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OBSERVATIONS ON THE CHROMOSOMES AND RELATIONSHIPS OF HAUYA AND XYLONAGRA[1]

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During the course of observations on chromosome number and morphology in Onagraceae, we have examined chromosomes of *Hauya ruacophila* Donnell Smith & Rose and of *Xylonagra arborea* (Kell.) Donnell Smith & Rose, originally described as *Hauya*. Our material of *Hauya* was cultivated in West Los Angeles, Los Angeles County, California (*Raven 14356*, RSA). Two plants investigated each had n=20 chromosomes (figure 1). The configuration at metaphase I of meiosis is of special interest, since many of the chromosomes are associated in rings or chains of 4, with as many as 7 such multivalent associations (out of a possible 10) in one cell, and 6 in another. Because of this association of chromosomes, it was difficult to determine the configurations in metaphase I cells. One of the clearest of these is shown in figure 2. The presence of many quadrivalents suggests that these plants are of autotetraploid origin, or have originated by chromosome doubling following the hybridization of two very closely related species. In either event, we interpret these observations to mean that the basic chromosome number in *Hauya* is probably 10, rather than 20. This may be determined when material of other species of the genus is available. The plants we have examined are self-compatible, inasmuch as they set an abundance of good seed when isolated. The flowers are vespertine, opening near sunset, and the long hypanthia are filled with nectar, suggesting pollination by hawk moths (Sphingidae).

The somatic chromosome number of *Xylonagra arborea* was determined from root-tip cells and was found to be 2n=14 (figure 3). Our material was grown at the University of California, Los Angeles, from seeds kindly supplied by Miss Annetta Carter from Baja California (*Carter 2995*, UC). A basic chromosome number of 7 for this monotypic genus does not suggest a close relationship with *Hauya*. In addition to this difference in chromosome number, *Xylonagra* has tubular red flowers, suggesting bird pollination. It has been grouped with *Hauya* chiefly on the basis of its large woody capsules and winged seeds. Upon closer examination, however, it is found that whereas in *Hauya* the wing extends on both sides of the body of the seed, in *Xylonagra* there is a single, one-sided wing. Development of a wing may not be unusual in Onagraceae; many examples are known of various cellular crests and narrow wings in other genera of the family. In addition, the stigma of *Hauya* is large, obconical, and 4-segmented, while that of *Xylonagra* is globose. Another interesting difference between the two was found during preparation of cytological material of *Hauya ruacophila*: here the sporogenous tissues in the anthers is divided into numerous staggered groups surrounded by sterile tissue. Divided sporogenous tissue is known in other genera of the family, such as *Clarkia*, but in these genera the packets of sporogenous tissue are in single series in each anther sac. The arrangement found in *Hauya*, which has subsequently been observed in herbarium material of all other species we have examined, seems to be unique to it. *Xylonagra*, on the other hand, has an undivided packet of sporogenous tissue in each locule of the anther. In 1873, Watson (Proc. Am. Acad. 8: 596) remarked that the affinities of *Xylonagra* (*Oenothera arborea* Kell.) appeared to be with *Oenothera*, subgenus *Chylismia*. Considering its chromosomal and morphological similarity to that portion of the genus and particularly to such species as *Oenothera cardiophylla* Torrey, Watson's suggestion is still valid. The affinities of *Hauya*, on the other hand, are more obscure.

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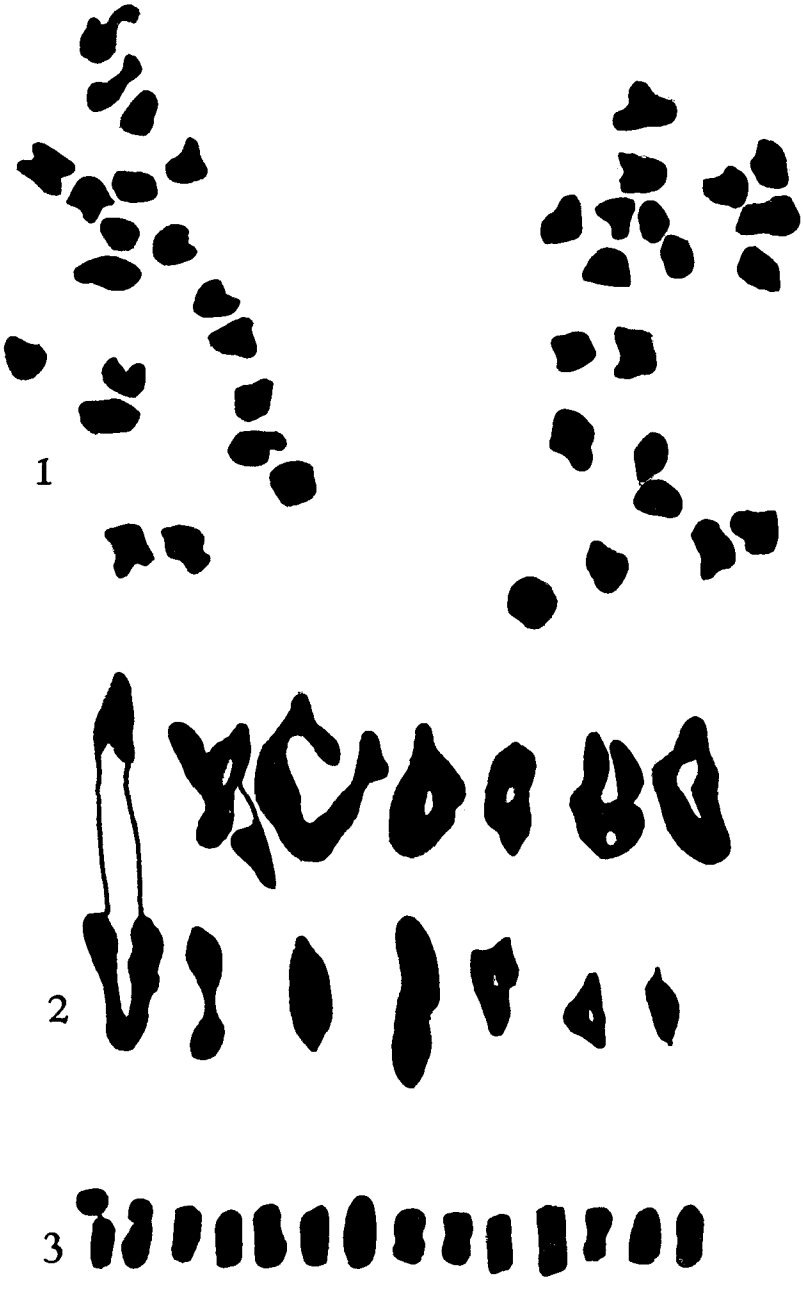

FIG. 1-3. Chromosomes of *Hauya* and *Xylonagra.* Fig. 1. Meiotic anaphase I in *Hauya ruacophila;* two groups of chromosomes moved closer together. Fig. 2. Meiotic metaphase I in *H. ruacophila,* spaced; figure at left and those on top row presumably quadrivalents, those below, bivalents. Thus configuration for cell probably 7 quadrivalents plus 6 bivalents. Fig. 3. Mitotic metaphase in root-tip cells of *Xylonagra arborea.* All figures × 2780.