Abnormal growth response in the host–parasite association

Cuscuta reflexa Roxb. (fam. Convolvulaceae) is a total ecto-parasite thriving on many species of herbs, shrubs and trees. Apparently, it has no host-specificity and is found to parasitize both monocots and dicots. The wiry stem coils around the host plant for support and pierces the tissues of the host by means of haustoria for extracting nutrients, while causing minimum damage to the host and without impairing its vitality. As many as 28 species of host plants have been found to develop galls and other hypertrophies[1] by *Cuscuta*. It is reported that *Quisqualis malabarica* Bedd. bears winged fruits[2] and *Quisqualis indica* L. a narrowly ellipsoidal 5-angled fruit. But *Q. indica* under cultivation does not bear fruits and is propagated vegetatively[3]. The host–parasite interaction between *Q indica* (Rangoon creeper) of the family Combretaceae and *Cuscuta reflexa* is unique, resulting in unusual responses on the part of the parasite and the host.

The haustorial penetration of *Cuscuta* into the ovaries of the flowers of *Quisqualis* was found to cause the development of parthenocarpic fruits (Figure 1 *a*, *b*) which do not abscise as against the shedding of flowers under normal conditions. The fruits induced by haustorial penetration are about 16 mm long, considerably thick, 5-angled and seedless. In this host–parasite association, the growth pattern of the shoot in *Cuscuta* is modified to a great extent. The thin wiry, sparingly branched, greenish yellow stem with long internodes becomes stout, bushy and much branched, showing shorter internodes (Figure 1 *c*) besides being intensely green.

These twin features, viz. induction of parthenocarpy in the host species and the much branched bushy shoot habit of the parasite, are peculiar and rather unusual compared to other host–parasite associations on record. It is known that application of growth substances such as indole acetic acid, indole butyric acid and gibberellic acid on young emasculated flowers of *Psidium guajava*, tomato, *Citrus* and fig results in parthenocarpy[4, 5]. Cytokinins have been reported to play a role in all phases of plant development, from cell division and cell enlargement to the formation of flowers and fruits[6]. In *C. chinensis*, application of cytokinin is reported to have induced the formation of numerous haustoria on free hanging vines, suggesting the role of cytokinin as a haustorium-initiating hormone in para-

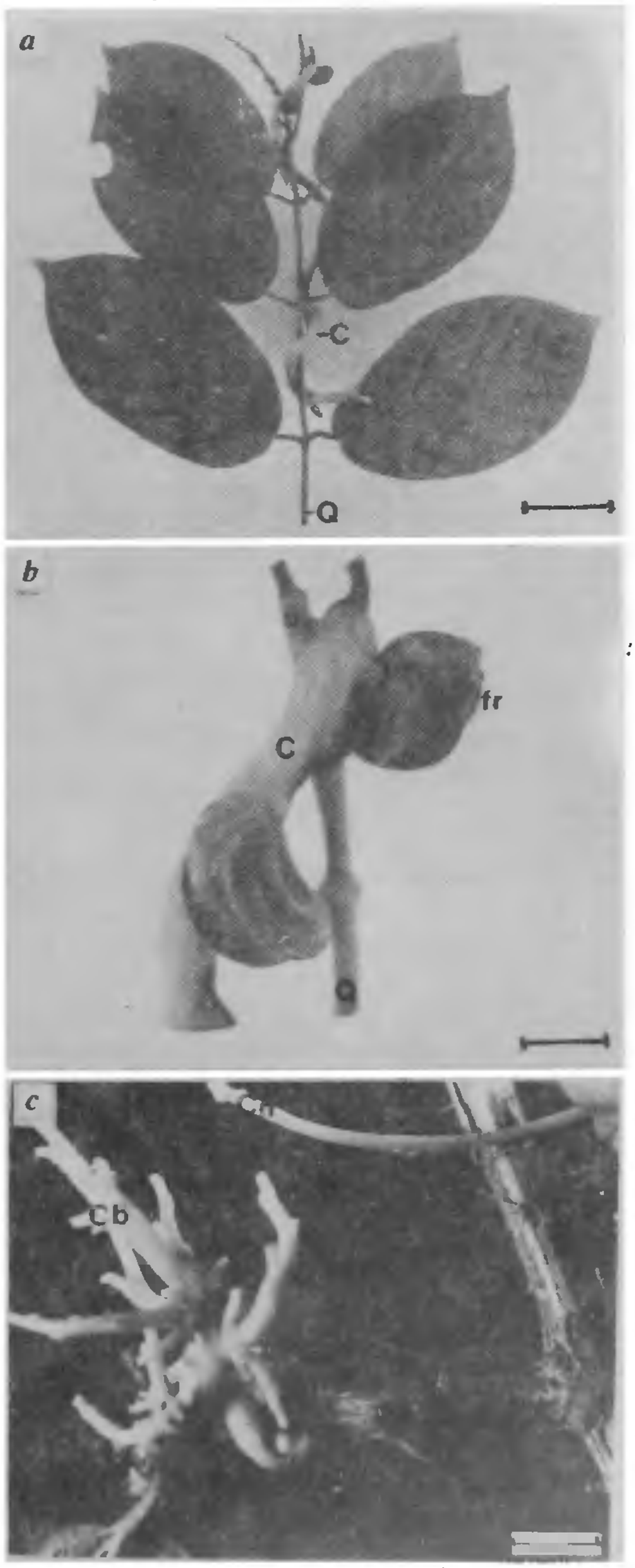

Figure 1. *a*, *Quisqualis Cuscuta* association, *b*, abnormal fruit development in host by haustorial invasion, *c*, the bushy shoot of *Cuscuta* in association with *Quisqualis* compared with the normal shoots Q – *Quisqualis*, C – *Cuscuta*, fr – fruit, normal (Cn) and bushy (Cb) shoots of *Cuscuta* *a* – 30 mm, *b*, *c* – 5 mm

sitic flowering plants[7]. In the present observation, the haustorial invasion by the parasite into the ovaries probably induced the biosynthesis of growth factors akin to cytokinin causing parthenocarpic development of fruits in the host.

Certain chemical substances such as naphthalene acetic acid (NAA), maleic hydrazide, ethylene, cytokinin and triiodobenzoic acid (TIBA) are known to produce a bushy habit in the shoots of several plants by suppression of apical dominance[8–12]. The much branched bushy and stubby nature of shoots of *Cuscuta* caused by the association with *Quisqualis* could be due to the suppression of apical dominance by direct or indirect blocking of the synthesis of native auxin in the parasite.

The interaction between the host and parasite which cause modification of the growth phenomena in the development of fruit in the host and branching of shoot in the parasite could have been mediated through reciprocal influence and alteration of endogenous growth substances.

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