

coast of India between Quilon and Mangalore. Specimens of both the genera *Diplobrachia* and *Siboglinum* were obtained during the 75th Fishery Cruise of the Indo-Norwegian Project Research Vessel VARUNA from depths as shallow as 9 metres between Quilon and Cochin. I am told by fishermen who were shown the empty tubes of pogonophorans that during the south-west monsoon large quantities of empty tubes are washed ashore along certain beaches and this is not in the least sur-

prising as the animals are found in dense congregations in certain areas close to the shore. Two points of interest are the occurrence of Pogonophora in very shallow waters of the littoral zone, and the apparent correlation in its occurrence in the continental shelf area and the areas of mud-bank formation and shrimp fishing grounds, along the south-west coast of India. Detailed investigations are under progress.

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ORIGIN OF *AMARANTHUS DUBIUS*

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A *AMARANTHUS DUBIUS* Mart. ex Thellung, though indigenous to tropical North America, has spread with man throughout tropics where it is used for its grain and as a vegetable.¹ In India its introduction seems to be recent, since it is neither recorded by Hooker,² nor is mentioned in any of the regional floras.³⁻⁷ However, it is a popular pot herb and has now become an escape in and around Lucknow where it is fast becoming a weed. Haploid chromosome number of the species is 32 (Fig. 2) and is the only natural tetraploid species reported so far in the genus.⁸

On the basis of his studies on F_1 *A. dubius* \times *A. spinosus*, Grant⁹ postulated that *A. spinosus* Linn. is one of the parents of *A. dubius*. We have not only studied a large number of individuals of the above hybrid ($2n=49$), but also the ensuing amphiploid ($2n=98$). In the light of our cytogenetic studies together with morphological comparison between the taxa concerned, the foregoing suggestion of Grant,⁹ regarding the role of *A. spinosus* in the origin of *A. dubius*, has been examined here.

Studies on a number of populations of *A. spinosus* and *A. dubius* reveal the presence of 17 (Fig. 1) and 32 (Fig. 2) bivalents respectively in pollen mother cells. Fertility in both is normal. The F_1 hybrid *A. dubius* \times *A. spinosus* arises spontaneously wherever and whenever the two species grow in sufficient proximity. These individuals possess $2n=49$ and at metaphase I more than 50% pollen mother cells show $17_{II} + 15_I$ (Fig. 3). While bivalents disjoin normally, univalents are distributed irregularly. Fertility is about 4%. In strong

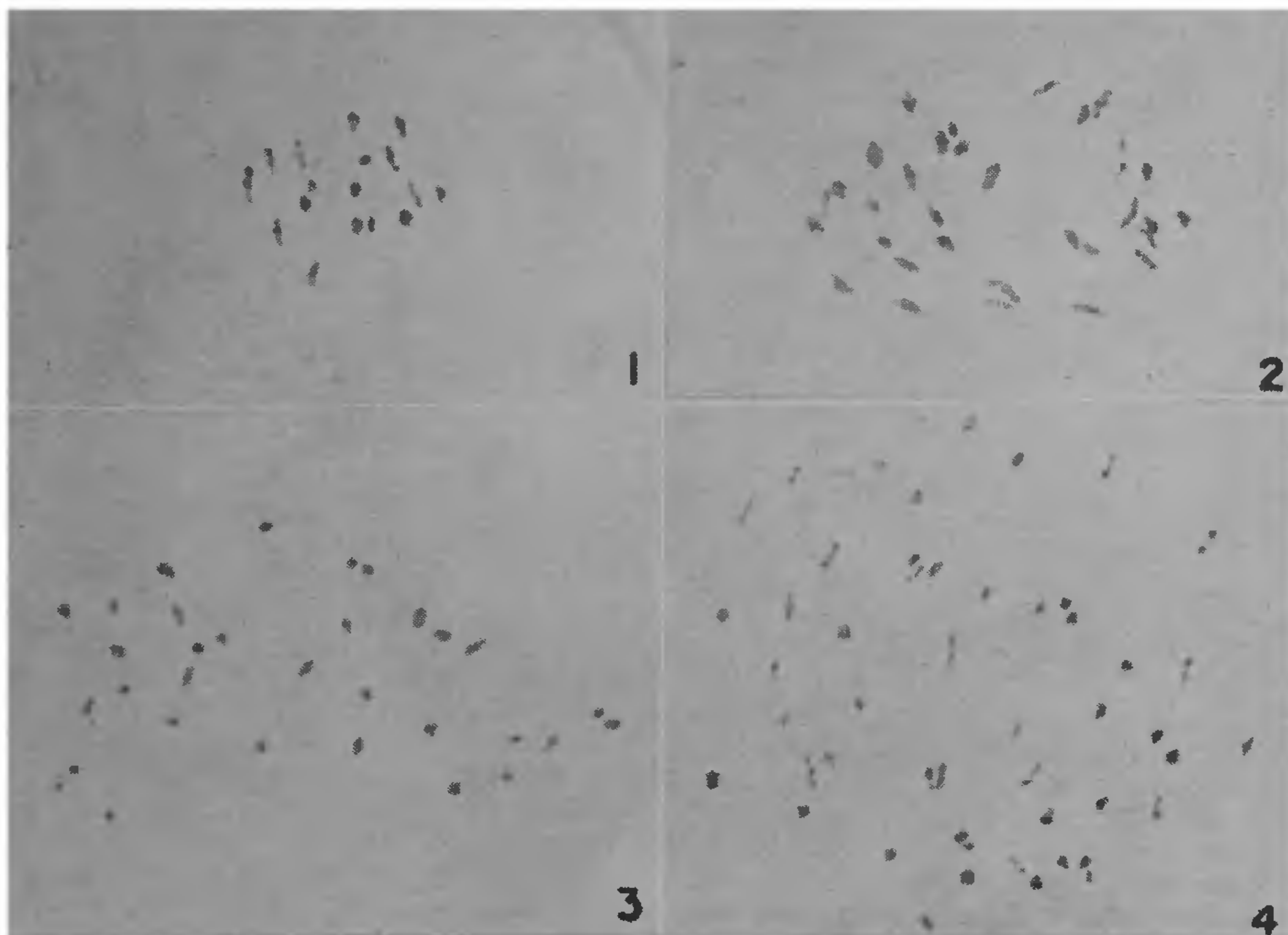
contrast to F_1 , the amphiploid regularly forms 49 bivalents (Fig. 4) with an occasional loosely associated quadrivalent. Further course of meiosis and fertility are normal.

The formation of 17_{II} in F_1 is the result of pairing between spinosus genome ($n=17$) and 17 chromosomes (out of 32) of *A. dubius*, leaving the remaining 15 dubius chromosomes unpaired. The presence of 17_{II} in the hybrid would ordinarily indicate that in *A. dubius* 17 chromosomes are homologous with the spinosus genome of $n=17$. On this basis, Grant made the suggestion that *A. spinosus* is one of the parents of *A. dubius*. However, this suggestion is not supported by the situation found in the amphiploid *A. dubius-spinosus* ($n=49$). In case the 17 bivalents of F_1 hybrid were organized between homologous chromosomes, then one should have encountered a high number of quadrivalents in the amphiploid. Far from a corresponding number of quadrivalents in the amphiploid, we found at the most just one quadrivalent and that too loosely associated. Therefore the 17 bivalents in F_1 are between homologous chromosomes, and evidently there ensues 96% sterility because of the disharmonious combinations resulting from differentially homologous chromosomes coupled with the irregular distribution of univalents. On the other hand, amphiploid is fertile because of the preferential pairing between the entirely homologous chromosomes followed by regular disjunction.

It emerges from the above that the genome of *A. spinosus* and the chromosomes of *A. dubius*, that pair with it, are not identical with each

other. As such *A. spinosus* in the present form does not appear to be one of the parents of *A. dubius*, unless we assume that after its entry

comparisons (unpublished data) we are inclined to look to the origin of *A. dubius* through allopolyploidy based on $16 + 16$, rather than $16 + 17$



FIGS. 1-4. *Amaranthus spinosus* $= 17_{II}$. Fig. 2. *A. dubius* 32_{II} . Fig. 3. F_1 Hybrid *A. dubius* \times *spinosus* $17_{II} + 15_I$. Fig. 4. Amphiploid *A. dubius-spinosus* 49_{II} . All, $\times 1,160$.

in *A. dubius*, the *spinosus* genome underwent radical alterations. Even after such an assumption, one more point requires solution. If *A. spinosus* ($n = 17$) is one of the parents of *A. dubius* ($n = 32$), it naturally implies that the other parent should have $n = 15$ (equivalent to the number of univalents in the F_1), a number not recorded so far in any of the species of the genus *Amaranthus*. However, Grant⁹ is of the view that the other parent involved was also with $n = 16$ or 17 . According to him the resulting amphiploid, with $n = 33$ or 34 , got reduced by aneuploidy to $n = 32$, the number found in the present-day *A. dubius*.

It is apparent that *A. spinosus* ($n = 17$) and *A. dubius* ($n = 32$) belong to two different basic numbers, former to $x = 17$ and latter to $x = 16$. Furthermore, in the light of the cytogenetic evidence presented here and morphological

or $17 + 17$ followed by aneuploidy. We are trying to verify this suggestion experimentally.

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