

**Fig. 110.** Flowers of *Cereus jamacaru* DC. subsp. *jamacaru*. (Picture by Geoff R. Nichols)



**Fig. 111.** Flowers of *Cereus jamacaru* DC. subsp. *jamacaru*. (Picture by Geoff R. Nichols)



**Fig. 112.** Fruit of *Cereus jamacaru* DC. subsp. *jamacaru* is known as 'pitaya'. (Picture by Lesley Henderson)

### Cylindropuntia Mill.

Trees or shrubs, erect, much branched; branches articulate on ramification; branch segments cylindric to somewhat placate, glabrous, firmly attached to easily detached, distinctly to hardly tuberculate, furrow delimiting each tubercle broadly rounded, tubercles more or less elongated. Glochidia present, flattened at base. Spines with entire, papery, deciduous, epidermal sheaths. **Flowers** variously coloured, pink to dark purple. **Inner tepals** ligulate to spathulate. **Fruit** cylindric to subglobose or clavate, variously coloured, fleshy or dry, mostly sterile and/or proliferous. **Seed** usually thick-discoid or lenticular, 2.5–5 mm long, white to pale yellow or beige; funicular envelope glabrous or with thin unicellular trichomes; girdle well-developed.

References: Anderson (2001), Pinkava (2003a), Hunt et al. (2006).

This genus consists of 33 species, distributed in Central America and the Caribbean, extending into the southwestern USA and northwestern South America (Anderson, 2001; Pinkava, 2003a; Hunt, 2006).

Species of *Cylindropuntia* always have cylindrical, segmented branches, and sheathed spines. As in *Harrisia martinii*, most species have elongated, prominent tubercles that give the branch segments a 'plaited rope' look. The inner tepals are never orange or scarlet as they are in the *Austrocylindropuntia* species treated here, and the tubercles are not so clearly delimited.

The frequent occurrence of hybrids, polyploid series, and taxa of hybrid origin in its native range (Parfitt & Gibson, 2003; Pinkava, 2003a) complicates the taxonomy of this genus (Hunt, 2006).

## Key to the species of *Cylindropuntia* in South Africa [based partly on Pinkava (2003a)]:

- 1'. Terminal stem segments commonly whorled or subwhorled, thicker, usually 1.5–5.5 cm in diameter; tubercles distinct, in some species obscured by densely interlacing spines; large spines (0–)6–30 or more per areole . . . . . 2
- 2. Fruits smooth to shallowly tuberculate, green to yellow-green, sometimes tinged red to purple at maturity, usually forming long chains in large plants, sometimes simple . . . . . . . . . . . . . . . . . 1 & 2. Cylindropuntia fulgida

- 3'. Distal stem segments firmly attached to next segment; spines scattered, not or little obscuring stem; flowers usually dark pink to magenta or purple-red.
  4

### 1. Cylindropuntia fulgida (Engelm.) F.M.Knuth

In: Backeberg & Knuth Kaktus-ABC: 126 (1936) var. fulgida.

**Common names:** chain-fruit cholla (English) (previously wrongly identified as rosea cactus, *Cylindropuntia pallida*, in South Africa).

Shrub to small tree 1–3 m tall; trunk well developed; branching divaricate; branch segments ovoid to narrowly ovoid-cylindric,  $6-23 \times 2-3.5$  cm, glaucescent, terminal segments easily detached; tubercles salient, 8-13(-19) mm tall, broadly ovoid, strongly mamillate, obscured by longer and denser spines than in var. *mamillata*, that are interlaced with spines from adjacent tubercles; areoles with gold or brown wool; glochidia 1–3 mm long, yellow. Spines (0-)c.12(-18), 2.5-3(-3.5) cm long, yellow, sheaths baggy, whitish to yellowish. **Flowers** opening late afternoon.

**Tepals** obovate to ligulate, usually recurved, pink to magenta. **Fruit** obconical, 2–5.5 × 1.3–4.5 cm, obscurely tuberculate, mostly spineless, fleshy, grey-green, proliferous. **Seed** aborted (sterile). **Distribution**: B, SA. (Fig. 113).

References: Henderson (2001), Pinkava (2003a), Hunt et al. (2006).

This species is centred on the Gulf of California and the Sonoran Desert of northwestern Mexico and southwestern USA. The type variety (var. *fulgida*) occupies the northeastern portion of the range from Arizona (USA) to Sonora (Mexico), at 300–1100 m above sea level (Pinkava, 2003a). In South Africa infestations are known near Douglas (Northern Cape), Beit Bridge (near Musina, Limpopo Province) and also from adjacent Zimbabwe (Henderson and Zimmerman, 2003). It is thought to have been introduced into South Africa for horticultural purposes, and was previously used as a protective hedge around many homesteads.

It is often confused with *Cylindropuntia pallida* and *C. tunicata* (Lehm) Knuth, especially during the juvenile stage, when it has densely interlacing spines. This species can be differentiated from those two species by its indistinctly tuberculate fruit proliferating in chains (particularly long chains in larger plants) (Fig. 114), and showy darker pink to magenta tepals that curve backwards with age (Fig. 115). In South Africa it has been confusingly named rosea cactus and roseakaktus (Afrikaans). This resulted from its initial incorrect identification as *C. pallida*.

The name 'chain-fruit cholla' (Pinkava, 2003a) emphasises the formation of proliferating or 'chain' fruits, an important feature that distinguishes it from *C. pallida* and other naturalised chollas (Henderson & Zimmerman, 2003).

Alongside *Opuntia aurantiaca* this is probably the most dangerous cactus invader (Fig. 116) because of its formidable thorns which can cause severe injuries and even death to animals. It is not uncommon to find dead birds, reptiles and small mammals impaled on the thorns (Fig. 117). Livestock get the joints on their mouths or groins which prevent feeding and result in death if not removed. It is understandable why humans used it as a living fence.

This cactus is a declared a category 1 weed in South Africa which is prohibited and must be controlled. It has also been proposed for classification as a category 1b invasive alien plant under NEMBA and CARA (Anonymous, 2009). A registered herbicide is available for its control in South Africa (Anonymous, 2004). An effective biological control agent, a virtually host specific cochineal biotype of *Dactylopius tomentosus*, was collected in Mexico on *Cylindropuntia cholla* (F.A.C.Weber) F.M.Knuth, and released at a number of sites in Limpopo in October and November in 2008. This cochineal has been found to be very damaging to the chain-fruit cholla and is proving to be very successful in controlling this weed (Klein & Zimmerman, 2009). Shown are healthy (Fig. 118) and infected (Fig. 119) plants which clearly demonstrate the effectiveness of this biological control agent.



**Fig. 113.** Distribution map of *Cylindropuntia fulgida* (Engelm.) F.M.Knuth var. *fulgida*.



**Fig. 114A.** *Cylindropuntia fulgida* (Engelm.) F.M.Knuth var. *fulgida*. Chain fruit shown against healthy spiny plant (Picture by Helmuth G. Zimmermann)



**Fig. 114B.** *Cylindropuntia fulgida* (Engelm.) F.M.Knuth var. *fulgida*. Fruit and large plant showing scale. (Picture by Helmuth G. Zimmermann)



**Fig. 115.** Flower of *Cylindropuntia fulgida* (Engelm.) F.M.Knuth var. *fulgida*. (Picture by Helmuth G. Zimmermann)



Fig. 116. Cylindropuntia fulgida (Engelm.)
F.M.Knuth var. fulgida is
an aggressive invader.
(Picture by Helmuth G. Zimmermann)



**Fig. 117**. Reptile impaled in *Cylindropuntia fulgida* (Engelm.) F.M.Knuth var. *fulgida*. (Picture by Helmuth G. Zimmermann)



**Fig. 118.** Healthy plant of *Cylindropuntia fulgida* (Engelm.) F.M.Knuth var. *fulgida*. (Picture by Helmuth G. Zimmermann)



**Fig. 119.** Plant of *Cylindropuntia fulgida* (Engelm.) F.M.Knuth var. *fulgida* damaged by biological control agent. (Picture by Helmuth G. Zimmermann)

# 2. Cylindropuntia fulgida (Engelm.) F.M.Knuth var. mamillata (A.Schott ex Engelm.) Backeb.

In: Die Cactaceae, Handbuch der kakteenkunde 1: 204 (1958).

=*Cylindropuntia fulgida* (Engelm.) F.M.Knuth var. *mamillata* (A.Schott ex Engelm.) Backeb. forma *monstrosa* (J.M.Coult) P.V.Heath

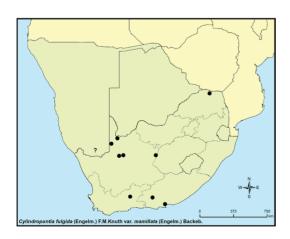
**Common names:** boxing glove cactus (applied only to the crested morphotype, forma *monstrosa*), coral cactus (English).

In comparison to the type variety that appears very spiny from afar due to its dense, longer (2.5–3.5 cm long) spinescence, strongly interlacing with that of adjacent areoles, that obscures the strongly mamillate tubercles beneath, var. *mamillata* appears spineless or nearly so from afar, exposing the strongly mamillate tubercles, due to the sparse, short (1–2 cm long) spines, not or only slightly interlacing with those from adjacent areoles [note that the photograph in Anderson (2001) labelled *C. fulgida* var. *fulgida*, shows these features of *C. fulgida* var. *mamillata*]. The spine sheaths are tightly fitting in var. *mamillata*, while they are baggy in var. *fulgida* (Pinkava 2003a). **Distribution**: SA. (Fig. 120)

Reference: Pinkava (2003a).

Its strongly tuberculate fruit distinguishes *Cylindropuntia fulgida* var. *mamillata* from *C. imbricata* and from the rose to reddish purple-flowered forms of *C. spinosior*, in which proliferation is rare or absent. Fruits are strongly tuberculate. Hybrids of *C. fulgida* with *C. leptocaulis* and *C. spinosior* are known in North America (Pinkava, 2003a).

This variety has a wider range, extending further southwest than *Cylindropuntia fulgida* var. *fulgida*. It occupies both sides of the Gulf of California, in Baja California and the Sonoran Desert in Sonora and Sinaloa (Mexico), as well as the northern extension of the Sonoran Desert in Arizona (USA), where the two varieties occur sympatrically and intermediates can be found (Pinkava, 2003a). The variety is not recognised by some authors (e.g. Hunt, 2006).



**Fig. 120.** Distribution map of *Cylindropuntia fulgida* (Engelm.) F.M.Knuth var. *mamillata* (A.Schott ex Engelm.) Backeb.

The widely cultivated crested morph (Fig. 121) is native to south-central Arizona in the USA (Pinkava, 2003a). This form lacks strong, barbed spines and fertile seed and has been assumed therefore to be less aggressive than var. *fulgida*. Although the boxing glove cactus does not appear related to *C. fulgida* at first sight, there is a population near Hopetown (Northern Cape Province), showing all the features of *C. fulgida* var. *fulgida*, with several individuals showing characteristics of both varieties on one plant. It would appear as if var. *mamillata* can revert back to the much more aggressive var. *fulgida*. This justifies the control envisaged for var. *mamillata*, despite the fact that it otherwise appears to be less invasive.



**Fig. 121.** Crested form of *Cylindropuntia fulgida* (Engelm.) F.M.Knuth var. *mamillata* (A.Schott ex Engelm.) Backeb. (Picture by Debbie Sharp)

In southern Africa the crested morph has invaded arid vegetation at a fairly local scale in southern Namibia, Limpopo Province (around Musina), the Northern Cape Province (near Upington, Askham and Noenieput) (Fig. 122), and in the Eastern Cape (near Port Elizabeth). A small population has also been detected in the Western Cape (near Beaufort West, including in the Karoo National Park). It is naturalised in Australia in Queensland, South Australia and Western Australia, and recently also in New South Wales. As in Australia, it is estimated that this species has spread from original plantings, since it is a popular succulent ornamental suitable for planting in semi-arid areas. Its characteristic boxing glove-like cladodes seem to have made it a popular seller. It is thought that it is the ability of these cladodes to persist for months after they have been discarded that has caused

them to start growing where discarded, e.g. at municipal refuse dumping sites. Localised dispersal is via movements of dislodged segments, especially by flood water. As it is the same species as *C. fulgida* var. *fulgida*, it is legally subject to the same control obligations as mentioned above.



**Fig. 122.** *Cylindropuntia fulgida* (Engelm.) F.M.Knuth var. *mamillata* (A.Schott ex Engelm.) Backeb. invasion. (Picture by Barbara K. Mashope)

### 3. Cylindropuntia imbricata (Haw.) F.M.Knuth

In: Backeberg & Knuth Kaktus-ABC: 125 (1936).

- =Cylindropuntia rosea (DC.) Backeb.
- =Opuntia imbricata (Haw.) DC.
- =Opuntia rosea DC.

**Common names:** devil's rope pear, imbricate cactus (English); kabelturksvy, toukaktus (Afrikaans).

Shrub, often treelike, 1–3 m tall, often with short trunks; branch segments whorled or subwhorled, cylindric to subclavate, 8–25 × 1.5–4 cm, dull grey-green; tubercles prominent, giving the effect of a woven rope, 40 × 5 cm; widely spaced; areoles elliptic, with yellow to tan wool; glochidia 0.5–3 mm long, pale yellow. Spines 5–30, stout, up to 3 cm long, silver-grey to yellow to reddish or brown, sheaths silvergrey to yellow. **Leaves** subulate, 1–2 cm long, caducous. **Flowers** from Nov. to

Jan. **Tepals** obovate to spathulate, dark pink, magenta or reddish magenta. **Fruit** obovoid, 2.4–4.5 × 2–4 cm, fleshy, spineless, yellow, sometimes proliferous and mostly sterile. **Distribution**: B, N, S, SA. (Fig. 123)

**References:** Obermeyer (1976), Zimmerman (1983), Henderson (2001), Pinkava (2003a), Hunt *et al.* (2006), Scheinvar *et al.* (2009).

*Cylindropuntia imbricata* is similar to *C. spinosior*, which differs by its rose, reddish purple, bronze purple, whitish, yellow or salmon tepals (in *C. imbricata* usually dark pink to magenta, or rarely, only in its native range, white) (Pinkava, 2003a). Other characters are mentioned in the key to species of the genus.

The name *Opuntia rosea* has for a long time been incorrectly applied to *Cylindropuntia pallida*, following the Mexican usage, e.g. Bravo-Hollis (1978). Judging by the illustrations (Rowley, 1994) that were cited by De Candolle in his original description of the species, we follow Britton & Rose (1963) in placing it under *C. imbricata*. The illustration depicts sparse, short spines, a crimson flower with most tepals slightly recurved (Fig. 124), and a proliferating fruit (Fig. 125).

Cylindropuntia imbricata has a naturally wide distribution range in the Rio Grande catchment at (800–)1 100–1 800(–2 200) m above sea level, often dominant in the Chihuahuan Desert, spanning northern Mexico and the south-central United States, crossing over into the Mississippi catchment in southwestern Kansas and western Oklahoma (Pinkava, 2003a). In central Mexico it responds to overgrazing, forming dense and weedy populations. It is naturalised in Australia (Telford, 1984). In South Africa, it is a transformer of karoo, dry savanna (Fig. 126) and grassland vegetation.

This is a declared category 1 weed in South Africa, and the registered herbicide available for control can be found in the latest update of 'A guide to the use of herbicides' published by the Dept of Agriculture (2004). It has also been proposed for classification as a category 1b invasive alien plant under NEMBA and CARA (Anonymous, 2009).

Cochineal, *Dactylopius tomentosus*, was originally introduced from the USA in 1970. It provides reasonable control in hot and dry regions. Best results are achieved if well-infested plants are felled and heaped. The insect needs to be hand-dispersed to create new infestations. Isolated plants are best controlled chemically (Moran & Zimmermann, 1991b).



Fig. 123. Distribution map of Cylindropuntia imbricata (Haw.) F.M.Knuth.



**Fig. 124.** Flower of *Cylindropuntia imbricata* (Haw.) F.M.Knuth. (Picture by Barbara K. Mashope)



**Fig. 125.** Proliferating fruit of *Cylindropuntia imbricata* (Haw.) F.M.Knuth. (Picture by Gideon F. Smith)



**Fig. 126.** Cylindropuntia imbricata (Haw.) F.M.Knuth is a transformer of dry savanna. (Picture by Arrie Klopper)

### 4. Cylindropuntia leptocaulis (DC.) F.M.Knuth

In: Backeberg & Knuth Kaktus-ABC: 122 (1936).

**Common names:** desert Christmas cactus, desert Christmas cholla, pencil cactus (English); potloodkaktus (Afrikaans).

Shrubby or treelike, variously branched, 0.5–1.8 m, usually with numerous short, spineless stems along major axes; branch segments very slender, 20– $80 \times 3$ –5 mm, scarcely tuberculate, grey-green to purplish; areoles broadly elliptic, with white to yellow wool, becoming grey with age; glochidia 1.5 mm long, yellow to reddish brown. Spines 0–1(-3), 14–45 mm long, mainly at apical areoles, porrect, flattish at base, acicular above; sheaths grey, purplish grey, or yellow. **Flowers** pale to greenish yellow, sometimes with reddish tips. **Fruit** occasionally proliferating, obovoid, c.  $15 \times 6$ –7 mm, fleshy, spineless, yellow to red when ripe. **Distribution**: N, SA. (Fig. 127)

References: Pinkava (2003a), Hunt et al. (2006).

This species is widespread in the deserts, grasslands, shrublands and woodlands of the southern USA from Arizona to coastal Texas, and in Mexico from Sonora to Zacatecas and Tamaulipas (Pinkava, 2003a).

It is readily distinguished from the other naturalised *Cylindropuntia* species by its thin stems and indistinct tubercles (Fig. 128). *Cylindropuntia leptocaulis* superficially resembles *Opuntia salmiana*, from which it can be distinguished by sheathed, hard spines and short (5–8 mm long) pale to greenish yellow tepals (flowers 2–3.5 cm across and whitish in *O. salmiana*). Hybrids with *Cylindropuntia fulgida* and *C. spinosior* are known in North America (Pinkava, 2003a).

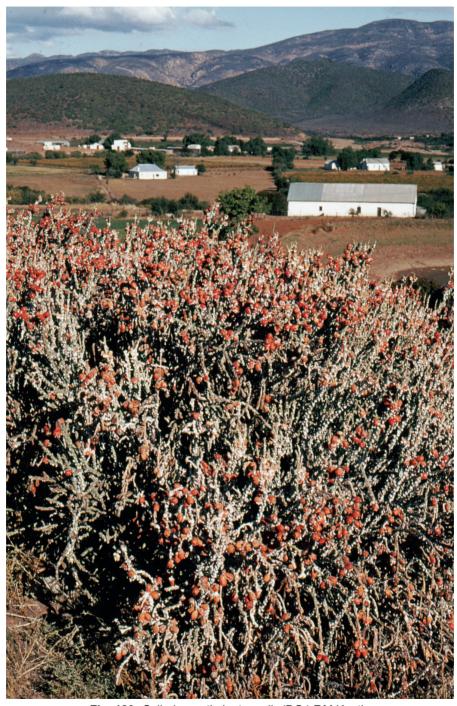
The pencil cholla became established in the Oudtshoorn district where it was spreading at an alarming rate during the seventies. The imbricate cactus cochineal, *Dactylopius tomentosus*, proved to be a very efficient biological control agent which has successfully controlled practically all known infestations. Isolated plants are still found around Oudtshoorn (Fig. 129) and beyond. No additional control measures are necessary.



**Fig. 127.** Distribution map of *Cylindropuntia leptocaulis* (DC.) F.M.Knuth.



**Fig. 128.** Fruits of *Cylindropuntia leptocaulis* (DC.) F.M.Knuth. (Picture by Helmuth G. Zimmermann)



**Fig. 129.** *Cylindropuntia leptocaulis* (DC.) F.M.Knuth. (Picture by Helmuth G. Zimmermann)

#### 5. Cylindropuntia pallida (Rose) F.M.Knuth

In: Backeberg & Knuth Kaktus-ABC: 122 (1936).

- =Opuntia pallida Rose
- =Opuntia rosea sensu auct. non DC. (misapplied name)

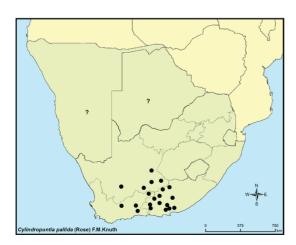
**Common names:** rosea cactus (in South Africa somewhat confusingly used for *C. fulgida* var. *fulgida*), Hudson pear (in Australia, J.R. Hosking, *pers. comm.*) (English); roseakaktus (in South Africa somewhat confusingly used for *C. fulgida* var. *fulgida*) (Afrikaans).

Shrub, branching basally with ascending stems, (0.2-)0.5-1 m tall (1.5 m in Australian form); branch segments cylindric,  $10-15 \times 1.6-2.5$  cm, grey-green; tubercles distinct; areoles large, 2-3.5 cm apart; glochidia 2-5 mm long, yellow. Spines (1-)4-9, acicular, 1-4 cm long, yellow, reddish or grey; sheaths papery, yellowish, not completely covering the spines. **Flowers** 3.8-4 mm long, pink. **Fruit** obconical to obovoid,  $1.6-1.8 \times 1.1-1.4$  cm, tuberculate, spiny, yellow. **Distribution**: B, N, SA. (Fig. 130)

References: Britton & Rose (1963), Anderson (2001).

Hunt et al. (2006) described Opuntia pallida as appearing to be 'a deep pink-flowered form of C. tunicata' and listed it as a synonym of Cylindropuntia rosea. Cylindropuntia pallida appears to be geographically isolated from C. tunicata of the Chihuahuan Desert (Pinkava, 2003a). The host-adapted cochineal insects also suggest that they are distinct species. The cochineal from C. pallida does not develop on C. imbricata and C. tunicata and the converse applies to the cochineal on C. imbricata (Mathenge et al., 2010). This strong specificity indicates that conspecificity or hybrid origin are unlikely.

This taxon has for a long time been treated under the name *Opuntia rosea*, following Mexican usage, e.g. Bravo-Hollis (1978). That name seems better placed as a synonym of *C. imbricata*, judging by the illustrations (Rowley, 1994) that were



**Fig. 130.** Distribution map of *Cylindropuntia pallida* (Rose) F.M.Knuth.

cited by De Candolle (1828). As any changes from a name in wide and current use could cause disruption, an alternative to using the currently correct name *O. pallida*, is that the name *C. rosea* (based on a painting of *C. imbricata*) is formally proposed to be conserved with a new type, in order to fix the application of the name to the Mexican taxon that has been the subject of most literature treatments.

Although plants are usually low growing (Fig. 131), some plants have been reported to reach up to 1.5 m high in Australia (Hosking *et al.*, 2007). In South Africa this species has sometimes been referred to under the name *C. tunicata* and it has also been confused with *Cylindropuntia fulgida*. The juvenile plants of these three cholla species are similar looking and with our current knowledge, can only be visually distinguished from each other by their flower tepal colour once they are mature enough to flower. *C. pallida* has pink (rose coloured) flowers (Fig. 132) whilst those of *C. tunicata* are yellow or yellowish green (Anderson, 2001; Hunt, 2006). *C. tunicata* is consistently low-growing as opposed to the taller *C. pallida*.

Cylindropuntia pallida is native to the provinces of Hidalgo, Mexico, Puebla and Tlaxcala of central Mexico. It can form dense stands in its natural range due to disturbance such as overgrazing. It has become invasive and has naturalised in New South Wales, Australia (Hosking *et al.*, 2007).

The species is used as a barrier plant in Namibia, and has recently also been recorded in Botswana. In South Africa it is known to be cultivated for decoration in drier regions (Fig. 133). Low-growing plants recorded in the Northern and Eastern Cape near Addo, Jansenville, Cradock, Graaff-Reinet, Murraysburg and Victoria West may belong to this species, but require verification as either *C. pallida* or *C. tunicata*. Populations from Jansenville, and from the Western Cape near Oudtshoorn, have been confirmed as *C. pallida*.

Cylindropuntia pallida spreads by the movement of easily detachable segments, especially by flood waters. The plant has long spines with detachable sheaths that are a hazard to grazing animals. Since segments are easily detached, they can be dispersed (as burrs) via vehicle tyres. The fruit (Fig. 134) bears sterile (abortive) seeds but individual fruit can root and form new plants, enhancing vegetative spread.

This plant is currently not listed as a weed in South Africa. Research on biological control of *C. pallida* has commenced in Australia (as *C. rosea*) and South Africa could in future collaborate on this initiative. So far, *C. tunicata* is only known in South Africa as a horticultural subject, but has been proposed to be listed under CARA and NEMBA similarly to *C. pallida* or *C. fulgida* (Anonymous, 2009). This proposal is supported by the fact that *C. tunicata* has already become naturalised in Australia, Argentina, Chile, Ecuador and Peru (Hunt, 2006).



**Fig. 131.** Cylindropuntia pallida (Rose) F.M.Knuth has a low growing habit. (Picture by Barbara K. Mashope)



**Fig. 132.** Flower of *Cylindropuntia pallida* (Rose) F.M.Knuth. (Picture by Barbara K. Mashope)



**Fig. 133.** *Cylindropuntia pallida* (Rose) F.M.Knuth spreading from abandoned homestead. (Picture by Barbara K. Mashope)



**Fig. 134.** Fruit of *Cylindropuntia pallida* (Rose) F.M.Knuth. (Picture by Barbara K. Mashope)