Brittonia, 31(2), 1979, pp. 253–256.

AUTOGAMY IN THE AMERICAN STRAIN OF WITCHWEED, STRIGA ASIATICA (SCROPHULARIACEAE)

DANIEL L. NICKRENT[1] AND LYTTON J. MUSSELMAN[2]

Nickrent, Daniel L. and Lytton J. Musselman (Department of Biological Sciences, Old Dominion University, Norfolk, VA 23508). Autogamy in the American strain of witchweed, *Striga asiatica* (Scrophulariaceae). Brittonia 31: 253–256. 1979.—American plants of *Striga asiatica* (witchweed), a serious pathogen of corn and other grains that was accidentally introduced to the Carolinas in the 1950's, exhibit a form of autogamy in which fertilization occurs before the corolla opens. Pollen is shed on the stigma while the flowers are still in bud. Pollen grains germinate immediately and by the time the corolla is open fertilization has occurred. Examination of a native population of the same species in Nigeria revealed no autogamy.

Striga is a genus of about 25 species reaching its greatest diversity in tropical West Africa where about 15 species occur (Hepper, 1963). All species are apparently root parasitic. Several, e.g., *S. hermonthica* (Del.) Benth. *S. asiatica* (L.) Kuntze and *S. gesnerioides* (Willd.) Vatke are serious pathogens of important crop plants. In fact, in rain-fed areas of semi-arid Africa *S. hermonthica* may be the most serious cause of reduction in yields of *Sorghum*, the main crop of subsistence farmers. Unlike most root parasites, these three species are obligate in their parasitism and will not germinate without a stimulant produced by the host root. Thus, they represent highly specialized parasites well adapted for their heterotrophic existence.

Striga asiatica (= *S. lutea* Lour.) is widespread in Africa, the Indian subcontinent and Indonesia (Hosmani, 1978). After its introduction to the United States it became the subject of a stringent control and quarantine program by the U.S. Department of Agriculture. The flowers vary in color from scarlet to yellow to white. In the American strain the majority of plants have brillant scarlet corollas and about 0.01 percent of them yellow corollas.

To our knowledge, the floral biology of *Striga* spp. has received little attention, despite the potential value of such findings in understanding a parasite that is spread entirely by seed. *Striga asiatica* shares several floral characters with other parasitic Scrophulariaceae: corollas are showy and last for only one day; the fruit is a capsule with numerous small, sculptured seeds; the style is persistent on the capsule, perhaps aiding seed dispersal by hygroscopic movements. Students of pollination ecology would refer to the flower of witchweed as a gullet type in which the stamens are turned to the dorsal side of the flower. Gullet flowers usually have strongly zygomorphic corollas with a conspicuous lower lip that functions as an insect landing platform. However, we have never observed any insect visitors, yet seed production is prolific. This prompted an investigation into the floral biology of witchweed.

We present here observations on autogamy in *S. asiatica.*

---

[1] This work represents part of a thesis submitted to the Graduate School of Old Dominion University in partial fulfillment of the degree of Master of Arts in Biology.

[2] Reprint requests should be addressed to the second author.

Materials and Methods

Striga asiatica is a federally quarantined plant and it is illegal to transport viable material outside the quarantine area. Thus, all studies on the American strain were conducted at the facilities of the USDA Whiteville Methods Development Center, Witchweed Laboratory in the vicinity of Whiteville, North Carolina. Observations are based on two large populations.

Field studies on *S. asiatica* in Africa were made near Tegina, Niger State, Nigeria. Specimens, devitalized by the USDA Plant Protection and Quarantine Germplasm Laboratory, are deposited in the herbarium of Old Dominion University (ODU).

Observations

Stages in flower development are presented in Figures 1–8.

The inflorescence of witchweed is a spike with individual flowers borne in the axils of bracts. For the sake of this discussion several stages can be distinguished.

The first (Fig. 1) shows an immature calyx totally enclosing the corolla. In the axil below, the corolla is just beginning to protrude from the calyx (Fig. 2). At this point the style has not yet begun its rapid elongation which matches that of the corolla tube. Figure 3 shows a later stage where the corolla has elongated to ca 1 cm. A dissection of the flower at this stage is shown in Figure 7. Here the stigma (with its glandular upper end) is distal to the two anterior stamens. On dehiscence of the anthers pollen is deposited *en masse* onto the retrorse hairs (Fig. 7) which line the corolla throat. This "pouch" region where pollination occurs can easily be recognized macroscopically (Fig. 4). Further growth of the style outstrips that of the corolla, pushing the stigmatic surface upward through the pollen mass. As this growth continues the corolla lobes begin to open (Fig. 5) and the two anterior anthers dehisce, depositing more pollen into the hair-lined pouch. The opening of the corolla throat is less than 3 mm wide and occluded by numerous hairs. Pollen from both anthers germinates quickly and masses of pollen tubes were seen advancing through the style (Fig. 8) and entering ovules. Within about three days after the corolla opens the capsule is mature and releases a large number of dust-like seeds (Fig. 6).

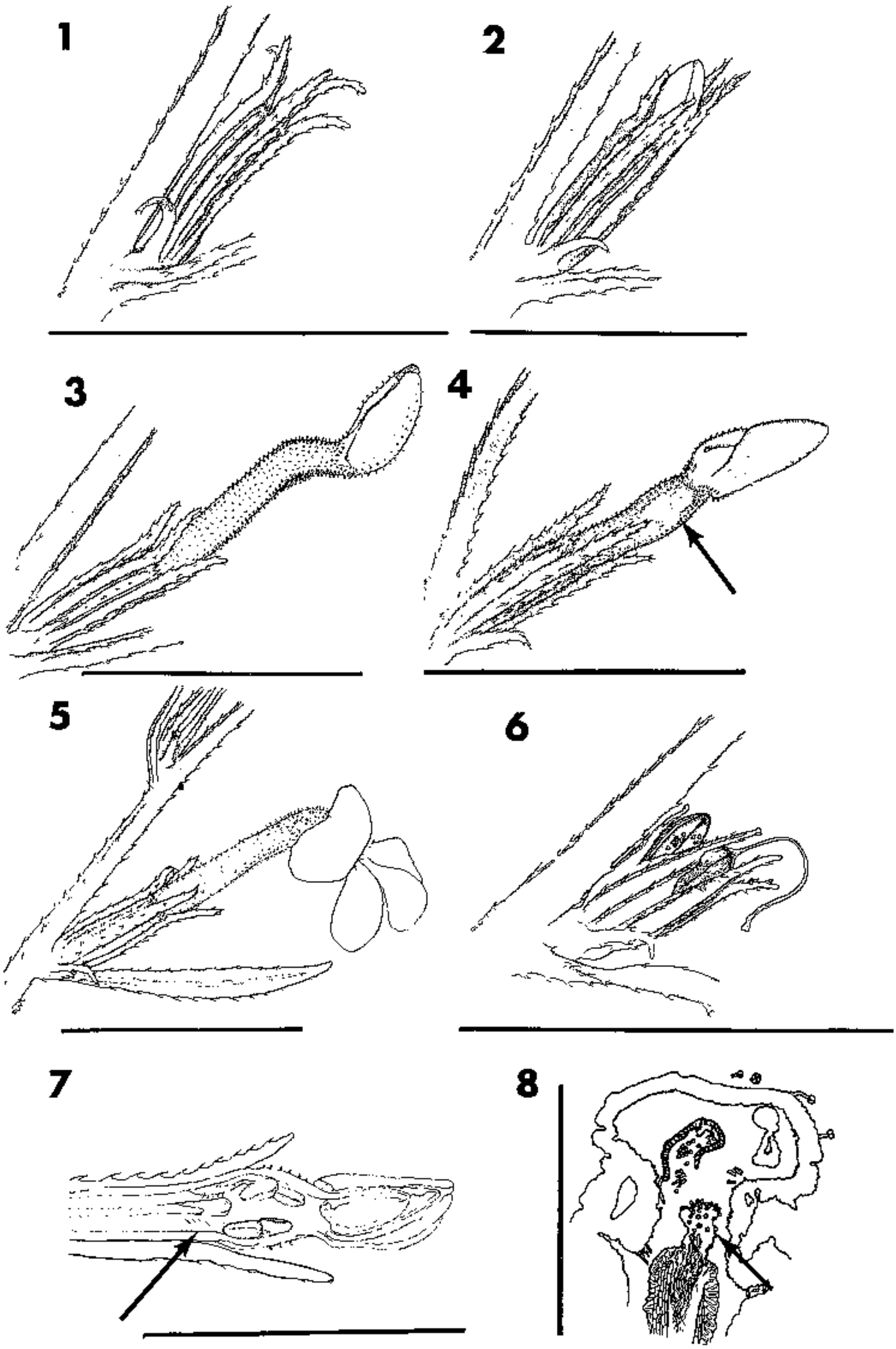
The small population near Tegina, Nigeria was on a rocky laterite outcrop, scattered amongst short grasses in the southern Guinea savanna vegetational zone. The corolla was similar to that of the American witchweed in size and general morphology although the distal lobes of the corolla were more tapered. None of the flowers in this population appeared to be autogamous; anther dehiscence coincided with corolla opening.

The flowers of *S. asiatica* are well adapted for the production of large numbers

---

→

FIGS. 1–8. Flower details of American *Striga asiatica* (scale bars in Figs. 1–7 = 1.0 cm, and in Fig. 8 = 1.0 mm). 1. Immature calyx not yet showing corolla tube. 2. Corolla just beginning to protrude from the calyx. 3. Lateral view of the corolla at the "pouch" stage. 4. Ventral view of the corolla (same stage as Fig. 3) showing prominent pouch (arrow). 5. Fully expanded corolla; note hairs at the opening of the corolla throat. 6. Mature capsule with hygroscopic, persistent style. 7. Dissected corolla (same stage as Fig. 3) showing the four stamens, stigma, and retrorse hairs (arrow). 8. Camera lucida drawing of sectioned portion of the corolla at stage shown in Fig. 4; note pollen mass on the glandular stigma (arrow).


1
2
3
4
5
6
7
8

of seeds even by a single isolated plant. While autogamy in this species is undoubtedly beneficial, it is not clear what strictures this will place on adaptability through the loss of recombination. The role of autogamy in the species *S. asiatica* as a whole is not known. For one thing, the genetics of the American introduction are not clear. We do not know if these plants are genetically uniform, that is, progeny of a single introduction, or if the pathogen was introduced more than once. Isoenzyme studies of different American populations might be useful in an assay of genetic similarity. Of particular interest would be a study of the very infrequent yellow-flowered strain which comprises about 0.01% of all American witchweed and will produce only yellow-flowered plants.

The chromosome number of *S. asiatica* is 12 (Kondo, 1973), a number close to that of related genera.

Acknowledgments

This work is part of a co-operative agreement between Old Dominion University and the Witchweed Laboratory. We thank Dr. R. E. Eplee, director of the Lab, for his support. Field work by one of us (L. J. Musselman) in Nigeria was co-ordinated by Mr. J. E. A. Ogborn, Weed Science Section, Institute of Agricultural Research, Ahmadu Bello University, Zaria. We are grateful for this support and for the invaluable assistance of Mr. R. A. Mansfield in locating populations of *Striga* in Nigeria.

Literature Cited

Hepper, F. N. 1963. Scrophulariaceae. *In:* J. Hutchinson & J. M. Dalziel. Flora of West Tropical Africa. Second edition. Crown Agents for Overseas Governments. London.

Hosmani, M. M. 1978. *Striga,* a noxious root parasitic weed. Published by the author. University of Agricultural Science, Dharwar, India.

Kondo, K. 1973. The chromosome number of *Striga asiatica* and *Triphyophyllum peltatum.* Phyton 31: 1–2.

ADDENDUM

Another species of *Striga, S. gesnerioides* (Willd.) Vatke, has recently been discovered in Florida (see R. P. Wunderlin, L. J. Musselman and A. G. Shuey. Plant Disease Reporter, April 1979).

BOOK REVIEW

Toxicology, biochemistry and pathology of mycotoxins. Kenji Uraguchi and Mikio Yamazaki (eds.). viii, 288 pp. John Wiley and Sons, New York. 1978. $27.50.

Mycotoxins and the serious "diseases" (mycotoxicoses) that can be caused by them are a relatively recent and fearful addition to our knowledge about certain fungi. When foodstuffs are stored or transported under conditions of high humidity and mild temperatures, fungal contamination can occur and mycotoxins may be produced. Several fungi have been implicated, mostly species of *Alternaria, Aspergillus, Cladosporium, Fusarium* and *Penicillium.* Studies of this problem have been rapid and profuse over the past decade or so and thus a need for a summary of knowledge existed. This book does just that. Several Japanese scientists have collaborated in its preparation. Coverage includes current scope of research and chemistry and toxicology of mycotoxins, damage to cells and tissues, carcinogenicity of mycotoxins and investigations of aflatoxins. Suggestions for prevention and control are given.

The book is timely and covers the subject thoroughly.—CLARK T. ROGERSON, New York Botanical Garden, Bronx, NY 10458.