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Group A, sub-group 1: ***M.excelsa***, *M. kermadecensis, M. robusta, M.umbellata*
sub-group 2: *M.perforata*

Group B .....

Groups A & B are chiefly distinguished by open v. closed florescences, semi-superior v. inferior ovaries, and seed release etc.

AN ANALYSIS OF FLOWERS AND FRUITS IN NEW ZEALAND METROSIDEROS

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SUMMARY

The inflorescences and internal and external features of the flowers and fruits of the 11 New Zealand species of *Metrosideros* are illustrated and a table and explanatory notes provided to show how the species can be arranged as follows:

Group A, sub-group 1: *M. excelsa, M. kermadecensis, M. robusta, M. umbellata;*
sub-group 2: *M. perforata;*

Group B: sub-group 1: *M. colensoi, M. diffusa, M. carminea, M. albiflora;*
sub-group 2: *M. fulgens, M. parkinsonii.*

Groups A and B are chiefly distinguished by open *v.* closed inflorescences, semi-superior *v.* inferior ovaries, and seed release through the free part of capsule *v.* seed release partly through the fused parts of capsule and hypanthium; sub-groups A1 and A2 by axillary *v.* terminal inflorescences, broad *v.* narrow cymule bracts, and persistent *v.* deciduous petals; sub-groups B1 and B2 by bulging *v.* not bulging ovaries at the capsule stage and not persistent *v.* persistent capsule veins.

INTRODUCTION

A detailed study of the inflorescences, flowers, and capsules of the 11 New Zealand species of *Metrosideros* has led to the division of the species into two groups, each of which comprises two sub-groups (Table 1). Consideration of the taxonomic status of the groups must await similar studies of the whole genus, whose 45 currently recognised species (van Balgooy, 1966) are distributed from New Zealand to the Celebes and Hawaii, with an outlying species in the Bonin Islands and another in South Africa. Genera related to *Metrosideros* will also need to be considered, with particular attention to *Mearnsia* Merrill, of which a few species were formerly included in *Metrosideros*.

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TABLE 1—A comparison of flowers and fruits in New Zealand *Metrosideros*

Subgroup	A1	A2	B1	B2
SPECIES	*M. excelsa* (T)* *M. kermadecensis* (T) *M. umbellata* (T) *M. robusta* (ET)	*M. perforata* (L)	*M. colensoi* (L) *M. diffusa* (L) *M. carminea* (L) *M. albiflora* (L)	*M. fulgens* (L) *M. parkinsonii* (ST)
INFLORESCENCE (Figs. 1, 2)				
(a) Position, 1 (*b*)**	Axillary in pairs	Terminal	Terminal or ramiflorous	Terminal or ramiflorous
(b) Form, 1 (*a*)	Open	Open	Closed	Closed
(c) Deciduous bud scales, 1 (*d*)	Present	Absent	Absent	Absent
Cymule bracts (Fig. 3)	Broad	Narrow	Narrow	Narrow
Petals	Persistent	Deciduous, 2 (Fig. 4U)	Persistent	Persistent
OVARY				
(a) of flower	Semi-superior (Fig. 6 A, E, I, Q)	Semi-superior (Fig. 6 M)	Inferior (Fig. 9 E, I, M, Q)	Inferior (Fig. 9 A, U)
(b) of fruit	Not bulging	Not bulging	Bulging (Fig. 8 F, H, J, L)	Not bulging
Style base placentas capsule, 3 (*a*)	Becoming widely separated	Remaining together	Remaining together	Remaining together
SEEDS				
(a) Ratio length/ breadth	7–10/1	*c.* 4/1	3.5–5/1	*c.* 4/1
(b) Release, 3 (*b*)	Through free part of capsule (Fig. 5 B, C, E, G)	Through free part of capsule (Fig. 5 I)	Mostly through openings in fused parts of capsule and hypanthium (Fig. 8 G, I, K, M)	Partly through openings in fused parts of capsule and hypanthium (Fig. 8 B, D)
Veins of fruit	Not persistent	Not persistent	Not persistent	Persistent (Fig. 8 A, E)

* T = Tree; ET = Epiphytic tree; ST = Small tree; L = Liane
** Numbers refer to Notes.

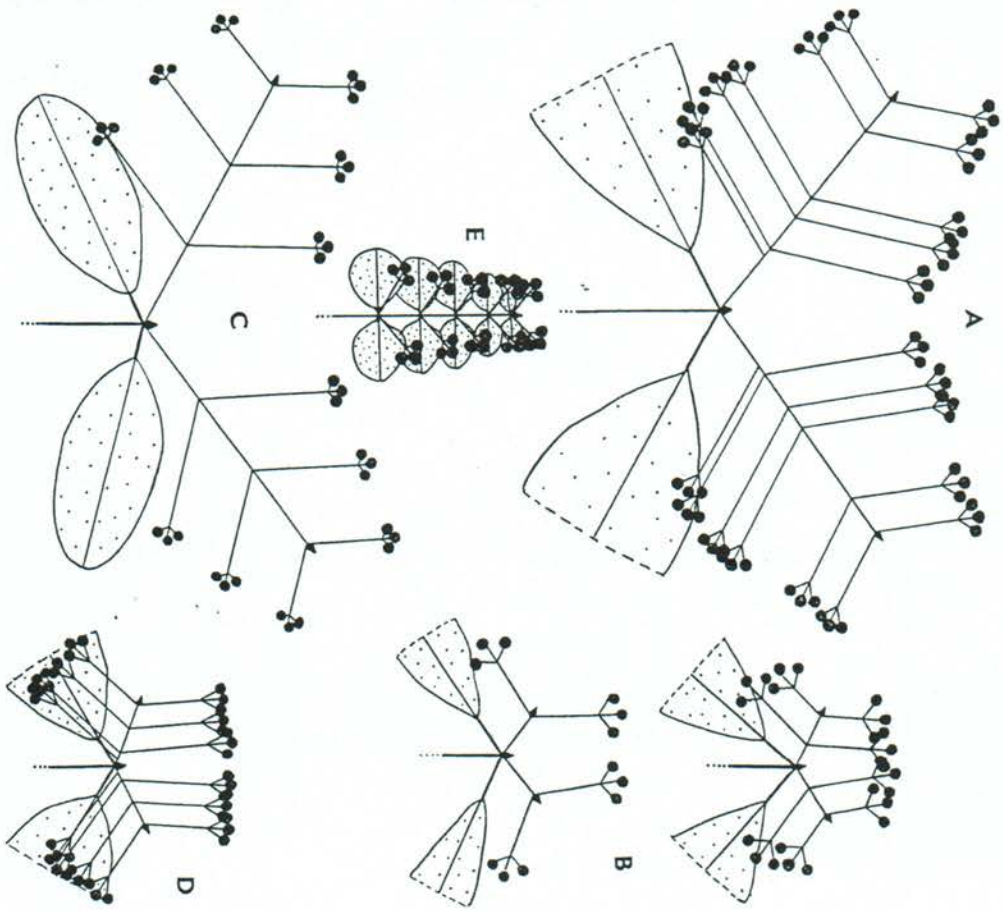

FIG. 1—*Metrosideros*, Group A. Inflorescences (diagrammatic). (A) *M. excelsa*, (B) *M. umbellata* (2 forms), (C) *M. kermadecensis*, (D) *M. robusta*, (E) *M. perforata*. Bracts not shown. Small black triangles represent vegetative apices.

NOTES

1. INFLORESCENCE (Figs. 1, 2, 3)

(a) Definition

The inflorescences have decussately compound systems of axes. All axes in Group B (Fig. 2) and all except the primary axis in Group A (Fig. 1) terminate in groups of three flowers (sometimes reduced to two or one), which are termed cymules (Fig. 3 A, B). Each cymule has a terminal and two lateral flowers.

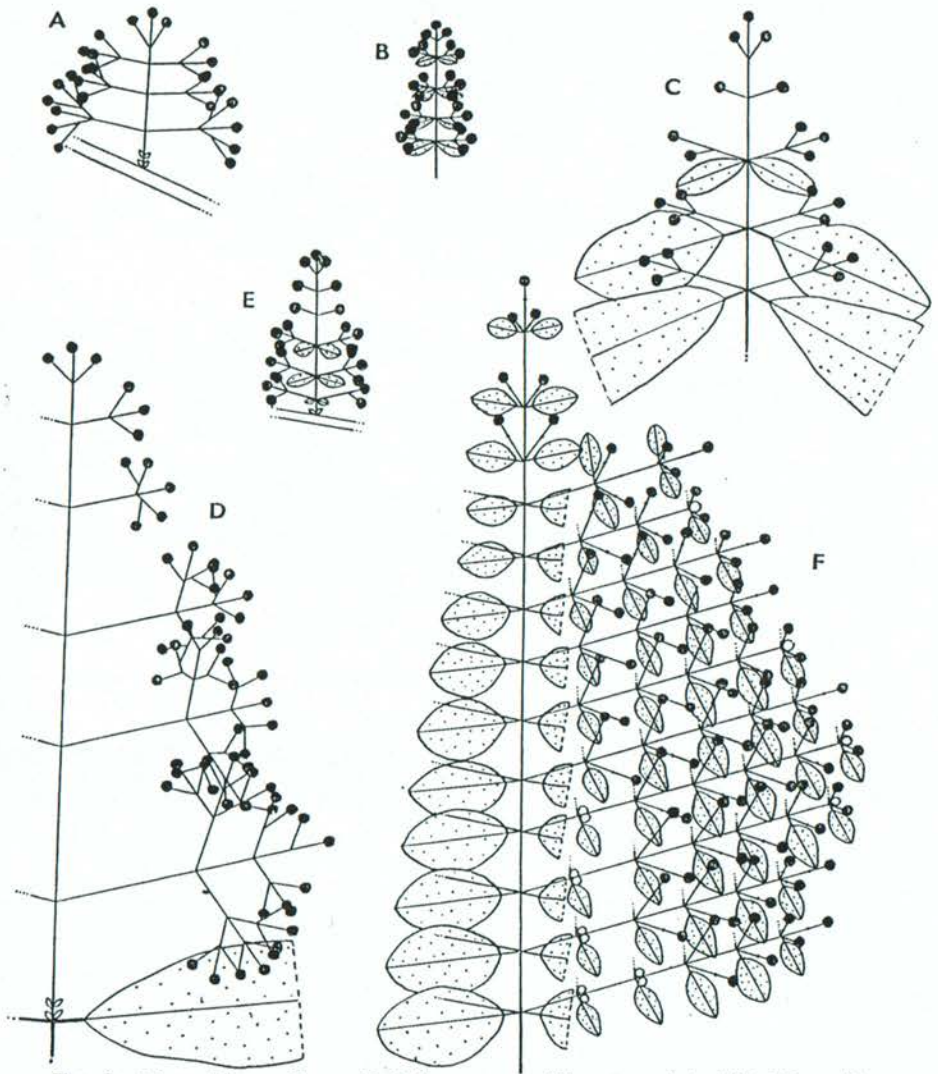

FIG. 2—*Metrosideros*, Group B. Inflorescences (diagrammatic). (A) *M. parkinsonii*, (B) *M. colensoi*, (C) *M. fulgens*, (D) *M. albiflora*, (E) *M. diffusa*, (F) *M. carminea*. Bracts not shown. Open circles represent abortive flowers.

In Group A the primary axis terminates in a vegetative bud (Fig. 1). The bud is inactive during flowering, but may later develop into a leafy branch. This is termed an "open" inflorescence. This contrasts with the inflorescences of Group B where the primary axis terminates in a cymule (Fig. 2). This is termed a "closed" inflorescen

(*b*) *Position*

In Sub-group A1 the inflorescences are usually in axillary pairs. Each pair flanks the abortive apex of a branch (Fig. 1 A, B, C, D). In young plants of this group the abortive branch apex may be replaced by a third inflorescence. There may also be a second pair of inflorescences below the first in strongly flowering mature plants.

In Sub-group A2 and Group B the inflorescences are terminal (Figs. 1 E, 2 B, C, D, F) or axillary on older woody stems (ramiflorous) (Fig. 2 A, E). The ramiflorous species may have a few terminal inflorescences and the terminal species a few axillary inflorescences.

(*c*) *Degree of Compounding*

In Group A there are primary and secondary axes only (Fig. 1), as is the case with some species of Group B (Fig. 2 B, C, E). The other species of Group B usually have higher orders of compounding (Fig. 2 A, D, F).

The most highly compound inflorescence of Group B is illustrated by Fig. 2 D. A type like Fig. 2 F may have been derived from this by reduction of the tertiary axes to single flowers, and this, in turn, by reduction of the secondary axes to one to three flowers, may have led to types like Fig. 2 B, C, E.

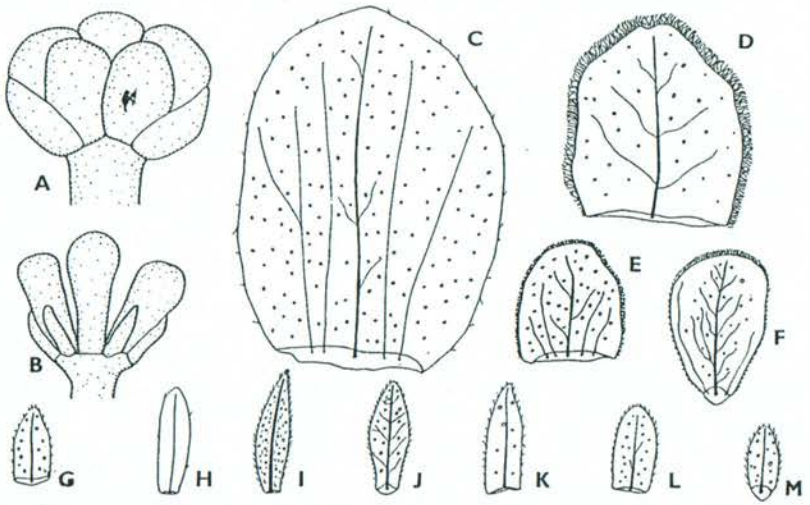

FIG. 3—*Metrosideros*. Cymule bracts of all species. (A) Cymule of *M. kermadecensis* showing 4 of the 6 bracts. (B) Cymule of *M. fulgens* showing 4 of the 6 bracts. (C–M) Cymule bracts, (C) *M. umbellata*, (D) *M. excelsa*, (E) *M. kermadecensis*, (F) *M. robusta*, (G) *M. fulgens*, (H) *M. parkinsonii*, (I) *M. colensoi*, (J) *M. diffusa*, (K) *M. albiflora*, (L) *M. carminea*, (M) *M. perforata*. (A–B × 3.5, C–M × 5). Spots on bracts are oil glands.

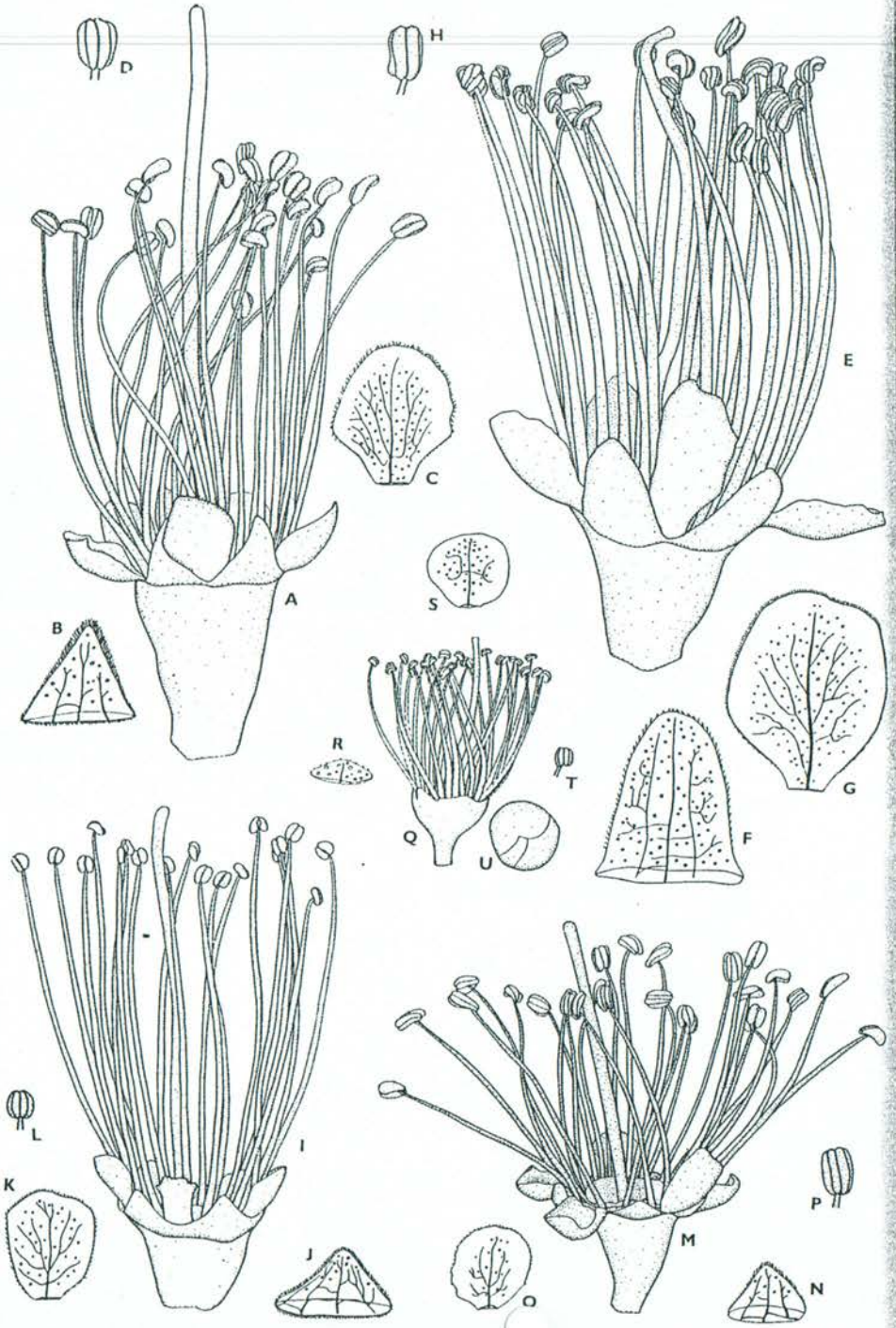

FIG. 4—*Metrosideros*, Group A. Flowers, sepals, petals, and anthers. (A–D) *M.*

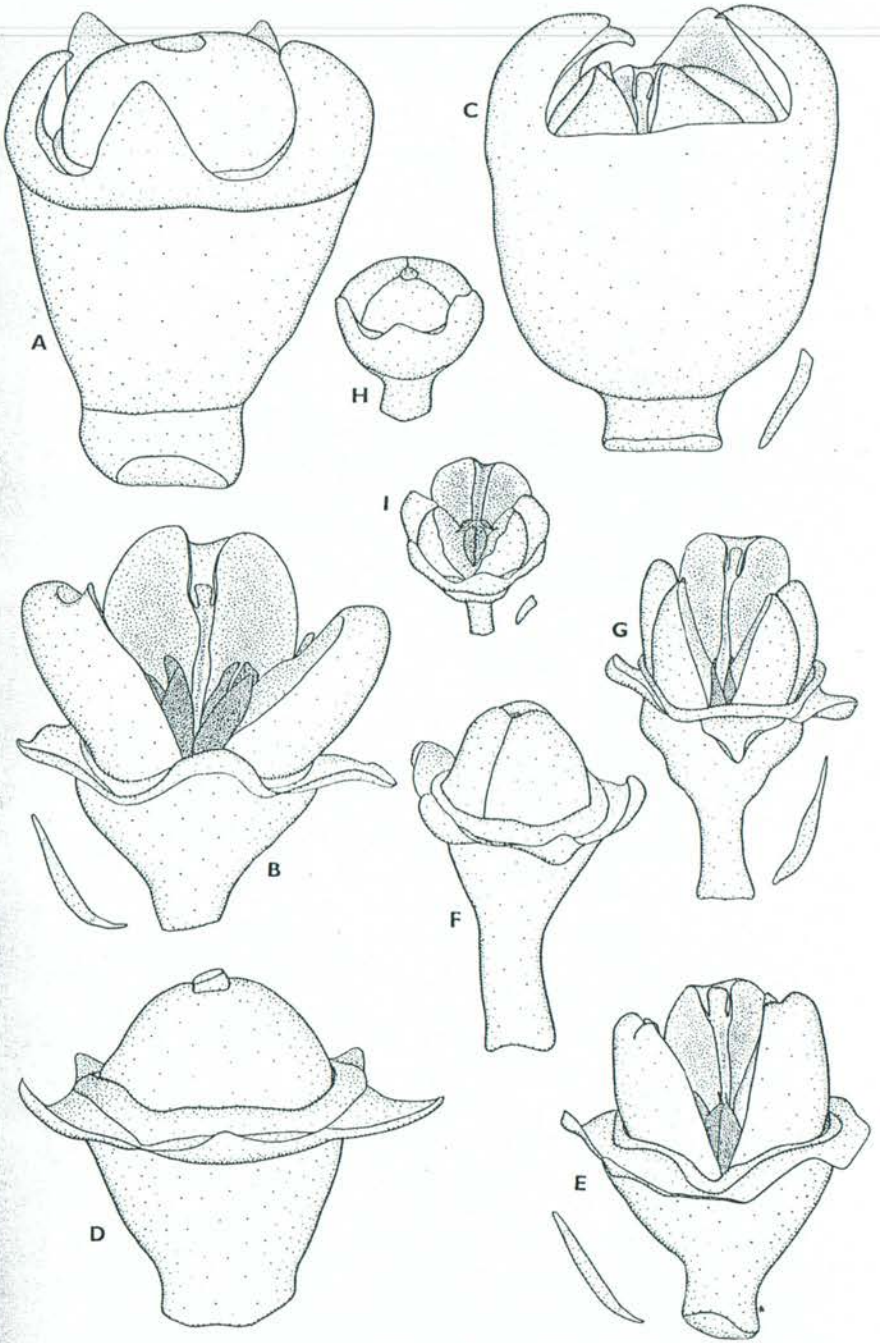

FIG. 5—*Metrosideros*, Group A. Dehisced and undehisced fruits; seeds. (A, B) *M. excelsa*, (C) *M. umbellata* (dehisced fruit only, with part of hypanthium cut away), (D, E) *M. kermadecensis*, (F, G) *M. robusta*, (H, I) *M. perforata*. (All × 5.) Placentas darkly stippled.

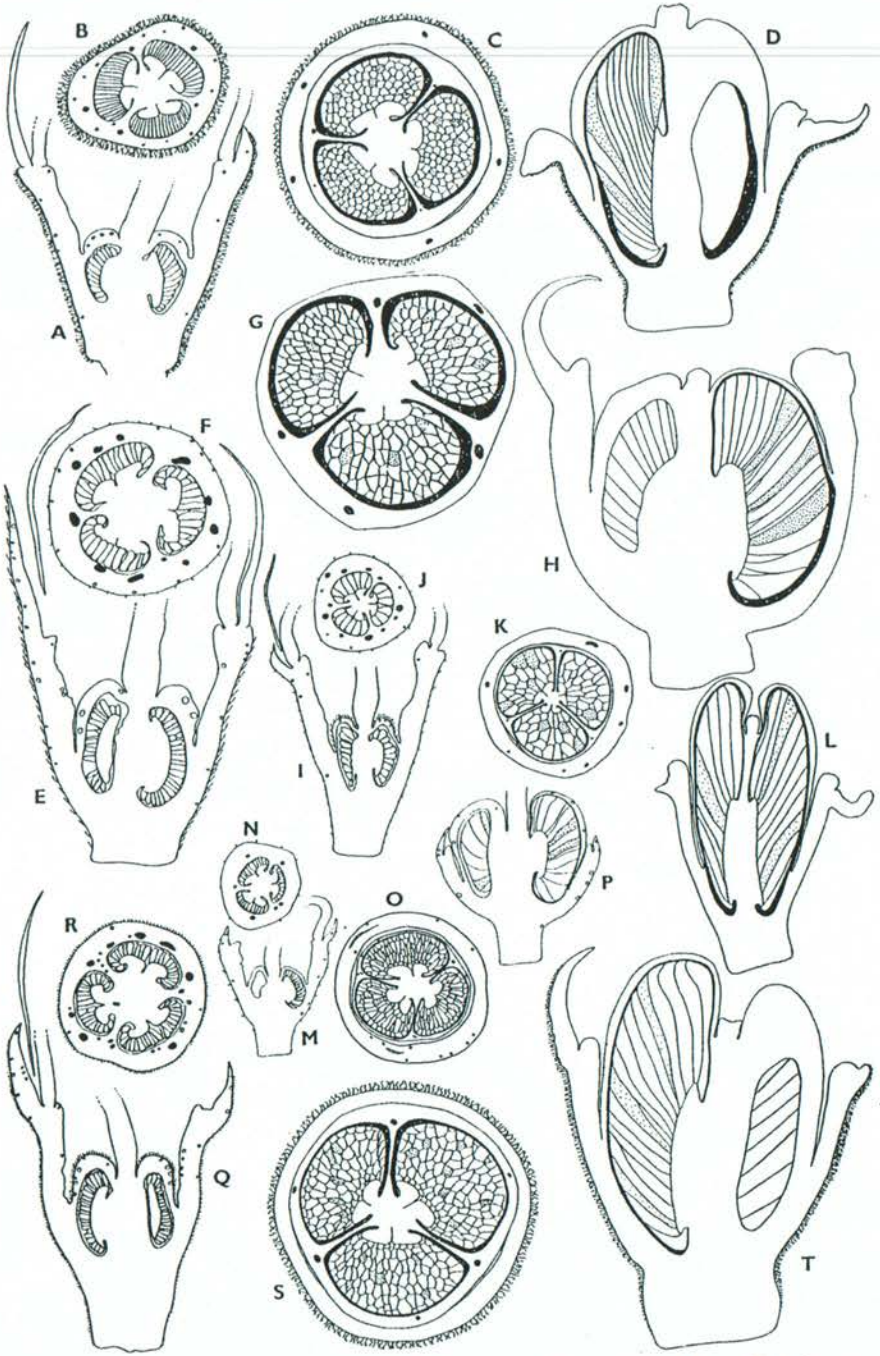

FIG. 6—*Metrosideros*, Group A. L.S. flowers, T.S. ovaries, T.S. and L.S. undehisced fruits. (A–D) *M. kermadecensis*, (E–H) *M. umbellata*, (I–L) *M. robusta*, (M–P) *M. perforata*, (Q–T) *M. celsa*. (All × 5.) Fertile seeds stippled. Lignified endocarps and vascular strands black.

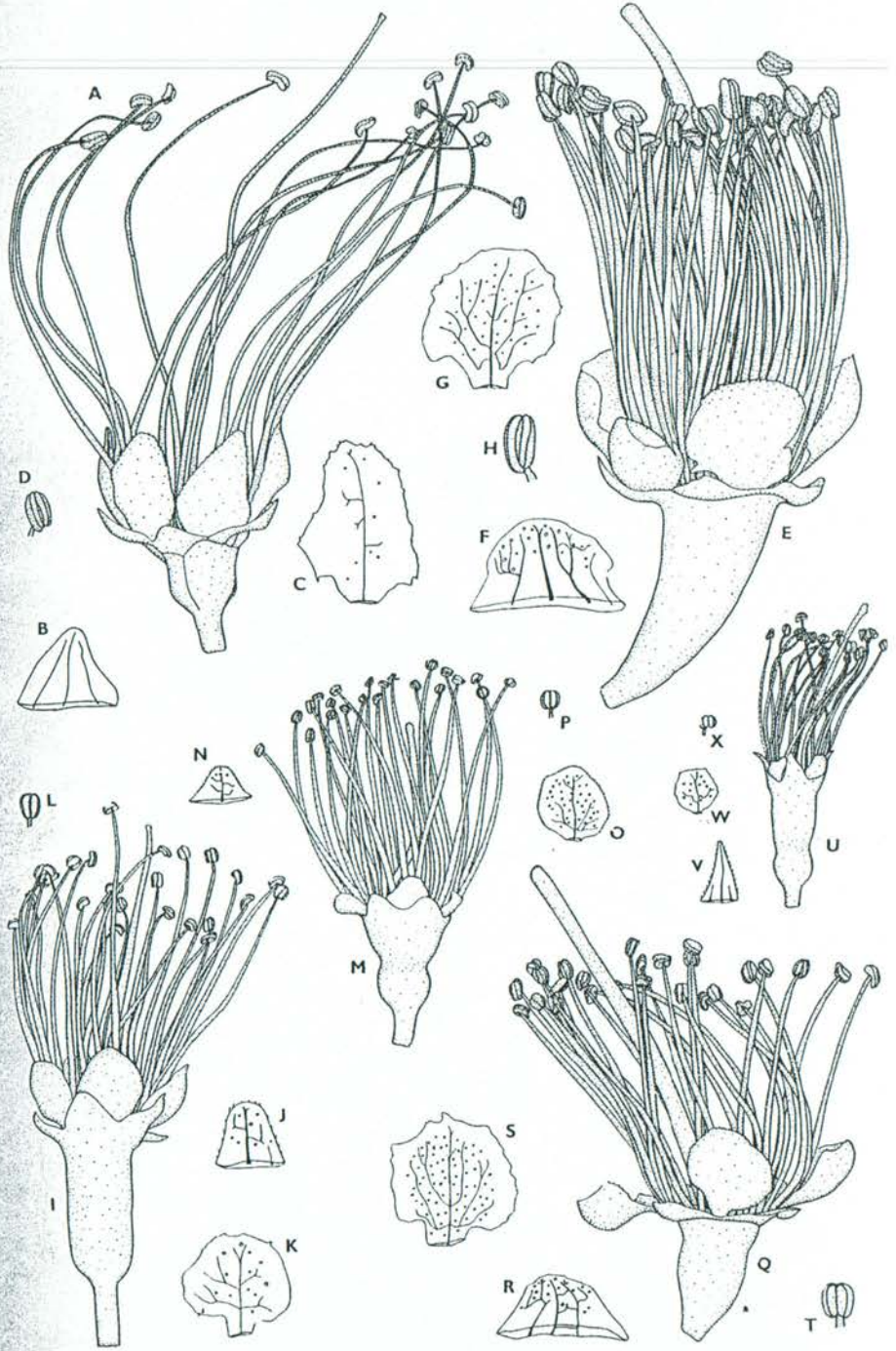

FIG. 7—*Metrosideros*, Group B. Flowers, sepals, and anthers. (A–D) *M. kinsonii*, (E–H) *M. fulgens*, (I–L) *M. albiflora*, (M–P) *M. diffusa*, (Q–T) *M. carminea*, (U–X) *M. colensoi*. (Flowers × 3.5, other parts × 5). Pubescence on flowers not shown. Spots on sepals and petals are

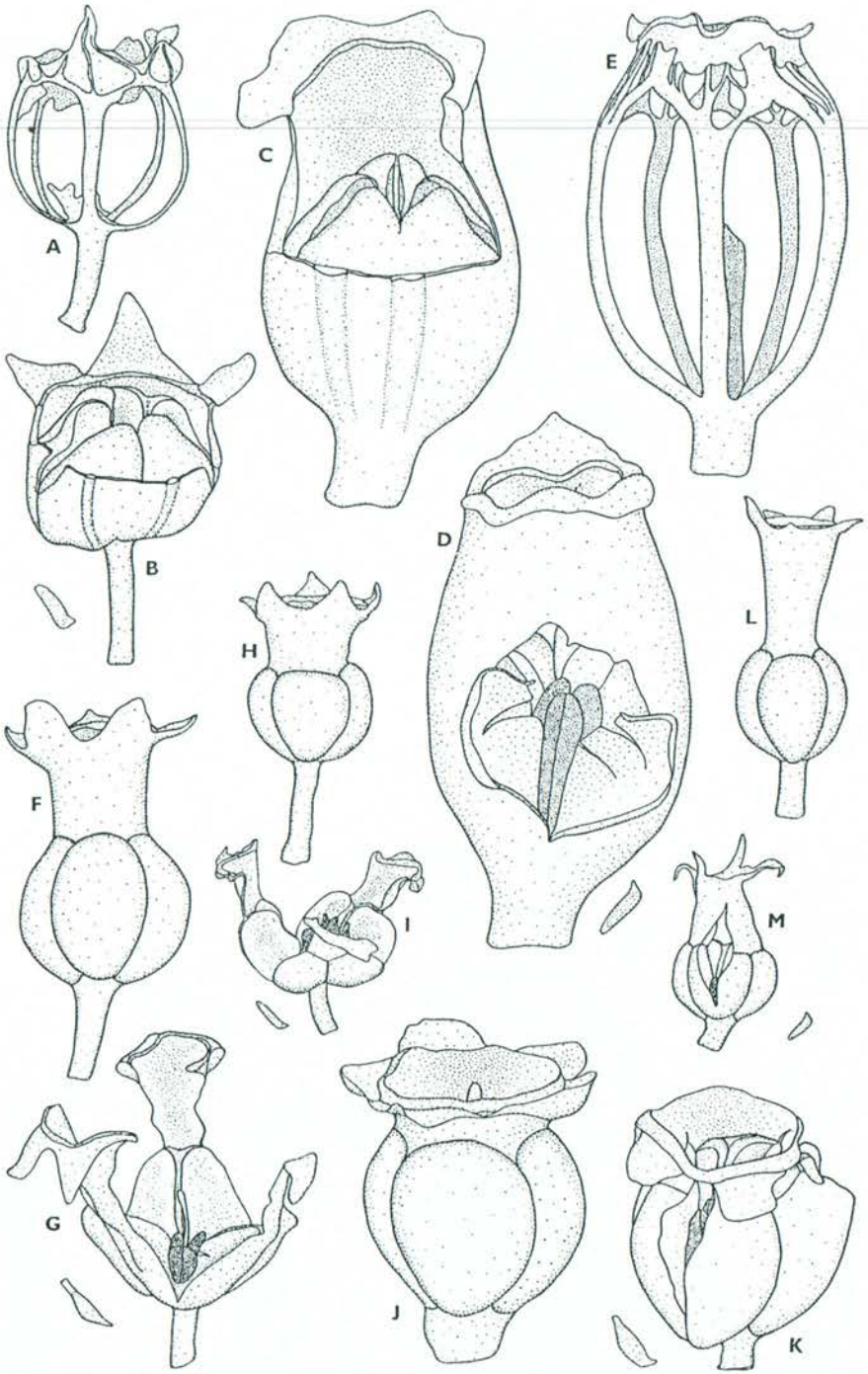

FIG. 8—*Metrosideros*, Group B. Dehisced and undehisced fruits; seeds. (A, B) *M. parkinsonii*, (A) vein skeleton, (B) dehisced fruit with part of hypanthium cut away. (C–E) *M. fulgens*, (C) fruit with part of hypanthium, cut away to show dehiscence of free part of capsule, (D) shows capsule valve protruding through break in hypanthium, (E) vein skeleton. (F, G) *M. albiflora*, (H, I) *M. diffusa*, (J, K) *M. carminea*, (L, M) *M.*

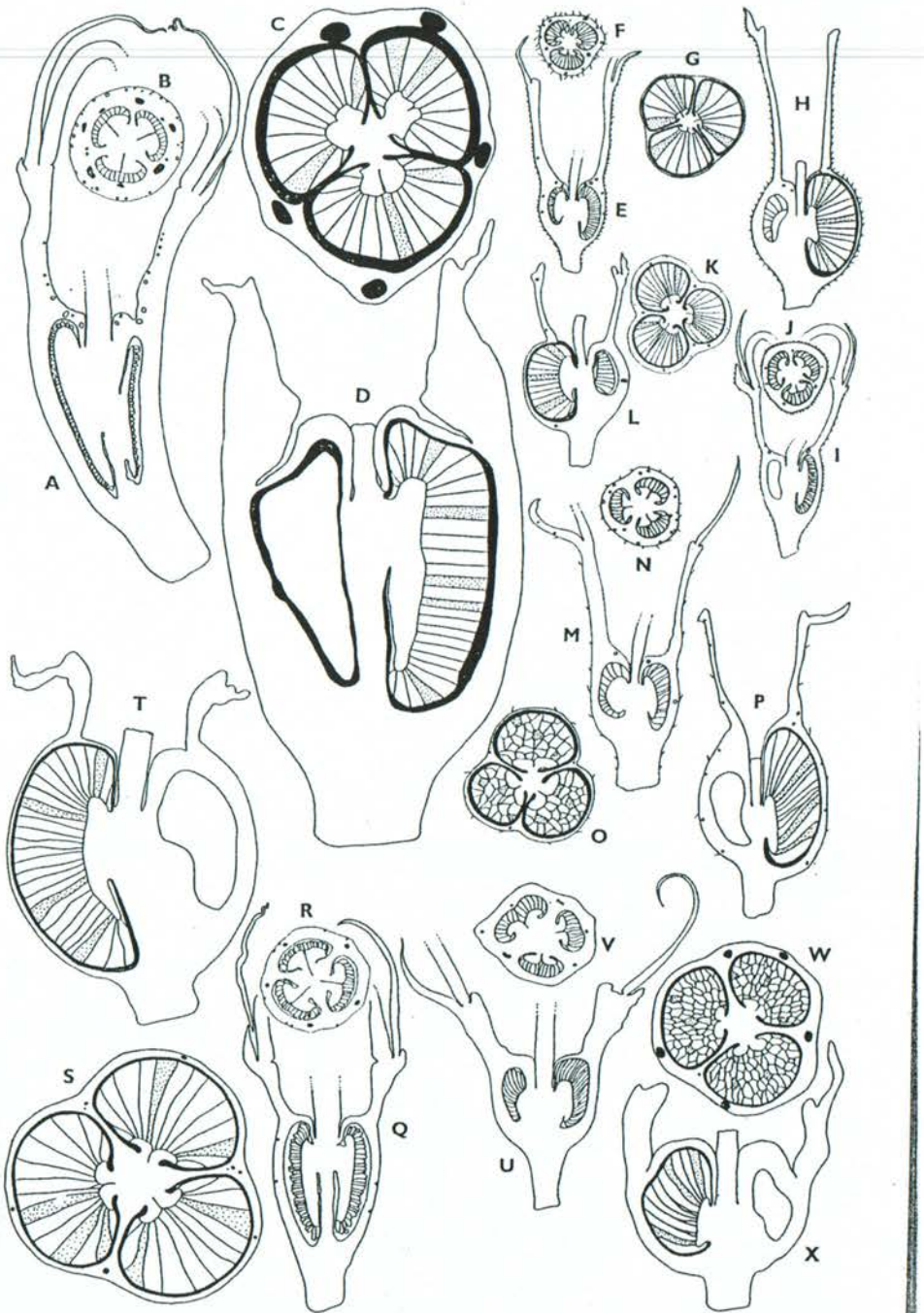

FIG. 9—*Metrosideros*, Group B. L.S. flowers, T.S. ovaries, T.S. and L.S. undehisced fruits. (A–D) *M. fulgens*, (E–H) *M. colensoi*, (I–L) *M. diffusa*, (M–P) *M. albiflora*, (Q–T) *M. carminea*, (U–X) *M. parkinsonii*. (All × 5.) Fertile seeds stippled. Lignified endocarps and vascular strands black.

(*d*) *Bracts and Other Appendages*

In Sub-group A1 the inflorescence buds are protected during the period of winter dormancy by several pairs of deciduous scales. In Sub-group A2 and Group B the inflorescences of some species develop terminally from vegetative shoots without any interruption of growth and have no bud scales (Figs. 1 E, 2 B, C, F). In the remaining species (Fig. 2 A, D, E) the inflorescences develop from terminal or axillary buds following a period of dormancy and they usually have a few pairs of very small scales. However, the latter are not deciduous and tend to become separated by internodes.

Sub-group A1 has the secondary axes subtended by deciduous bracts, while in A2 they are subtended by only slightly reduced green leaves (Fig. 1 E). In Group B there is more variability in this respect. In Fig. 2, A and D show cases where the secondary inflorescence axes are subtended by deciduous bracts, and B, C, E, F show cases where they are subtended by reduced leaves, of which the more distal may be bract-like and deciduous.

The cymules of all species have six deciduous bracts (Fig. 3 A, B). The terminal flower of a cymule is without bracts, but each lateral flower is subtended by a bract and has a pair of bracts attached to its base (the latter are sometimes termed bracteoles).

2. PETALS OF *M. perforata* (SUB-GROUP A2)

The petals of *M. perforata* begin to turn brown before the flower bud opens. As the stamens unfold the petals drop off as a cap (Fig. 4 U) although they are not fused together.

3. FRUIT

(*a*) *Position of the Base of the Style Relative to the Placentas*

In the flowers of Sub-group A2 and Group B the base of the style is at or a little below the level of the tops of the placentas (Figs. 6 M, 9 A, E, I, M, Q, U). The position of the style base relative to the tops of the placentas is maintained during enlargement of the capsule (Figs. 6 P, 9 D, H, L, P, T, X).

In the flowers of Sub-group A1 the base of the style is a little above the level of the top of the placentas (Fig. 6 A, E, I, Q). During enlargement of the capsule the tissue between the base of the style and the placentas elongates greatly, so that in the mature capsule they are widely separated (Fig. 6 D, H, L, T).

(*b*) *Dehiscence*

Dehiscence is loculicidal. In Group A the seeds are released entirely through the distal free* part of the capsule.

In Sub-group B1 the upper free part of the capsule is limited and most of the seeds are released through longitudinal splits in the fused tissues of the lower parts of the capsule and hypanthium (Fig. 8 G, I, K, M). Sometimes the splits extend completely through the free part of the hypanthium as well so that the fruit separates in to three valves (Fig. 8 G, I).

* i.e., not fused to the hypanthium, which is a cup-like structure thought to be formed by fusion of the bases of the sepals, petals, and stamens.

In Sub-group B2 the free part of the capsule bulges upwards during enlargement of the fruit (Fig. 8 B, C) and some of the seeds are released through it. Seeds are also released through more or less irregular openings in the fused lower parts of the capsule and hypanthium (Fig. 8 D).

(*c*) *Seeds*

As is usual in the Myrtaceae, only a few seeds contain embryos. These are stippled in Figs. 6 and 9.

COMPARISON WITH CHEESEMAN'S CLASSIFICATION

Cheeseman 1925*	Present Treatment
(1) *M. perforata*	(A2) *M. perforata*
M. robusta	
M. excelsa	(A1) *M. robusta*
M. kermadecensis	*M. excelsa*
	M. kermadecensis
(2) *M. umbellata*	*M. umbellata*
M. fulgens	
M. parkinsonii	(B2) *M. fulgens*
	M. parkinsonii
(3) *M. albiflora*	
M. diffusa	(B1) *M. albiflora*
M. carminea	*M. diffusa*
M. colensoi	*M. carminea*
	M. colensoi

In Cheeseman's scheme Group 1 is distinguished by the exsertion of the capsules beyond the rim of the hypanthium during development of the fruit. In the remaining species Cheeseman states that the capsule remains well below the hypanthial rim; but this is not the case in *M. umbellata*, where the capsule is about level with the hypanthial rim.

Group 2 is distinguished by having coriaceous or woody capsules, which dehisce apically or irregularly, while in Group 3 the capsules are "hardly coriaceous" and dehisce to the base.

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* The names have been brought up to date.