weed that sometimes appears in rice fields, ditches and other moist, disturbed habitats (Rudd 1955, Isely 1990, Smith 1988, Carulli et al. 1988). Its current northernmost known occurrence is in Brunswick County, North Carolina (J. Massey, pers. comm.), the southernmost coastal county in that state. In the past there has been some confusion as to whether these three *Aeschynomene* taxa were all good species. Some workers have considered *Ae. virginica* probably not distinct from *Ae. indica* (Godfrey and Wooten 1981), and Isely (1990) believes that *Ae. indica* and *Ae. rudis* intergrade. However, isoenzyme studies (Carulli and Fairbrothers 1988) indicate that all three merit recognition as species and that none of them has arisen by inter-specific hybridization.

Aeschynomene virginica usually can be distinguished from the other two species by its longer fruit (loment) stipe. [Note: when measuring stipe length, one must distinguish the stipe proper from the tapering (abortive) lowermost loment segment that is continuous with it (Rudd 1955).] The generally larger flowers and longer leaflets of *Ae. virginica* also usually distinguish it from *Ae. indica* but not *Ae. rudis* (Table 1). Due to overlap in other characteristics, it is often necessary to know stipe length in order to confidently distinguish *Ae. virginica* from *Ae. rudis* (Table 1). Flower color may not be a highly reliable taxonomic character (Rudd 1955; J. Perry, pers. observ.); the amount of red pigmentation may possibly be affected by environmental conditions. However, Weakley (pers. comm.) considered color characters (shown in Table 1) reliable enough to include in a key to separate *Ae. virginica* from the other two species in the Carolinas and Virginia.

Aeschynomene indica and *Ae. rudis* overlap with regard to many characteristics, but usually can be distinguished by a combination of flower length, bracteole margin and length, and fruit segment dimensions. A summary of these differences is presented in Table 1 in a form similar to Table 1 in Carulli et al. (1988). Some specimens of *Ae. rudis* also have leaflets much longer than those of *Ae. indica*. The two species also may differ in surface features of the fruit, with those of *Ae. rudis* more often becoming verrucose or muricate along the midline on each side (Rudd 1955, Isely 1990). However, these features may not develop until the loments are both fully expanded and fully ripened, which may not be true of many herbarium collections. In a small sample of these two species in Arkansas, Smith (1994, pers. comm.) found the outside surface of the banner of fresh flowers of *Ae. indica* to be yellow flushed with pale carmine and that of *Ae. rudis* to be orange.

Discussion

Since the plants of *Aeschynomene indica* we found were located in a created wetland system, the parent source of the seed for the range extension into Virginia is open to question. The top 15 to 20 cm of substrate consists of soils transported in from a nearby forested wetland that was displaced by road construction (S. Russell, VDOT, pers. comm.). The parent wetland was located on a small, unnamed creek that is a primary tributary of the Blackwater River. Although normal flow of the Blackwater River is south to the Chowan River and then to the Pamlico Sound, current reversals during times of severe drought have been documented (National Weather Service 1996). This may allow transport of seeds from northeastern North Carolina into the Virginia side of the Blackwater watershed, including the unnamed creek area. The seeds would then be moved with the parent soil to the created wetland. However, the extended distance of the northernmost population of *Ae. indica* in North Carolina from the Virginia border (approximately 200 miles) makes the possibility of water transport seem unlikely. A more likely means of transport would be through animal vectors such as birds, fish, or large mammals. Red-winged blackbirds (*Agelaius phoeniceus*), great blue heron (*Ardea herodias*), and mallard duck (*Anas platyrhynchos*) all are frequent users of the created wetland (pers. observ.) and are known to migrate through the coastal plain of North Carolina. These or other avian species may have visited the created site, or the parent marsh prior to construction activities, and deposited *Ae. indica* seeds that had either adhered to their body or had been passed undigested through their gastro-intestinal system, into the wetland soil seed bank. Further searches for *Ae. indica* in the area of the parent marsh and in the southern Virginia and adjacent North Carolina section of the Blackwater River were unsuccessful.

This finding of *Ae. indica* growing on a created wetland site raises a question concerning the possibly significant role of created wetlands in providing habitat for rare and/or invasive plant species. Shaffer et al. (1992) have classified *Ae. indica* as a stable delta marsh species capable of adjusting to elevation shifts according to dynamic accretion and erosion forces. Langston et al. found that both *Ae. indica* and *Ae. virginica* have the potential to produce adventitious shoots from decapitated seedlings. The documented occurrence of *Ae. virginica* in wet disturbed habitats in North Carolina (A. Weakley, pers. comm.) and recently in a created wetland in Essex County, Virginia (R. Pickett, VDOT, pers. comm.; J. Perry, pers. obs.) is evidence of the potential for this species to also colonize created wetlands. It raises the possibility that such habitats might provide a meeting ground on which rare species might be out-competed by a weedy species or where a rare species and a weedy species, previously isolated spatially, might hybridize.—JAMES E. PERRY, SCHOOL OF MARINE SCIENCE, VIRGINIA INSTITUTE OF MARINE SCIENCE, COLLEGE OF WILLIAM AND MARY, GLOUCESTER POINT, VIRGINIA 23062; DONNA M.E. WARE, BIOLOGY DEPARTMENT, COLLEGE OF WILLIAM AND MARY, WILLIAMSBURG, VIRGINIA; and AMANDA MCKENNEY-MUELLER, SCHOOL OF MARINE SCIENCE, VIRGINIA INSTITUTE OF MARINE SCIENCE, COLLEGE OF WILLIAM AND MARY, GLOUCESTER POINT, VIRGINIA 23062. VIMS CONTRIBUTION # 2091.

LITERATURE CITED

- CARULLI, J.P. and D.E. FAIRBROTHERS. 1988. Allozyme variation in three eastern United States species of *Aeschynomene* (Fabaceae) including the rare *Ae. virginica*. Syst. Bot. 13:559-566.
- CARULLI, J.P., A.O. TUCKER, and N.H. DILL. 1988. *Aeschynomene rudis* Benth. (Fabaceae) in the United States. *Bartonia* 54:18-20.
- GODFREY, R.K. and J.W. WOOTEN. 1981. Aquatic and wetland plants of southeastern United States: Dicotyledons. University of Georgia Press, Athens, 933 p.
- HARVILL, A.M., JR., T.R. BRADLEY, C.E. STEVENS, T.F. WIEBOLDT, D.M.E. WARE, D.W. OGLE, G.W. RAMSEY, and G.P. FLEMING. 1992. Atlas of the Virginia flora III. Virginia Botanical Associates, Rt. 1 Box 63, Burkeville, Virginia. 144 p.
- ISELY, D. 1990. Vascular flora of the southeastern United States. Volume 3, Part 2, Leguminosae (Fabaceae). University of North Carolina Press, Chapel Hill. 258 p.
- LANGSTON, V.B., T.R. HARGER, and P.S. JOHNSEY. 1984. Potential for adventitious regeneration of selected weed species. *Weed Sci.* 32:360-363.
- NATIONAL WEATHER SERVICE. 1996. Regional climatic data for Virginia. Wakefield, Virginia.
- RADFORD, A.E., H.E. AHLES, and C.R. BELL. 1968. Manual of the vascular flora of the Carolinas. University of North Carolina Press, Chapel Hill. 1183 p.
- RUDD, V.E. 1955. The American species of *Aeschynomene*. *Contr. U.S. Natl. Herb.* 32:1-172.
- SHAFFER G.P., C.F. SASSER, J.G. GOSSELINK, and M. REJMANEK. 1992. Vegetation dynamics of emerging Atchafalaya Delta, Louisiana, USA. *J. Ecol.* 80:677-687.
- SMITH, E.B. 1988. An atlas and annotated list of the vascular plants of Arkansas, 2nd ed. University of Arkansas Press, Fayetteville. 489 p.
- SMITH, E.B. 1994. Keys to the flora of Arkansas. University of Arkansas Press, Fayetteville. 363 p.
- WILBUR, R.L. 1963. The leguminous plants of North Carolina. *Tech. Bull. No.151*. North Carolina Agricultural Experiment Station, Raleigh. 294 p.