ESTABLISHMENT AND COLONIZATION BY A WILD POTATO SPECIES IN THE OLD WORLD—IN THE SIMLA HILLS, INDIA

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THE tuber-bearing *Solanums* (section *Tuberarium*, subgenus *Pachystemomum*, family Solanaceæ) are native to the Americas and occur throughout that continent except Guianas and Canada. They are present most abundantly in South Central Mexico and Peru-Bolivia-North-West Argentina. Though confined for the most part to mountains—upto 5,000 metres altitude, but mostly between 2,000–4,000 metres altitude—they are found in a great variety of habitats, from arid and semi-arid regions, to bleak alpine meadows, wet subtropical forests, and even in salty spray at sea-level.[1,2] The only report of section *Tuberarium* occurring in Old World is of some potato plants found growing in Basutoland, South Africa, at about 2,000 metres altitude.[3] They have been suggested as potatoes originally introduced in this region in 1830, or later escapes from their cultivation. They resemble a coarse cultivated plant.[1]

Plants of a tuberiferous *Solanum* species, *S. chacœnse* Bitt., have been found to grow naturally in Simla (latitude 31° 06′ N., longitude 77° 10′ E., elevation about 2,200 metres) for about the last 15 years. They first appeared on dumps where used soil and trash after harvesting pots in the glass house (wherein are planted experimental material and *Solanum* germplasm collections) of the Institute were being thrown. They began spreading steadily after about the first five years. They now occur in colonies, except inside and just outside the Botany laboratories of the Institute. Here, they are found in about a hectare of land, both singly and in clusters, all around the glass houses, in drainage channels, path sides, field borders, along hedges, waste lands and on dumps. The population has increased considerably during the last two years, and they have now begun to appear even as weeds in potato fields which have never been planted with any wild *Solanum* species.

Elsewhere, ten district populations have been located 200–2,000 metres away and consisting of 40–1,000 plants. The terrain of Simla is hilly, and the area is wooded, mostly with pure stands of *Cedrus*. All populations are at higher elevations than that of the Institute. The populations were observed regularly for their emergence, flowering and berry setting. About 15–50 plants each from six populations were planted singly in pots, and studied for their variations and breeding behaviour. The main inferences are given below.

This Institute has been maintaining since 1934, most of the tuber-bearing *Solanum* species. They have been introduced from Britain (Commonwealth Potato Collection and Prof. Hawkes' collection) and the USA (US Department of Agriculture). Most species have 2–6 accessions, but some like *S. chacœnse*, *S. demissum*, *S. acaule* and *S. phureja* have many more.

Obviously, the species first escaped on the rubbish dumps where soil and trash were being thrown after harvest from pots planted with experimental material including species. Since many accessions of this species have been available in the collection, tubers of more than one accession might have escaped and established themselves as plants thereafter. The species is self-incompatible, and hence berries would have been formed on these plants through outcrossing. These berries might then have been dispersed by birds. This is evident from the following: (1) Population size—New populations, when they make their first appearance, consist of colonies of 20–30 plants each. We have not so far observed plants singly anywhere except inside the Institute. (2) All the ten populations are located at higher elevations than that of the Institute, and rains could not therefore have dispersed them. (3) Grazing by cattle is limited in the area, and further, local cattle do not eat them.

The species, *S. chacœnse*, is self-incompatible and asexually propagated, but in its native habitats is generally seed-propagated.[2] But, in Simla hills its establishment, colonization and spread are being accomplished through a series of adaptive features brought about by shifts in breeding system. They are, firstly, as pointed out earlier, it disperses itself through berries carried by birds. Next, the colonies establish themselves asexually, as is evident from the following: (1) the three smallest populations do not flower, (2) the percentage of flowering plants and flower number per plant

increase with population size, (3) the build-up rate of smaller populations is slow. It is well known that vegetative mode of reproduction is the safest and surest means of survival.

In the third stage, after colonies attain a certain size, their plants begin to flower, their incompatibility apparently breaks down, and they begin to produce berries, probably by selfing also. This is inferred from the following: (1) Populations having about 60 plants or more produce flowers, and the largest of populations (Institute) produce plenty of berries and seeds; (2) pollen was more than 75% stainable; (3) when selfed, about 40% of plants in largest populations produced berries and a single plant (one of 20 plants tested) of second largest population also produced a berry.

It is an established fact that self-compatibility gives more assured seed production than self-incompatibility. It is reasonable to assume that the largest population has now been going through this third stage, and the second largest population is just entering it. When once any population becomes well established, it is possible that it might revert back to its original self-incompatible nature, thus ensuring outbreeding. This maximizes the potentialities of sexual reproduction and is thus the most desirable breeding system. The Institute population seems to have established itself firmly in the area and has been spreading fast. They produce flowers and seeds in plenty, and since the last two seasons, have even begun to appear as weeds in potato fields.

The tuber-bearing *Solanum* species are a large group of over 150 species characterized by inter- and intraspecific variability. A number of them are weedy and ruderal in nature. *S. chacœnse* is a highly polymorphic weedy species and has the widest distribution in this group of species.[1,2]

It would be interesting to see why this species alone has been able to establish itself in this area, though the Institute has been growing most of the species, and perhaps growing and using even more widely, another weedy, widely occurring self-fertile species *S. demissum*. The material offers a good opportunity to observe the genetic mechanisms responsible for the establishment, colonization and spread of a self-incompatible species that is capable of both sexual and asexual reproduction in a new region half-way round the world. This is under way.

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ORIGIN OF "COMMON SUBSIDIARIES" OF STOMATA IN THE ANGIOSPERMS

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OCCURRENCE of stomata separated from one another by several epidermal cells in leaves and other plant parts can be attributed to less frequent stomatal origin. But so often, stomata, irrespective of their structure and development, are spaced out by single epidermal cells or what could be called the "common subsidiaries". Presence of common subsidiaries, specially in high frequency, is significant in that it may not only affect the pattern of spacing of stomata but also their density; besides, it contradicts the notion that inhibitory organogenetic fields[1] operate during stomatogenesis. It was, therefore, considered that a study of the origin of common subsidiaries should yield some basic data on stomatal origin in space and time. As far as the authors are aware, there has been no work in the past on this aspect. Therefore, they present here results of their study on the origin of common subsidiaries in the leaves of three species, *Brassica oleracea* L., *Clematis gouriana* Roxb., and *Dioscorea bulbifera* L., where common subsidiaries are frequent. The investigation involved examination of epidermal peels from early stages of leaf primordia to those of mature blade. For convenience the abaxial leaf epidermis was only studied. Acetocarmine staining helped in following stomatogenesis in whole mounts of early stages of leaf development of which dermal peels are difficult to obtain. The mesogenous subsidiaries of the stomata are referred to as M1, M2, and M3 respectively following the sequence of their origin.