Variation of the Acclimatised Species of Prickly-pear (*Opuntia.*)

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(By permission of the Board.)

(Plates VIII.–X.)

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I.—INTRODUCTORY.

Of the species of the American genus *Opuntia* acclimatised in Australia, nine have established themselves so securely as to be regarded as pests, and two of these cover enormous areas of country. The vast numbers of plants growing in a country new to them under conditions different from those of their native land, in a great variety of soils, and, in the case of the most widespread pest (*O. bentonii,* Griff.), under great differences of climate, might be expected to vary correspondingly. This expectation might be held even more strongly when it is considered that in their monograph of this genus, published in 1919, Drs. Britton and Rose described 240 species and added nine more in a supplement published in 1923. The estimate of these authors is undoubtedly a conservative one, very many species considered distinct by other students of these plants being relegated by them to synonymy. This fact in itself would indicate that the authors regarded the species of *Opuntia* as essentially variable. Some account of the actual variations met with by the writer among the species acclimatised in Australia during over four years of study may therefore be of interest, for in this continent the species found in any locality are so few that it is possible to decide with very little hesitation as to the origin of any variety met with.

The species acclimatised in Australia have been described and illustrated in a booklet published by the Commonwealth Prickly-pear Board, in the preparation of which the writer received valuable assistance from Mr. C. T. White, F.L.S., Government Botanist of Queensland. Those classed as pests were identified as follows:—

1. Common Pest Pear (*Opuntia bentonii,* Griff. = *O. inermis,* D.C. var.) established over some 47,500,000 acres in Southern Queensland and Northern New South Wales, and over great areas growing so densely as to be impenetrable.

2. Spiny Pest Pear (*O. stricta,* Haw.) spread over about 1,000,000 acres in Southern Central Queensland, in the watersheds of the Fitzroy and Burnett Rivers, often growing so densely as to be impenetrable.
3. Tiger Pear (*O. aurantiaca,* Lindl.) acclimatised in many areas in Northern New South Wales and Southern Queensland.
4. Smooth Tree Pear (*O. vulgaris,* Mill. = *O. monacantha,* Willd.) established in many localities in the coastal districts of all the Australian States.
5. Velvety Tree Pear (*O. tomentosa,* Link.) established in numerous localities in Queensland and a serious pest in parts of the Fitzroy and Dawson Districts, where some of the brigalow scrubs are quite impenetrable owing to its presence.
6. Devil's Rope (*O. imbricata,* D.C.) established in numerous localities in Northern New South Wales and at one or two places in Southern Queensland.
7. Cardona (*O. streptacantha,* Lem.) acclimatised about Rockhampton and at scattered localities for 150 miles west of that city.
8. Joconoxtle (*Opuntia* sp.) established about North Rockhampton.
9. Dark-spined Pear (*O. elatior,* Mill. = *O. nigricans,* Haw.) established near Denman in the Hunter district of New South Wales.

The writer has met with no variations in *O. aurantiaca, O. vulgaris, O. streptacantha,* and the Joconoxtle other than such as were obviously due directly to greater or less suitability of the situation in which the plants were growing.

The variations met with among the other species will be grouped under the heads of:—Fluctuations, Mutations, and Hybrids.

II.—FLUCTUATIONS.

The development of spines in *O. bentonii* and *O. stricta* and to a less extent in *O. tomentosa* and *O. elatior* depends to a considerable degree on the situation in which the plant is growing.

In the open and in poor soil spine development is at its maximum, whilst in good soil in the shade of bushes and trees *O. bentonii* is practically always spineless and *O. stricta* produces very few spines.

In these contrasted situations the form of the individual joints is also considerably modified. In the open and in unfavourable soils they are thick and comparatively short, sometimes subcircular in *O. bentonii,* whilst in deep shade they are thin and elongated.

That these differences are correctly regarded as fluctuations due to environment can readily be shown by transplanting spiny plants from

an unfavourable environment to sheltered situations. The new shoots produced at once take on the form proper to their new environment. This is clearly shown in the accompanying photograph of a plant of *O. stricta* transferred from the open to a dimly lighted enclosure (Plate VIII.). If kept in a very subdued light for a prolonged period all the species of *Opuntia* produce very long, cylindrical, or strap-shaped joints, and these may sometimes be seen on plants of *O. bentonii* growing beneath a thick bush of *Lantana*.

It is the great variability in form and spininess of the joints which sometimes leads to confusion between the two principal pest pears of Australia, but to anyone familiar with the fluctuations of the two species there is no difficulty in distinguishing them under any circumstances.

III.—MUTATIONS.

Under this heading I am including all those variations which do not appear to be due directly to environment.

In the Velvety Tree Pear, *O. tomentosa*, a certain proportion of the plants are very much more spiny than the majority. The spines are both more numerous and considerably longer, and their white colour contrasting with the dark green pubescence of the joints gives these spiny plants quite a distinctive appearance. Probably about 5 per cent of the plants in Central Queensland are spiny and the variation is well marked in the seedling. It is true that occasionally intermediate plants may be found with a moderate development of spines, but these are far less common than the extremely spiny form. It seems almost certain that in this species spinelessness and spininess are Mendelian characters.

At Glenmore, North Rockhampton, are growing a number of plants of cultivated species of *Opuntia* from the province of Zacatecas, Mexico. Seeds of these plants were brought by the late Mr. Birkbeck from that country over seventy years ago. Among them are four which seem to be essentially the same species but differ in two pairs of characters—red or white fruit and spiny or spineless joints. They are known in Spanish as Tuna colorada espinosa, Tuna colorada sin espinas, Tuna blanca espinosa, and Tuna blanca sin espinas.

Here again we meet with spinelessness and spininess acting as if they were Mendelian characters.

It is perhaps as well to emphasise that "spinelessness" is used here as a relative rather than an absolute term. It is doubtful whether any entirely spineless *Opuntia* exists. Those commonly called "spineless" are species on which the spines are generally few and often disappear altogether from the older joints.

The pest pear of South Africa exists in spineless and spiny forms, known to the inhabitants respectively as "kaalblad" (cabbage-leaf) and "doornblad" (thorn-leaf). Both are regarded as forms of *O. ficus-indica* or a closely related species.

At Gravesend, New South Wales, there is a plant of *O. imbricata* growing in a garden which is markedly less spiny than the plants commonly met with. This is perhaps the "spineless" form of this species, though its spinelessness is very far from complete. I have not myself seen this plant, but Mr. F. H. Roberts, M.Sc., showed me specimens obtained from it. It is possible that it is only a fluctuation produced by garden conditions, but I have seen other plants of this species in gardens with normal spininess.

Opuntia bentonii, our common pest pear, is apparently a fixed "spineless" species. Occasionally it produces as a bud variation an extraordinary spiny form which bears a great resemblance to *O. dillenii*, Ker-Gawler, and is certainly responsible for some of the records of the occurrence of that species in Australia. This spiny mutation of *O. bentonii* differs from the normal form in a number of features, not merely in the development of spines, so that it cannot be grouped with the simple mutations referred to above. The joints are spatulate or elongate obovate and at least twice as long as they are broad, whereas in the normal form they are broadly obovate and the breadth is usually considerably more than half the length. The areoles are usually less than an inch apart, six or seven in a diagonal line across the joint, whereas in the normal form they are an inch apart and only three or four occur in a diagonal line across the joint. But it is the armature of the areoles which is the most striking feature. Each bears a large number of flattened recurved spines, like those of *O. dillenii* but usually shorter, and a thick brush of stout bristles or spicules of a brown colour, those in the upper part of the areole being sometimes fully half an inch long. On the basal joints the areoles are frequently so near together that the joint is almost hidden by the spines and spicules, and it is sometimes difficult to say where the spines end and the spicules begin, there being a complete transition from one to the other (Plate IX.).

Joints of this type were brought to the Lands Office at Roma some years ago, and it was probably from this specimen that a plant in the Brisbane Botanic Gardens was grown for some years. A similar plant is growing near Dulacca, for information about which I am indebted to Mr. N. Culliford. Mr. E. R. Caldwell sent me a specimen from Taroom and Mr. R. Range sent a specimen from Warra to the Prickly-pear Lands Commission, who kindly presented it to me. Another specimen from Gogango was brought by Mr. W. Munns to the Westwood Prickly-pear Experiment Station. Mr. Munns stated that he had found the specimen at Gogango growing from a plant of pest pear (*O. bentonii*), and the specimen sent by Mr. Range consisted of two joints growing from the top of a normal joint of *O. bentonii*, proving conclusively that it was a bud-variation of that species. The sporadic occurrence of this plant in regions where the pest pear is common is thus satisfactorily explained.

There can be little doubt that if this plant was found in America, and its origin were unknown, it would be called *O. dillenii*, just as it was formerly in Australia. *O. dillenii* is a variable species, a plant from

Florida and another from Central America grown side by side at Sherwood remaining decidedly different. Neither of them has the profusion of spines and bristles possessed by most of the areoles of the mutation in question, but some of the most spiny areoles of *O. dillenii* could be matched among the less spiny areoles of the mutation.

The evidence suggests that *O. bentonii* is possibly a spineless mutation of *O. dillenii*, and that these bud-sports are reversions to the original form. The distribution of *O. bentonii* in America is said by Dr. D. Griffiths to extend from the mouth of the Brazos River in Texas to eastern Florida, but he adds:—"Always in cultivation in the eastern portion of this range and native in South-western Louisiana and Texas." Britton and Rose give the distribution of *O. dillenii* as:—"Coasts of South Carolina, Florida, Bermuda, the West Indies, east coast of Mexico, and northern South America; extending inland in Cuba." From these records it would appear that *O. dillenii* occurs all round the coasts of the Gulf of Mexico and the Caribbean Sea, except for an area from Texas to northern Florida, where *O. bentonii* occurs. One is tempted to suggest that in this region a spineless mutation known as *O. bentonii* has replaced the typical *O. dillenii*.

Dr. J. K. Small, writing of the prickly-pears of Florida, says of *O. dillenii*:—"This species is the common and typically maritime prickly-pear of our range, and also the most vigorous of the several different kinds. It is apparently the longest-lived and the healthiest of them all, seemingly wholly free from disease and also from insect pests. It grows either in perpetual shade or in exposed sunny localities and will stand almost any amount of ill-treatment and frequent transplanting for ornamental purposes with impunity.

"Although typically maritime and sometimes growing even in mangrove swamps or in low situations where the plants are partly submerged during high tide, it may be found equally vigorous on the high quiescent sand-dunes along the eastern coast of the Florida peninsula."

Most of these remarks would apply exactly to *O. bentonii* in Australia, except that it thrives even more inland than it does on the coast.

Another very interesting plant, which I have no doubt is a mutation from the common pest pear, was discovered by Mr. T. A. Cole, junr., in the bush near Chinchilla. I inspected it in his company and brought back joints which have continued to produce further joints of the same form. These joints are much more elongated than those of normal plants of *O. bentonii*, being ensiform instead of obovate. Every joint on the plant, which was a large one, had exactly the same form, as shown in the accompanying illustration (Plate X., figs. 1 and 2). The plant is growing in an area of dense pear amongst which no other plants with similar joints were noted.

The interest of this specimen is that its joints approach in form to those of *O. linguiformis* Griff. Britton and Rose state of this

supposed species:—"This plant is rather common in cultivation in the South-west and is now found in most cactus collections. According to Dr. Griffiths, it is occasionally found wild near San Antonio, Texas. We have seen somewhat similar plants, from Brownsville, Texas, probably referable to one of the races of *Opuntia lindheimeri*. On account of the shape of the joints, this species is commonly called cow's tongue or *lengua de vaca*."

It would thus appear that a tongue-shaped or sword-shaped mutation sometimes occurs in *O. lindheimeri* and that a quite similar mutation may occur in *O. bentonii*. Though the form of the joints is so different, the areoles, spines, and spicules are unchanged and thus give a clue to the origin of the new form.

An interesting plant found by Mr. A. N. Burns on the summit of Mt. Sebastopol, Westwood, is undoubtedly a mutation of *O. stricta*, amongst normal plants of which species it is growing. Joints transplanted to the grounds of the experiment stations at Westwood and Sherwood have continued to produce joints of the abnormal form. The abnormality consists in the fact that the joints are so narrow as to be almost cylindrical. Full-grown joints are about 6 inches long and only 1½ to 2 inches broad, whilst in normal plants of *O. stricta* they are from 2½ to 3 inches broad. In other respects this plant is normal. The form of its joints gives this mutation a superficial resemblance to the slender-jointed *Opuntias* placed in the sections *Curassavicæ* and *Aurantiacæ* by Britton and Rose.

The mutations referred to above have all proved to be viable, but there is a form of variation not infrequently met with which is apparently a non-viable abnormality. In this abnormality the joints are extremely short and crowded together and form a dense bunch sometimes resembling the head of a cauliflower, but at other times not so crowded. A bunch of joints of this nature growing on a normal plant is a fairly common phenomenon in the pear country and some bushmen refer to it as mistletoe. I have noticed abnormalities of this type on *O. bentonii*, *O. stricta*, *O. tomentosa*, and *O. elatior*.

The commonest of all abnormalities, both in *O. bentonii* and *O. stricta*, is one in which the fruits are all sterile. This variety was described in the case of *O. bentonii* by Dr. Jean White in the first of her Annual Reports of the work of the Prickly-pear Experimental Station, Dulacca. She found it was so common that she referred to it merely as "abnormal pear." These sterile plants of *O. bentonii* do not appear to differ in the form of their joints from normal plants. In the case of *O. stricta*, however, the sterile plants can be readily distinguished, since the spines on the joints are short and dull-grey in colour instead of yellow. The plants also grow taller than normal ones and the joints are somewhat lighter in colour, so that the sterile plants can be distinguished readily even if no sterile fruits are present on them.

IV.—HYBRIDS.

The flowers of the various species of *Opuntia* are so much alike that it might be anticipated that hybridisation would occur commonly between them in localities where they grow mingled together. In the Rockhampton district of Queensland the two principal pest pears grow mingled together over a very large area, and two other species are quite common, yet in the fifteen months in which I lived in that district I only once found a plant which I could not at once assign to one of the known species. Since then three other plants, probably of hybrid origin, have been shown me in the district.

Of these four supposed hybrids, two are apparently hybrids between *O. bentonii* and *O. stricta,* though it is possible that they are really mutations of one or other of these species. Both these plants were found at Westwood, one by myself, the other by Mr. A. N. Burns. The former has joints like those of *O. bentonii* in size, shape, and thickness, but with more spines than are normally found in that species. These spines are long and slender and closely resemble those typical of *O. stricta.* The fruits are sub-spherical as in the latter species.

The second supposed hybrid has joints larger than usual in *O. stricta,* 7 inches long and 4 inches broad, but otherwise agreeing in form with those of that species. The spines are exceptionally long, sometimes measuring over 2 inches, whereas in *O. stricta* they are usually from 1 to 1½ inches long. The fruits resemble those of *O. bentonii,* being markedly pear-shaped.

That the two other plants referred to above are actually hybrids there can be no reasonable doubt. One pointed out to me by Mr. T. Birkbeck at Glenmore is a single plant growing amongst plants of *O. stricta* and the Joconoxtle, and is intermediate between these very different species. The plant is low-growing like *O. stricta* and it joints have the size and the elliptic form characteristic of that species. In colour, however, they are bluish with a purplish patch round the areoles as in the Joconoxtle. The spines are white like those of the latter species and about the same length, shorter than those of *O. stricta.* The fruits have the form and colouring of those of the Joconoxtle but are much reduced in size.

The following characters of *O. stricta* are dominant:—Low-growth (the Joconoxtle is a "tree-pear"), size of joints, form of joints, and size of fruit. The following characters of the Joconoxtle are dominant:—Colour of joint, form of spines, colour of spines, form of fruit, and colour of fruit.

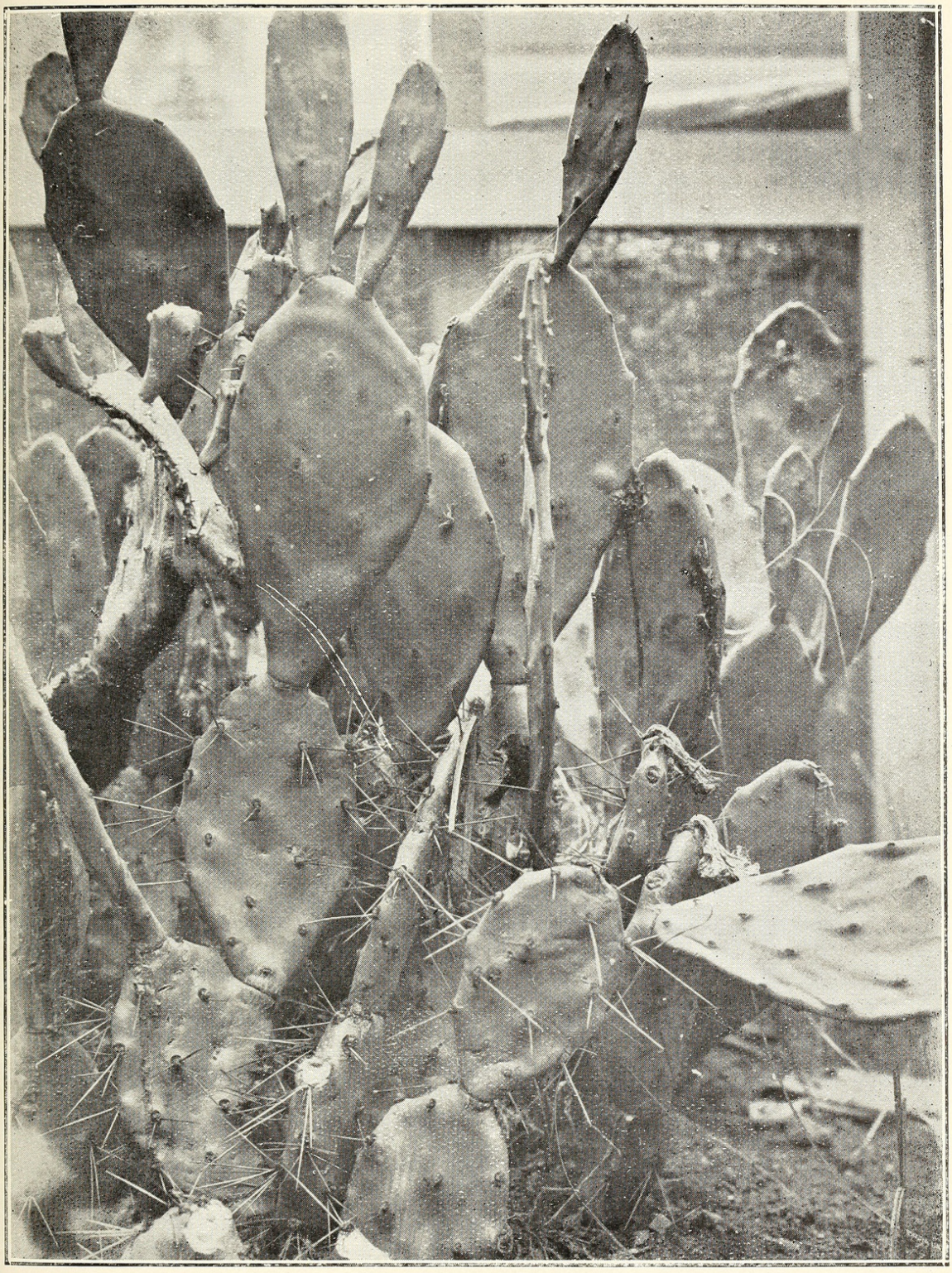
The other undoubted hybrid was found by Mr. A. N. Burns at Gogango and is certainly the result of a cross between *O. stricta* and *O. tomentosa,* which are there growing intermingled. The plant is tall like the tree-pear (*O. tomentosa*) and the joints have the shape of those

of that species, but entirely lack the characteristic tomentum. They are rather a bright green in colour, lighter than those of *O. tomentosa* and not so bluish as those of *O. stricta*. The spines are numerous and long, somewhat flattened and recurved, mainly white as in *O. tomentosa*, but somewhat banded with yellow, the colour of those of *O. stricta*. They are as plentiful as in *O. stricta* but longer than is usual in either parent. The flowers are pale orange-yellow, just intermediate in colour between the orange flowers of *O. tomentosa* and the yellow ones of *O. stricta*. The fruits appear to be intermediate between those of the two parents in every respect—shape, size, and number of areoles.

The following character of *O. stricta* is dominant:—Smooth cuticle. The following characters of *O. tomentosa* are dominant:—Tall growth and form of joints. In all other features the plant is either more or less intermediate between the parents, or presents characters different from those of either.

It is a curious fact that whilst the former hybrid agrees in every character with one or other of the parents, the latter is more or less intermediate between the parents in the majority of its characters.

[Note.—In the absence of the author in England this paper was communicated by Mr. C. T. White (Government Botanist, Brisbane), who suggested that a plate illustrating the very peculiar spiny variation of the Common Pest Pear (*Opuntia bentonii* Griff.) described by the author should be included. The approval of the Council was granted and an illustration (Plate IX.) is published herewith.—Ed.]

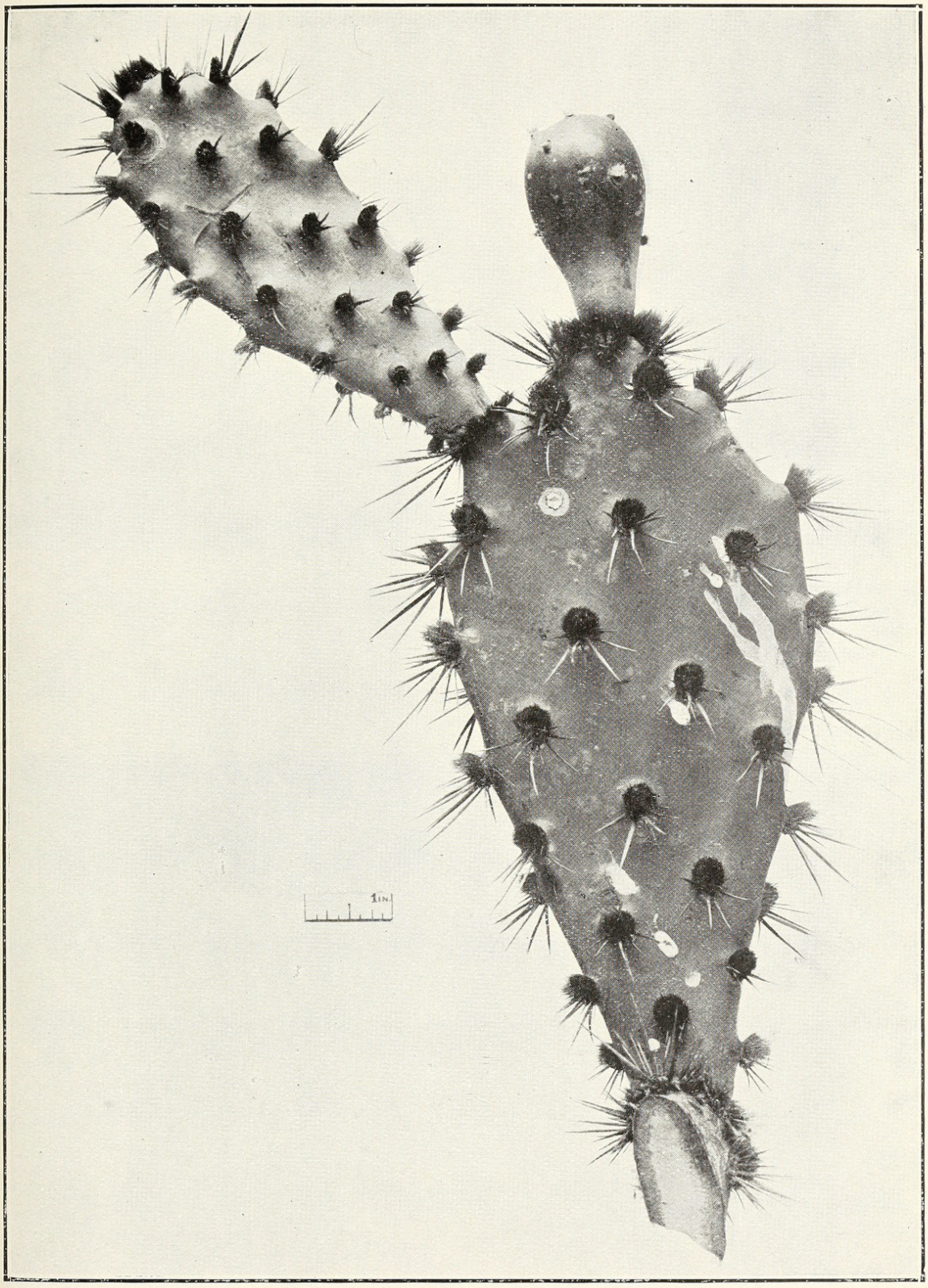


Spiny Pest Pear.

Showing spineless growth of upper joints due to shade.

[*Photo. by H. Hacker.*

Face page 54.]



Spiny Bud Variation of *Opuntia Bentonii.*

Face page 54.]

Fig. 1.—Abnormal plant of Pest Pear, with ensiform joints, growing at Chinchilla, Q.

[*Photo. by W. B. Alexander.*

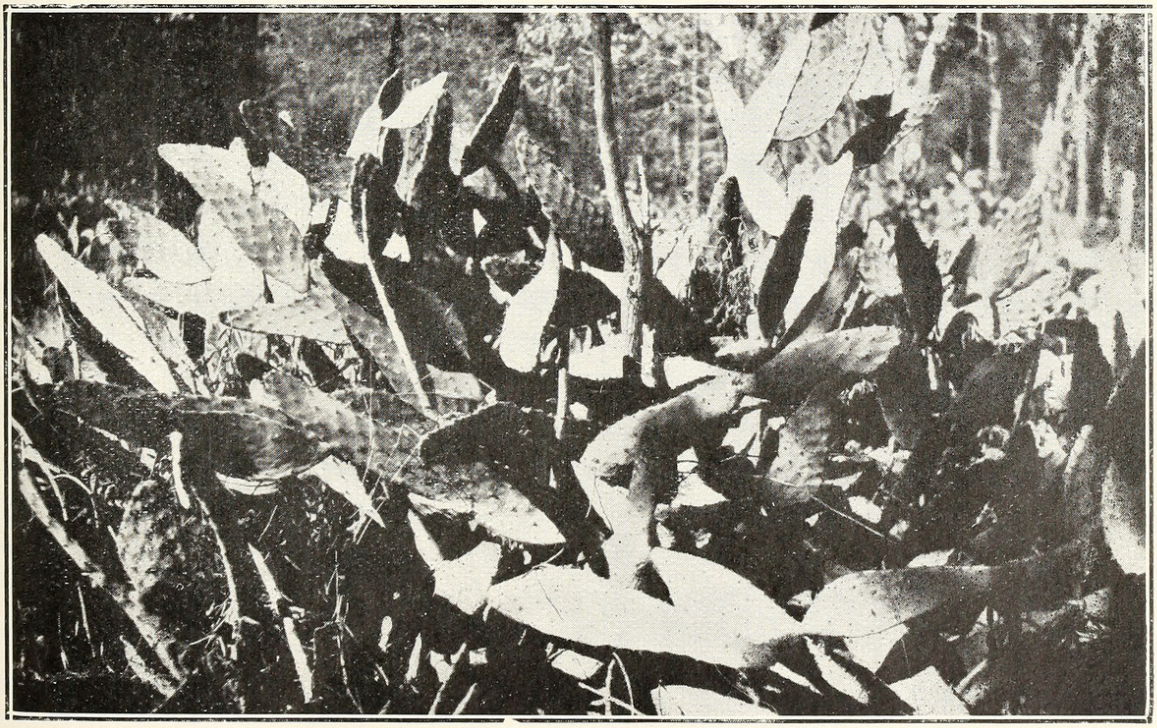


Fig 2.—Another view of the same plant (shown above).

[*Photo. by W. B. Alexander.*

[*Face page* 54]

Alexander, Wilfrid Backhouse. 1927. "Variation of the Acclimatised Species of Prickly-pear (Opuntia)." *The Proceedings of the Royal Society of Queensland* 38, 47–54. https://doi.org/10.5962/p.351519.

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