IDENTIFICATION OF NIGHTSHADES (*Atropa* and *Solanum*) IN NEW ZEALAND

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The genus *Solanum*, which includes the majority of plants known collectively as "nightshades", is represented in New Zealand by three indigenous and seventeen adventive species, by a range of ornamental shrubs and climbers, and by the economically important potato (*S. tuberosum*). Comprised of weedy herbs which have followed in the footsteps of man around the globe, and garden escapes of varied form, the wild species have differing significance as weeds and are rated as troublesome for reasons which include:

- i. compete with vegetables and ornamentals in gardens and market gardens, and with crops in arable land;
- ii. compete with, and sometimes replace sown grassland on poor country;
- iii. suppress seedlings, ferns, and the shrub layer in damaged indigenous forest;
- iv. armed species cause mechanical damage to humans and farm livestock, and restrict stock movement;
- v. contain glycoalkaloids which cause poisonings in humans and livestock, producing depression of the central nervous system, followed by failure of the respiratory system and of the heart;
- vi. the succulent, coloured fruits are attractive to birds, with bird dispersal responsible for new and distant weed infestations.

CHARACTERISTICS OF NIGHTSHADES

As a group, species of *Solanum* have the following characteristics:

- i. annual or perennial herbs, climbers, shrubs or small trees, armed or unarmed, hairless or with hairs of diverse form (Fig. 1) — long or short, spreading, curved or appressed, glandular or non-glandular, branched or star-shaped (stellate); often unpleasant smelling when crushed:
- ii. *Leaves* alternate, stalked, often a large leaf accompanied by a smaller lateral leaf (two in *S. mauritianum*), simple (compound and pinnate in *S. tuberosum*), entire, toothed, or variously lobed or dissected (Fig. 5):
- iii. *Flowers* regular, bisexual, solitary or in few- to many-flowered stalked heads or clusters, terminal at ends of branches, or from leaf axils, from stem opposite a leaf axil (leaf-opposed), or from a point on stems between two nodes (extra-axillary); calyx 5-lobed (Fig. 1), hairless, hairy or prickly, persistent and sometimes enlarging and partly or wholly enveloping the mature fruit (Fig. 2Aa, 4B); corolla 5-lobed or 5-partite (Fig. 1), rotate, often star-like (Fig. 1), flattened, tube very short, white, blue, violet, yellow, lobes often reflexed; stamens 5, filaments short, anthers projecting from flower, converging as an often prominent cone around the style, and opening by an apical pore or slit (Fig. 1); style longer than, and projecting beyond the anthers:

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- iv. *Fruit* a 2-celled, many-seeded, usually globose, succulent or leathery berry (Fig. 2A), black, purple, green, yellow, orange-red, red etc., dull or glossy, wholly, partially, or not enclosed in persistent calyx; stone cells present or absent.

DIFFERENTIATION OF NIGHTSHADES AND RELATED PLANTS

While some plants may be placed with relative ease as types of nightshade, this is not so with others; a summary of genera of the nightshade family (Solanaceae) with species wild or casual in New Zealand, will assist the reader in deciding if a particular plant is a nightshade, or whether it falls outside the scope of this paper.

- A. COROLLA ROTATE, FLATTENED TO BROADLY BELL-SHAPED, TUBE VERY SHORT: ANTHERS PROJECTING FROM FLOWER, FORMING CONE AROUND STYLE (Fig. 1): FRUIT A BERRY
 - i. SOLANUM (nightshades): pollen released from anthers by apical pores or slits (Fig. 1); flowers white, blue, violet, purple (yellow in *S. rostratum*), always without 5 purplish basal spots; plants clammy-(viscid-) hairy only in *S. sarrachoides* and *S. sisymbriifolium*; if berry closely enveloped in enlarged calyx; then bur-like with prickles, in *S. rostratum*:
 - ii. LYCOPERSICON (tomato): pollen released from anthers by longitudinal slits; flowers yellow, lacking 5 purplish basal spots; plants clammy-hairy; leaves compound:
 - iii. PHYSALIS (cape gooseberry): pollen released by longitudinal slits from anthers: flowers yellow or white, with 5 basal purplish spots: leaves not clammy-hairy, simple: berries enclosed in enlarged calyx (cape):
- AA. COROLLA URN-, BELL-, TRUMPET-, OR FUNNEL-SHAPED, TUBE LONG, OBVIOUS (Fig. 1): ANTHERS NOT PROJECTING FROM FLOWER AND NOT FORMING CONE AROUND STYLE: FRUIT A BERRY OR CAPSULE
 - a. Fruit a $\pm$ succulent berry:
 - i. ATROPA (deadly nightshade): perennial herb from fleshy rootstock; flowers bell-shaped, dull dark purple tinged green, rarely yellow-green; berry black [a yellow-green form known overseas], glossy, with enlarged, green, spreading calyx lobes:
 - ii. CAPSICUM (peppers): herbs or soft-woody shrubs; fruits variously shaped, pungent, green, yellow or red "peppers":
 - iii. CESTRUM: shrubs or small trees; flowers long-tubed, red, white, greenish, yellow, or orange: berries small, few-to 1-seeded by abortion:
 - iv. NICANDRA (apple of Peru): tall hairless annual, flowers solitary, blue-violet, on recurved stalks; berries leathery, enclosed in a 5-winged enlarged calyx (cape):
 - v. LYCIUM (boxthorn): shrubs or small trees, usually with spiny branches; leaves small, entire, in fascicles; berries small, globose or ovoid, orange-red or scarlet:
 - vi. SALPICHROA (lily of the valley vine): rampant perennial climber or scrambler, with rhizomes or far-extending roots with shoots; flowers and berries small, white:
 - b. Fruit a dry, many-seeded capsule:
 - i. DATURA: flowers long, funnel-shaped; herbs — flowers up to 10 cm long, white or purple; valves of fruit 4, with long, stout

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Fig. 1: Types of hairs; stamen of *Solanum* sp.; flower types in family Solanaceae; and raceme and umbel of black nightshade group (*Solanum*) (diagrammatic and not to scale).

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- spines (thorn apple): shrubs or small trees — flowers large, to 30 cm long, white to orange-red, sometimes double or triple; valves of fruit without spines (angel's trumpet):
- ii. HYOSCYAMUS (henbane): evil-smelling, clammy-hairy herb; flowers yellow, purple-veined, in 1-sided spikes; capsule enclosed in spiny-toothed fruiting calyx:
 - iii. NICOTIANA (tobacco): clammy-hairy herbs, often woody below, strong-smelling; flowers long-tubed, white or yellow: if a tall shrub or small tree, leaves large, thick, leathery, bluish-green, hairless, flowers yellow:
 - iv. PETUNIA: clammy-hairy herb: leaves entire: casual from gardens:
 - v. SALPIGLOSSIS: clammy-hairy herb: leaves entire or lobed: casual from gardens:
 - vi. SCHIZANTHUS: clammy-hairy herb: leaves deeply cut into very fine segments: flowers asymmetrical: casual from gardens:

KEY TO NIGHTSHADES (ATROPA AND SOLANUM)

1. Plant unarmed (i.e. lacking prickles on stems, leaves, calyces) 2
 Plant armed (i.e. with prickles on stems, leaves, calyces) 21
2. Plant an erect or spreading herb, shrub or small tree 3
 Plant a creeper, climber, or scrambler 19
3. Flowers bell-shaped (Fig. 1), 2-3 cm long, dull dark purple-tinged-green, rarely yellow-green, solitary (occasionally several) in leaf axils, between leaf pairs, or in forks of branches: berries shining black [occasionally yellow-green overseas], globose, 1.5-2 cm diam., with large green spreading calyx lobes (Fig. 2, Af,j,C) *Atropa bella-donna*
 Flowers rotate (Fig. 1), flattened, to broadly bell-shaped, colours various, but not as above: berries variously shaped and coloured; if black and 1.5 cm diameter or more, then calyx lobes not enlarged and spreading 4
4. Flowers and fruits solitary (sometimes 2-4 together), stalked, leaf-opposed or extra-axillary (Fig. 2Ah,B): flowers white, starry: berries scarlet, orange-yellow, or orange-red, erect, globose or pointed, 1.2-2 cm diameter (Jerusalem cherry group) 5
 Flowers and fruits never solitary, stalked, few to many in compact or diffuse, open, long or short-stalked heads: flower colours various: fruit colours various, if scarlet or orange-red, less than 1 cm diameter 6
5. Upper leaf surface glossy: plant hairless (Fig. 2B) *S. pseudocapsicum*
 Upper leaf surface dull: stellate hairs on young shoots and under-side of leaves (Fig. 1, 2Ah) *S. diflorum*

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6. Flowers (and fruits) 3-6(-10) in compact, stalked umbels or racemes (Fig. 1): leaves simple (Fig. 5.1): flowers white or tinged blue or violet, to 1.4 cm diameter: berries black, green, red, yellow, or yellow-green, to 2 cm diameter (black nightshade group) 7
 Flowers (and fruits) few to many, in compact or diffuse open heads (Fig. 3C, 4A,C,D): leaves simple or compound (Fig. 5.9): flowers violet, blue, purple — if white, rhizomes and tubers present, or flowers more than 2 cm diameter: berries green, yellow, lemon or red 14
7. Plant clammy-(viscid-) hairy, or soft, greyish, velvety-hairy (Fig. 3B,D) 8
 Plant hairless or hairs not obvious, difficult to see with naked eye (Fig. 3A) 9
8. Plant clammy- (viscid-) hairy: fruiting calyx enlarged, partly enclosing yellow-green, dark-veined berry (Fig. 2Aa, 3B, 5.3) *S. sarrachoides*
 Plant soft, grey, velvety-hairy: fruit calyx not enlarged: berry dull purple-black (Fig. 2Ab, 3D, 5.2) *S. gracilius*
9. Berries red, yellow or yellow-green, without dark veins: plants usually with short glandular and non-glandular hairs (use hand lens) 10
 Berries black or green, without dark veins: glandular hairs absent 11
10. Berries yellow or yellow-green (Fig. 2Ac) *S. nigrum* var. *humile*
 Berries red *S. nigrum* var. *miniatum*
11. Berries green *S. nigrum* var. *chlorocarpum*
 Berries black (Fig. 2Ae) 12
12. Berries large, 1.5 cm or more diameter (cultivated) *S. nigrum* var. *guineense*
 Berries small, $\pm$ 1 cm diameter (wild) 13
13. Flowers 5-7(-9) mm diameter, in umbels (Fig. 1): anthers 1.1-2 mm long: berries black, glossy: fruiting calyx lobes strongly reflexed (i.e. rolled back) *S. nodiflorum*
 Flowers 1 cm or more diameter, in racemes (Fig. 1): anthers 2-2.7 mm long: berries black, dull or $\pm$ glossy: fruiting calyx appressed or lobes slightly reflexed (Fig. 3A) *S. nigrum* var. *nigrum*
14. Leaves compound (Fig. 5.9), leaflets broad: rhizomes and tubers below ground *S. tuberosum*
 Leaves simple, entire, toothed or lobed (Fig. 5): rhizomes and tubers lacking 15

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15. Leaves large, to 40 cm long, usually with 2 small stipule-like leaves at base of large leaves, thick and densely felted, with stellate and branched hairs (Fig. 4D): berries stellate-hairy *S. mauritianum*
 Leaves large or small, hairless, or if hairy, hairs not forming thick felt, and berries hairless 16
16. Leaves narrow, at least 5 times as long as broad, to 30 cm long, entire, or with narrow acute lobes (Fig. 4C,5.7): berries drooping, 2-3 cm long, orange to lemon (poroporo group) 17
 Leaves broad, $\pm$ twice as long as broad, $\pm$ entire, or with 1-2(-4) basal lobes (Fig. 5.5,6): berries $\pm$ 1 cm long, red or yellow 18
17. Stem purple: apex of corolla lobes notched: berries lemon-yellow, lacking persistent green cross at base: seeds 2.2-2.5 mm long (Fig. 2Ai, 4C, 5.7) *S. laciniatum*
 Stem green or purple: apex of corolla lobes acute: berry orange, often with persistent green cross at base: seeds less than 2 mm long *S. aviculare*
18. All leaves $\pm$ entire, (Fig. 5.6) hairless or stellate-hairy on new shoots and underside of older leaves (use lens); flowers pale violet, 2-3 cm diameter: berries yellow *S. crispum*
 Some leaves with 1-2(-4) basal lobes (Fig. 3C, 5.5), hairless or with simple hairs: flowers purple, $\pm$ 1 cm diameter: berries red (Fig. 2Ag) *S. dulcamara*
19. Leaves $\pm$ entire, small basal lobes always absent: small stellate hairs on new shoots and underside of older leaves: flowers pale violet: berries yellow *S. crispum*
 Some leaves with 1-2(-4) basal lobes: plants hairless, or with simple spreading or appressed hairs 20
20. Leaves hairless or short hairy: flowers purple, occasionally whitish: berries red: stems 0.5-2.5 (-4) m long (Fig. 2Ag, 3C,5.5) *S. dulcamara*
 Leaves hairless; flowers white or blue-tinged: berries black or blue: stems far climbing, to 10 m or more long *S. jasminoides*
21. Plant perennial with wiry, far-extending root system producing aerial stems: flowers bluish-white: berries 1-2.5 cm diameter, orange-yellow *S. carolinense*
 Plant annual or perennial, herbs, shrubs, or small trees, lacking far-extending roots with shoots 22
22. Calyx lobes, flower and fruit stalks without prickles: berries with nipple-like protuberances *S. mammosum*
 Calyx lobes, flower and fruit stalks with prickles: berries without protuberances 23
23. Fruits bur-like (Fig. 4B), berry closely and completely enclosed in enlarged, prickly calyx lobes: flowers yellow: annual to 0.6 m tall *S. rostratum*
 Fruits not bur-like: flowers white, blue, violet: annual or perennial, shrub or small tree 24

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24. Leaves green on underside, deeply and irregularly lobed nearly to midrib 25
- Leaves white, rusty or tawny felted-hairy on undersides, margins shallowly lobed only 26
25. Prickles yellow or straw-coloured: woody shrub to 2.5 m or more: berries yellow, 2-2.5 cm diameter (Fig. 5.12) *S. sodomeum*
- Prickles orange-red: bushy annual to 1.5 m tall: berries red, 1-2 cm diameter, lower half loosely enveloped in prickly calyx lobes *S. sisymbriifolium*
26. Underside of leaves white-felted: branches white, wingless (Fig. 4A) *S. marginatum*
- Underside of leaves rusty- or tawny-felted: branches tawny, with conspicuous wings *S. robustum*

DESCRIPTION OF SPECIES, DISTRIBUTION ETC

NOTE:

- A. Unless stated otherwise:
- in the armed species, prickles occur on branches, both leaf surfaces, flower and fruit stalks, and calyces:
 - leaves are stalked, and leaf lengths given refer to leaf blades only:
 - hairs, if present, occur on all parts of plants:
 - flowers and berries are stalked:
 - berry colour refers to mature fruits:
 - toxicity is not discussed under every species, but as stated earlier, glycoalkaloids occur, and all species of *Solanum* should, unless there is reliable information to the contrary, be treated as potentially poisonous to humans and farm livestock.

1. ATROPA BELLA-DONNA L. (DEADLY NIGHTSHADE)

Erect, hairless or short hairy perennial herb (Fig. 2Af,j,C), to 1.5 m tall, from stout fleshy rootstock: *stems* often branching into 3, soft woody below: *leaves* ovate, to 20 cm long, acute, entire, simple and alternate, or in opposite very unequal pairs along branches and in one plane: *flowers* dull dark purple tinged green, rarely yellow-green, bell-shaped to 3 cm long, solitary, or several from leaf axils, from between stalks of paired leaves, or in forks of branches, drooping: calyx lobes enlarging and spreading below fruit, green and sometimes $\pm$ leaf-like: *berries* depressed globose, 1.5-2 cm diameter, black to purple-black [yellow-green forms known overseas], glossy.

The true deadly nightshade, long known for its narcotic effects and very poisonous nature, is a source of the drug belladonna. The common name is all too frequently misapplied to *Solanum nigrum*, the widely distributed and abundant weedy black nightshade of gardens and cultivated land, and confusion is still widespread: the illustrations and tabulation of diagnostic characters should help resolve the confusion:

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BLACK NIGHTSHADE (Fig. 2Ac-e, 3A)	DEADLY NIGHTSHADE (Fig. 2Af, j, C)
taproot slender, wiry	rootstock stout, fleshy
leaves usually solitary, alternate	leaves usually in unequal pairs
flowers small, $\pm$ 1 cm diameter, starry, rotate, white, usually in racemes	flowers large, 2-3 cm long, bell-shaped, dull purple-black tinged green, rarely yellow-green, usually solitary
berries globose, to 1 cm diameter, black, green, yellowish, red, dull to $\pm$ glossy	berries depressed-globose, 1.5-2 cm diameter, purple-black, glossy
fruiting calyx inconspicuous	fruiting calyx much enlarged, lobes large, green, spreading

Reported in 1903 as naturalized in Ashburton County, there is no reliable evidence that it occurred there, and no record of it being found in the wild state subsequently. In the 1950's, deadly nightshade was noted as an occasional ornamental in gardens about Christchurch, and in 1964 a single wild occurrence was found in waste land at Hornby, Christchurch. The plant could be more widespread in cultivation than is known, and it should be watched for in other districts. (Europe, W. Asia, N. Africa).

2. *S. AVICULARE* Forst. (Poroporo)

Soft woody shrubs to small trees, to 6 m tall, hairless or very short hairy, stems angled, green or purplish: *leaves* narrow linear-lanceolate to lanceolate, at least 5 times longer than broad, entire or irregularly lobed with 1-6 narrow acute lobes: *flowers* lavender, paling to margins (white in var. *albiflorum*), to 3.5 cm diameter, corolla lobes distinct, $\pm$ acute: berries ovoid, 2-2.5 cm long, bright orange, often with persistent green cross at base: seeds less than 2 mm long, and stone cell masses usually smaller than seeds.

Can be confused only with the related *S. laciniatum*, which until recent years was not treated as distinct from *S. aviculare*: it differs in the stems, purplish, flowers dark blue-purple, to 5 cm diameter, corolla lobes indistinct, notched at tip, berries pale lemon-yellow, longer and larger than in *S. aviculare*, and seeds more than 2 mm long (Baylis, 1954: 639-43; Bulfin, 1969: [13-14]).

S. aviculare and *S. laciniatum* are grown as crops overseas for production of steroid precursors, and are currently under evaluation trials in New Zealand: should they become widely grown in future, it is likely that both species will appear in an "adventive" state in sites where they would not occur normally.

Occurs in and about coastal and lowland forest margins and in shrubland through North Island and south to Banks Peninsula on the east coast, South Island. (Indigenous: also in Australia).

3. *S. CAROLINENSE* L. (HORSE NETTLE)

Sparingly prickly, stellate-hairy, green perennial, with thick, wiry, far-extending roots which produce new shoots: *stems* erect, branched or unbranched, to 1 m tall: *leaves* ovate to oblong, shallow lobed: *flowers* white or light blue, 2-3.5 cm diameter: *berries* globose, 1-2 cm diameter, yellow or orange-yellow.

The far-extending, wiry root system with shoots enabling vegetative reproduction, distinguish this plant from the other armed species.

A troublesome and undesirable weed, known from three occurrences: Te Puke (1934); waste land, Rotoehu State Forest (1944); pasture, Waiterimu, Waikato (1960). (N. America).

Fig. 2: A. Berries — a. *Solanum sarrachoides*; b. *S. gracilius*; c. *S. nigrum* var. *humile*; d. *S. nigrum* var. *chlorocarpum*; e. *S. nigrum* var. *nigrum*; f. *Atropa bella-donna*; g. *S. dulcamara*; h. *S. diflorum* Vell.; i. *S. laciniatum*; j. *Atropa bella-donna*. B. *S. pseudocapsicum* (Jerusalem cherry); C. *Atropa bella-donna* (deadly nightshade).

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4. *S. CRISPUM* Ruiz et Pavon

Erect, branching, hairless or short hairy shrub, to 3.5 m tall, new growth often long, zig-zag and $\pm$ climbing; small stellate hairs on shoots and young leaves, scattered on older branches and about veins on older leaves: *leaves* $\pm$ entire, ovate-lanceolate to ovate, variable in size — on long shoots, to 12 cm long; on short lateral branchlets with terminal flower heads, 2-4 cm long: *flowers* violet with dark mid-vein 2-3 cm diameter, in many-flowered heads: *berries* globose, $\pm$ 1 cm diameter.

Unlikely to be confused with, and distinguished from other climbing species by the stellate hairs, $\pm$ entire leaves, and yellow berries.

Planted in the homestead garden at Bluecliffs station, South Canterbury, in the 1910-1920 period, it was noted in 1964 as an established garden escape in nearby forest remnants, where it still persists: a single wild plant was in 1969 found at Okains Bay, Banks Peninsula, and the species might well be detected as a garden escape in other districts. (Chile, Peru.)

5. *S. DIFLORUM* Vell. (FALSE JERUSALEM CHEPRY)

= *S. capsicastrum* Link

Similar in habit and general features to the closely related *S. pseudocapsicum* L. (which see), this species differs in the leaves dull on the upper surface, stellate or branched hairs on young branches, leaves, shoots, and sometimes on undersides of older leaves, and berries either globose or ovoid and $\pm$ pointed, scarlet or orange-red (Fig. 2Ah).

Can be confused only with *S. pseudocapsicum*, which differs in the shining upper leaf surfaces and absence of hairs.

Long cultivated as an ornamental, this species and *S. pseudocapsicum* have been confused in New Zealand, as overseas, and many records of distribution and poisonings are unreliable. It is very likely, however, that *S. diflorum* has caused poisonings in children, and it should therefore be treated, at all times, as dangerous.

Cultivated in gardens in both islands, this species varies in abundance in the adventive state from casual bird-introduced seedlings in gardens, through scattered plants to dense shrub communities in damaged forest: occurs alone or associated with *S. pseudocapsicum* or *Berberis darwinii*; about hedgerows, in shaded waste places, in or about plantations, and in damaged indigenous forest and forest remnants in localities in North Island and northern South Island. (S. America).

6. *S. DULCAMARA* L. (BITTERSWEET)

Climbing, scrambling or sprawling deciduous perennial, hairless or with simple hairs (Fig. 2Ag, 3C, 5.5): *stems* 0.5-2.5 (-4) m long, sometimes woody below, wiry above, with raised lenticels: *leaves* ovate, to 10 cm long, entire, or with 1-2 (-4) pointed basal lobes: *flowers* purple, occasionally near white, $\pm$ 1 cm diameter, in stalked, many-flowered heads: *berries* red, ovoid to globose, $\pm$ 1 cm long, drooping.

Recognised by the scandent stems, starry purple flowers and drooping red berries: climbing forms of *S. crispum* are distinguished by the stellate hairs on new growth and absence of basal leaf lobes, and *S. jasminoides* differs in the much longer stems, larger white flowers, and small blue or black berries.

The name "bittersweet" is descriptive of the taste of the foliage — initially bitter, becoming sweet: cattle poisonings occur, some beasts acquiring an abnormal appetite, searching out and consuming large and occasionally lethal amounts of the foliage: children should be warned that the attractive red berries are poisonous.

Fig. 3: A. *S. nigrum* (black nightshade); B. *S. sarrachoides* (hairy nightshade); C. *S. dulcamara* (bittersweet); D. *S. gracilius* (velvety nightshade).

Fig. 4: A. *S. marginatum*; B. *S. rostratum*; C. *S. laciniatum*; D. *S. mauritianum*.

Established in damp or shaded waste places, along drain banks, in *Phormium* communities in swamps or wet areas, in rough growth along river and stream banks, in hedgerows, shaded places in domestic gardens, about plantations and indigenous forest margins: known from scattered localities in North Island, from Taranaki and Hawkes Bay southwards, ascending to over 600 m at Balls Clearing, Puketitiri, n.e. of Napier: in South Island, widely occurring in Canterbury, Otago, and Southland, and known from Westport and Hokitika, West Coast: not known from Nelson and Marlborough. (Europe, Asia, N. Africa).

7. *S. GRACILIUS* Herter (VELVETY NIGHTSHADE)
= *S. gracile* Dunal non Sendt.
S. ottonis Hyland.

Hardy, $\pm$ deciduous, greyish perennial herb or sub-shrub, to 1.5 m tall and broad, velvety-hairy with appressed simple hairs (Fig. 2Ab, 3D, 5.2): *stems* soft hairy above, rough and $\pm$ woody below, 2-lined: *leaves* ovate to ovate-lanceolate, to 11 cm long, thick, $\pm$ entire: *flowers* white, 0.7-1.4 cm diameter, usually $\pm$ umbellate, the common stalk (peduncle) to 4 cm long and strongly deflexed (bent sharply downwards) in fruit: *berries* globose, dull purplish-black, to 0.8 cm diameter, fruiting calyx appressed to berry.

Distinguished from allied species by the greyish appearance, velvety feel of the leaves, very long peduncles sharply bent downwards in fruit, and the dull purplish-black berries.

Originally collected from Greymouth in 1941, this species has been well established on the West Coast, South Island, for many years: in recent years it has appeared and is increasing in other South Island districts. Occurs as a weed of gardens, hedgerows, bush edges, about plantations and shaded places, infrequent in crop land generally, but a problem in some market gardens near Christchurch: in North Island, occurs about Wellington, with a single collection from the Rangitikei River, near Kakariki. (S. America).

8. *S. JASMINOIDES* Paxt. (POTATO VINE)

Vigorous, $\pm$ hairless, climber, stems to 10 m or more: *leaves* lanceolate to ovate-lanceolate, to 6 cm long, entire, or lower leaves with 1-2 small basal lobes (similar to those in *S. dulcamara*), often with short white hairs in vein angles on underside of leaves: *flowers* white or white tinged blue, starry, 1.5-2.25 cm diameter, in many-flowered open heads: *berries* small, globose, 4-5 mm diameter, black or blue.

Could be confused only with other climbing or scrambling species, but differs in the vigorous, far-climbing stems, the plant hairless, except for the vein-pit hairs on leaf undersides, and white flowers.

A garden escape established and climbing over willows along streams or trees on indigenous forest margins etc., has been found in localities in both islands — Auckland; between Pahiatua and Eketahuna; Belmont, Hutt Valley; Pohara, n.w. Nelson; Grovetown, near Blenheim; Riccarton Bush, Christchurch: near Kurow, North Otago. (Brazil).

9. *S. LACINIATUM* Ait.

Previously included under *S. aviculare* (which see) and similar in general aspect to that species (Fig. 2Ai, 4C, 5.7): differs in the stems always purplish, the flowers dark blue-purple, to 5 cm diameter, the corolla lobes indistinct and notched at the tip, the berries pale lemon-yellow and larger and longer than in *S. aviculare*, the seeds more than 2 mm long, and store cell masses as large as, or larger than seeds.

Occurs in similar habitats to *S. aviculare* — shrubland and about coastal and lowland forest margins — from Auckland south to Dunedin: in Canterbury and Otago, it is sometimes seen with $\pm$ weed status about

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Fig 5: Leaf silhouettes — 1. *S. nigrum*; 2. *S. gracilius*; 3. *S. sarrachoides*; 4. *S. nodiflorum*; 5. *S. dulcamara*; 6. *S. crispum*; 7. *S. laciniatum*; 8. *S. pseudocapsicum*; 9. *S. tuberosum*; 10. *S. marginatum*; 11. *S. mammosum*; 12. *S. sodomeum* (all reduced to same size).

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farmyards and shelter plantings, exotic tree plantations, in gorse, broom and other live farm hedgerows, and showing ability to reach and establish in more rigorous lowland habitats and localities. (Indigenous: also in Australia).

10. *S. MAMMOSUM* L.

Armed, much-branched, hairy sub-shrub, to 1.5 m tall, prickles yellow: *leaves* broadly ovate, to 15 cm long, soft hairy with long appressed simple hairs, irregularly lobed (Fig. 5.11): *flowers* bluish-purple or violet, 1.5-3 cm diameter, solitary or several together, flower stalks and calyx lobes without prickles: *berries* yellow, conical or broad ovoid, to 6 cm long, with nipple-like protuberances.

Differs from the other armed species in New Zealand in the soft simple hairs, the flower stalks and calyx lobes lacking prickles, and the protuberances on the fruits.

Cultivated as an ornamental in many warm countries, this species was reported as an horticultural escape in the Auckland and Waikato districts in 1870: not found since, but may be grown in gardens in warmer parts of North Island because of the unusual fruits. (C. and S. America).

11. *S. MARGINATUM* L.f. (WHITE-EDGED NIGHTSHADE)

Armed, much branched shrub to small tree, to 5 m tall, prickles yellow, to 1.5 cm long, hairs simple, branched and stellate, young branches white-felted-hairy: *leaves* broadly ovate, to 20 cm long, shallowly sinuate lobed (Fig. 4A, 5.10), discolorous — upper surface whitish hoary in young leaves, older leaves becoming green (as hairs deciduous from margin outwards) except for a narrow marginal white border; lower surface always white-felted (tomentose): *flowers* white with purple veins, 2.5-3.5 cm diameter: *berries* globose, 1.5-4 cm diameter, yellow, without prickles, on stout, woody and prickly stalks.

Readily distinguished from the other armed nightshades by the white-felted twigs, white marginal zone on upper surface of mature leaves, white underside of all leaves, large yellow berries on stout woody stalks.

Introduced as an ornamental, and reported wild at Auckland by 1883, it was rated by the 1930's as "Frequent in waste places about Auckland". Still occasionally seen in cultivation, this is a serious woody weed if permitted to establish, since it forms dense communities impenetrable to humans and stock alike.

Casual plants from bird-carried seed appear in gardens and hedgerows, and scattered plants to colonies or communities occur in lowland waste places, in and about gullies with rough growth, about forest margins and farm plantations etc: spreading and increasing in density in pasture on poor rough country: in North Island, south of Auckland Province, most occurrences are within a few miles from the coast: in the South Island, known from the Marlborough Sounds and scattered occurrences in Nelson Province and down the West Coast, long persistent in Canterbury at Motunau and on Banks Peninsula. (N. Africa).

12. *S. MAURITIANUM* Scop. (WOOLLY NIGHTSHADE)

= *S. auriculatum* Ait.

Shrub to small tree, to 10 m tall, trunk to 15 cm diameter, all parts thickly and densely covered with branched and stellate hairs (Fig. 4D): *leaves* ovate to elliptic, to 40 cm long, discolorous — upper surface light or dark green, lower surface whitish or yellowish-green, commonly with two characteristic small stipule-like, rounded leaves at base of each leaf stalk: *flowers* lilac to purple, rarely white, 1-1.5 cm diameter, in dense clusters on stout peduncles: *berries* leathery, yellow, globose, $\pm$ 1 cm diameter, stellate-hairy.

Identification of Species

Cannot be confused with any other species, and readily recognized by the large discolorous, stellate-felted, hairy leaves, usually the two small stipule-like leaves at the base of the stalks of the large leaves, and stellate hairy berries.

Introduced as an ornamental, it had escaped about Auckland and at Mahurangi by 1883: a weed of waste places, about plantations and forest margins, and pasture on poorer country, it is causing increasing concern in some districts with its invasion of hill country grassland, and formation of woody communities. It is the only *Solanum* to have status as a noxious weed under the Noxious Weeds Act 1950.

Occasional to locally common in Auckland Province localities, this weed is gradually extending southwards, increasing in coastal Taranaki and about Wanganui: it is thoroughly established and spreading on hill slopes near Nelson, and about Collingwood and in other north-west Nelson localities. (Uruguay: Brazil).

13. *S. NIGRUM* L. (BLACK NIGHTSHADE)

Variable, dark to purplish-green, frost-tender (regenerating from crown), annual to perennial herb (Fig. 2Ac-e, 3A,5.1), hairless or with some appressed or spreading simple hairs or short glandular hairs (use hand lens); leaves ovate, to 10 cm long, entire, toothed or lobed, thin; flowers white or white tinged violet or pink, $\pm$ 1 cm diameter, usually in racemes (Fig.1), sometimes $\pm$ umbellate; anthers 2-2.7 mm long; berries black (var. *nigrum*), green (var. *chlorocarpum*), yellow or yellowish-green (var. *humile*), or red (var. *miniaturum*), globose, 7-8 (-10) mm diameter ($\pm$ 1.5 cm diameter in var. *guineense*), dull or $\pm$ glossy, fruiting calyx lobes pressed against berry, or slightly reflexed (rolled back): seeds 1.7-2.4 mm long.

In being hairless or not noticeably hairy, *S. nigrum* should not be readily confused with the obviously hairy *S. gracilius* and *S. sarrachoides*, while *S. nodiflorum* may be separated by the smaller flowers (usually in umbels), anthers and seeds, and strongly reflexed fruiting calyx lobes.

All green, black and most yellowish-berried material examined belongs to the typical var. *nigrum*, characterized by being hairless or with appressed non-glandular hairs only: all red, and some yellowish-berried plants have short glandular hairs mixed with longer, $\pm$ spreading non-glandular hairs.

Some treatments of the morella or black nightshade group (Wessely, 1961: 290-321) separate out red-berried plants as *S. alatum* Moench, others place both yellowish and red-berried plants under *S. luteum* Mill.: the different berry colour forms have been retained here within *S. nigrum* for the reason that standard common names are available, and that the affinities of such plants are clear.

There is widespread and unfortunate confusion in New Zealand in the application of the name "deadly nightshade", and it is erroneously and frequently used for *S. nigrum*: distinguishing features are tabulated under the true deadly nightshade (*Atropa bella-donna*).

Over the years, conflicting views have been expressed on the toxicity of *S. nigrum*, and it seems probable that, since this and allied species have been confused and not always differentiated, some comments have in fact, referred to other species. In the interests of safety, *S. nigrum* and others of the black nightshade complex — *S. gracilius*, *S. nodiflorum*, and *S. sarrachoides*, should be treated as dangerous.

A troublesome weed of cultivated land, black nightshade competes with, and may smother crop plants: the berries of this and allied species are a nuisance in processed food products, and the ripe berries stain wool when sheep graze infested land after a crop has been harvested or abandoned.

The most widespread and abundant species of the black nightshade (morella) complex, it occurs throughout New Zealand, occasional to locally abundant in waste places, gardens, market gardens, cultivated land, and sometimes in newly-sown pastures. (Europe).

S. nigrum L. var. *guineense* L.
(= *S. intrusum* Soria)

Grown under the name "garden huckleberry", this large berried plant is re-introduced periodically by the horticultural industry, and grown in home gardens (de Latour, 1961:208). Differing from the wild forms of the species in the strongly winged stems, brown anthers and large black berries, this horticultural entity has not yet been found in the wild state in New Zealand. The name, *S. melanocerasum* All., is correctly applied if the plant is treated as a distinct species.

14. *S. NODIFLORUM* Jacq. (SMALL-FLOWERED NIGHTSHADE)

= *S. allanii* Polgar
S. pachystylum Polgar

Variable, erect to bushy herb or sub-shrub, to 1 m tall, hairless or nearly so, green or purplish: *leaves* ovate, to 10 cm long, thin, $\pm$ entire to shallowly lobed or toothed: *flowers* white to tinged violet, 5-8 (-9) mm diam, usually $\pm$ umbellate, anthers 1.1-2 mm long: *berries* black, glossy, 5-7 mm long, fruiting calyx lobes strongly reflexed (rolled back): seeds 1.2-1.5 mm long.

Likely to be confused only with *S. nigrum* which differs in the larger flowers, anthers and seeds, the usually racemose flower clusters, and fruiting calyx lobes closely appressed or slightly reflexed.

The New Zealand forms of *S. nodiflorum* and related species were studied by Baylis (1958: 379-85), and he, and later Allan (1961: 835), consider that there are both indigenous and adventive forms of the species. A recent worker (Edmonds, 1971: 634-5) has considered *S. nodiflorum* as conspecific with *S. americanum* Mill., and reduced it to varietal status (var. *nodiflorum* (Jacq.) Edmonds) under that species: the existing status has been maintained here.

A weed of shaded waste places, forest margins, and gullies and about rock faces, damaged forest, secondary growth, about plantations and trees, infrequent in open drier sites: more frequent in upper half of North Island, but extends down to Cook Strait: known in South Island from near Farewell Spit and Kaikoura, but could well be found elsewhere. (In part indigenous, part adventive: C. and S. America).

15. *S. PSEUDOCAPSICUM* L. (JERUSALEM CHERRY)

Erect, hairless shrub to 2 m tall, twigs wiry (Fig. 2B, 5.8): *leaves* lanceolate to ovate-lanceolate, to 4 times as long as broad, to 10 cm long, $\pm$ entire, margins wavy, dark green and shining above, lighter green below: *flowers* white, 1-2 cm diameter, starry, solitary (or 2-4 together), leaf-opposed, axillary, or extra-axillary: *berries* globose, 1.5-2 cm diameter, scarlet, yellowish or orange-red, glossy, persistent.

Can be confused only with *S. diflorum*, which differs in the leaves dull, new growth and underside of older leaves with branched or stellate hairs.

TOXICITY: The berries are attractively coloured and are responsible for many plant poisonings in humans in New Zealand: some children require treatment in surgeries and hospitals each year, and death may even result from such poisonings. There has been, and still is confusion between this and the closely related *S. diflorum*, and the actual species concerned in many records of occurrence and poisonings is not certain. It is imperative that both *S. pseudocapsicum* and *S. diflorum* be recognized as dangerous, since as widely grown garden

Identification of Species

ornamentals and as patio and indoor tub subjects, they are commonly within hand-reach of crawling and toddling children.

Still grown as an ornamental, this species occurs as an established escape in localities through both islands: casual, bird-introduced plants appear in gardens, and scattered shrubs to dense communities occur about hedgerows, shady waste places, in and about plantations, and in damaged indigenous forest and forest remnants: may grow alone, or associated with *S. diflorum* and *Berberis darwinii*. (Madeira).

16. *S. ROBUSTUM* Wendl.

= *S. alatum* Seem. et Schmidt

Armed shrub, 2 m or so tall, rusty or tawny-felted with branched and stellate hairs: prickles large, flattened, to 1.25 cm across base: *stems* strongly winged: *leaves* ovate, large, to 30 cm long, margin wavy-lobed, greenish above, tawny below, blade continued down each side of stalk and extended down branches as conspicuous, tawny, prickly wings: *flowers* white, 2-3 cm diameter, calyx-lobes without prickles: *berries* ± globose, 1-1.5 cm diameter, orange, hairy.

Characterized by the stout prickles, large stem wings, and tawny aspect, it is readily distinguished from all other species in New Zealand.

Grown as an ornamental overseas, this species was found as a casual at Mt. Wellington, Auckland, by the late M. Hodgkins, exact date uncertain, probably in the 1930's. (Brazil).

17. *S. ROSTRATUM* L. (BUFFALO BUR)

Very prickly, erect or spreading, yellowish-green, stellate-hairy annual, to 0.60 m tall: *leaves* ovate in outline, to 12 cm long, deeply lobed: *flowers* yellow, 2-2.5 cm diameter: *fruit* bur-like, the ± 1 cm diameter red berry closely and completely enclosed in the enlarged calyx lobes, prickles 0.5-1.5 cm long (Fig. 4B).

Recognized by the deeply lobed leaves, yellow flowers, and bur-like fruits, it might be confused with *S. sisymbriifolium*, which differs in the orange-red prickles, white or violet flowers, and berries only loosely and partly enclosed by the fruiting calyx; with *S. sodomeum*, a woody shrub with violet flowers and yellow berries; and *S. carolinense*, which lacks the deeply lobed leaves, and has a tough, far-extending root system from which new shoots arise.

A troublesome weed should it establish, but fortunately to date, the species has been found only on four occasions — Whangamomona, Taranaki (1929); in pasture, Taneatua, Bay of Plenty (1950); in swede crop, Bideford, near Masterton (1959); garden, Loburn, North Canterbury (1974).

18. *S. SARRACHOIDES* Sendt. (HAIRY NIGHTSHADE)

Much branched, ± succulent, clammy (viscid), light or yellowish-green, ± prostrate to bushy, frost-tender annual, hairs glandular and non-glandular (Fig. 2Aa, 3B, 5.3): *leaves* ovate, to 5 cm long, irregularly toothed: *flowers* white or white tinged violet, to 1 cm diameter, in racemes: *berries* globose, 8-9 mm diameter, greenish-yellow, with dark veins, fruiting calyces enlarged and enveloping lower half of berries.

Recognized by, and differing from other species of the black nightshade complex, in the plant clammy- (viscid-) hairy, light colour, greenish-yellow veined berries, and enlarged fruiting calyces. In some habitats, plants have a dark or "grubby" aspect, because of wind-borne soil particles trapped by the sticky hairs.

Our material agrees with *S. nitidibaccatum* Bitter, an entity variously treated by overseas workers as a distinct species (Saarisalo-Taubert, 1967: 89-93), or as merged with either *S. sarrachoides* or *S. chenopodioides* Lam.: it is retained here under *S. sarrachoides*, the name by which it was originally recorded in New Zealand in 1968.

Identification of Species

Tolerant of loose dry soils and high summer temperatures, this weed has steadily increased its distribution, abundance, and economic significance: a nuisance in gardens, market gardens, cultivated land, dry waste areas, process crops, the often large, sprawling, bushy plants competing strongly with crop plants, and the berries sometimes present in processed food products. Appearing originally in Central Otago, it gradually spread northwards into coastal N. and S. Otago, N. and S. Canterbury, and more recently into Marlborough and Nelson, where it is spreading in tobacco and tomato areas: present in localities in Bay of Plenty and Hawkes Bay, significant in process crops. (S. America).

19. *S. SISYMBRIFOLIUM* Lam. (VISCID NIGHTSHADE)

Robust, armed, clammy (viscid) and stellate-hairy annual, to 1.5 m tall: prickles orange-red, to 1.5 cm long, lower flattened parts glandular and stellate-hairy: *leaves* ovate in outline, to 20 cm long, deeply and irregularly lobed, green on both sides: *flowers* white or violet, 2.5-3.5 cm diameter: *berries* red, globose, 1-2 cm diameter, loosely enveloped in the enlarged prickly calyx lobes.

The orange-red prickles, viscid glandular hairs, and red berries loosely enveloped in the fruiting calyx readily distinguish this from other prickly nightshades known in New Zealand.

Rated as a troublesome weed overseas, this species was originally found at Henderson in 1935, and subsequently in pasture near Katikati, Bay of Plenty, in 1966. (Tropical America).

20. *S. SODOMEUM* L. (APPLE OF SODOM)

Armed bushy shrub, 1-3 m tall, green, stellate-hairy, prickles yellow, to 1 cm long (Fig. 5.12): *leaves* ovate to elliptic in outline, to 9 cm long, deeply and irregularly lobed: *flowers* 2-2.5 cm diameter, violet: *berries* globose, 2-2.5 cm diameter, mottled green and white when immature, yellow when mature.

Recognized by the leaves green below and deeply, irregularly lobed, and the yellow berries; could be confused with *S. sisymbriifolium*, which differs in the prickles orange-red, and red berries partly and loosely enveloped by the fruiting calyces, and *S. marginatum* with leaves white on underside.

Reported in 1883 as common on the hills of the Auckland Isthmus, and as occurring at Mangonui, Bay of Islands, and in the Waikato, this species is now a characteristic weed of coastal sand country in the northern half of North Island, south to Taranaki and Hawkes Bay. Found also in waste places inland but to a limited extent only, this weed is increasing in some districts and becoming more significant as invading pastures and forming dense communities. (N. Africa).

21. *S. TUBEROSUM* L. (POTATO)

Spreading herbaceous perennial, with underground rhizomes and tubers: stems erect or sprawling, to 1 m long: *leaves* compound, to 30 cm long, with large terminal and 2-4 pairs of large lateral leaflets, and small leaflets between (Fig. 5.9): *flowers* white, violet or purple, 1.5-3 cm diameter: *berries* globose, 1.5-2 cm diameter, green or yellowish.

Characterized by the underground rhizomes and tubers, and compound leaves.

An often persistent escape or outcast in waste land and about sites where garden refuse and agricultural warehouse rubbish is dumped: temporary in new pasture and crops following previous potato crops. (S. America).

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