

PHARMACOGNOSTIC STUDIES IN *ABRUS PRECATORIUS* L.

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Introduction

The leaves and roots of *Abrus precatorius* L. are used in curing biliousness, eye diseases, leucoderma, itching, wounds, fevers, stomatitis, head-complaints, asthma, tuberculosis and caries of the teeth (Nadkarni, 1976; Kirtikar and Basu, 1980; Chopra et al., 1982). Root is a good substitute for liquorice (Dymock, 1890).

The pharmacognostic studies of leaf and root, which includes anatomical, histochemical, chemical and fluorescence analysis of the powder is presented. Leaf is hypostomatic and has anomocytic and anisocytic stomata. Unicellular conical hair occur on either laminar surfaces. Pericyclic fibers over the veins are encrusted with prismatic crystals of calcium oxalate.

Phelloderm of the bark consists of a layer of stone cells containing calcium oxalate crystals. Axiate parenchyma show apotracheal and paratracheal bands. Fibers are scanty. Ray parenchyma is abundant and possess starch and calcium oxalate crystals. Lignins, tannins, starches, alkaloids, proteins and calcium oxalate are present in leaf. Whereas saponins, lignins, tannins, starches, alkaloids and calcium oxalate occur in roots.

Materials and Methods

The plant material studied (leaf, root) was obtained from Survey of Medicinal Plants and Collection Unit, Ooty and also collected from Osmania University Campus, Hyderabad. Leaves were fixed in Carnoy's fixative (Johansen (1940)). Roots were boiled, and preserved in 1:1 (70% alcohol-glycerine) solution. Epidermal peels were obtained by scraping the leaves with a razor blade or scalpel and subsequently stained with aniline blue and mounted in glycerine. Free hand sections

were employed for the purpose of histochemistry. Microtome sections cut at 12-15 μm were made to study anatomical features of leaf following usual paraffin method (Johansen, 1940). Root was cut at 20-25 μm thickness on a sliding microtome (Spencer), stained with saffranine and light green and mounted in caneda balsam. Macerations of the elements of root was done following Jaffrey's maceration methods (Johansen, 1940). Histochemical tests were done after Johansen (1940), Youngken (1951) and Gibb's (1974). Chemical analysis of the powders were after Youngken (1951) and Gibb's (1974).

Observations

Leaf/Let

VENATION: Reticulodromous type (Fig. 1.8,9)

LEAF LAMINA ADAXIAL SURFACE (Fig. 1.1)

Epidermis: Epidermal cells on the adaxial 4-8 sided, polygonal anisodiametric to polygonal isodiametric, sides (anticlinal walls) thin or slightly thick, sinuous, cytoplasm scanty, in few with styloid and prismatic crystals, surface smooth (Fig. 1.1).

Distribution: Common irregularly arranged, variously oriented. E.C. F. 1,98,438 per cm^2 ; palisade ratio: 3.24. Cells overlying the veins 4-6 sided, polygonal anisodiametric to linear; sides thin, straight to curved. surface striated. Distributed parallelly on midvein, secondary and tertiary vein.

Stomata: Absent on the adaxial surface.

Trichomes: Unicellular, conical. hair conical, bent, pointed towards the apex, thickwalled, surface granulate, distributed all over and oriented towards the apex of the leaf. (Fig. 1.12).

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ABAXIAL SURFACE

Epidermal cells: Similar as on lamina adaxial but deeply sinuate, E.C.F. 2,22,656 per cm², palisade ratio. 3.92. Cells overlying the veins similar to those found on the adaxial and distributed on all grades of veins (Fig. 1.2).

Stomata: Mostly anomocytic and anisocytic, few tetracytic, subsidiaries 3-6 indistinct, mostly a-type, few f-and c-types, guard cells 17-22 μm long and 10-15 μm broad, distributed all over the surface except on veins. Various directed. Stomatal number 25,562 per cm², S.I. 10.66.

Trichomes: Similar to those found on the adaxial but more dense. (Fig. 1.2, 10, 11).

SECTIONAL VIEW: (1.5, 5 & 7)

In T.S. flat, dorsiventral, ribbed prominently on the abaxial and slightly ribbed on the adaxial side, epidermis 1-layered, cells adaxially large, rectangular, squarish, few oval and oblong; of midvein 12-28 (20) μm long tangentially and 8-20 (15) μm radially wide; on the adaxial small, oval and circular, radially 12-20 (16) μm long and 8-16 (13) μm tangentially wide; cells on the wing adaxial 12-34 (24) μm long tangentially and 8-20 (14) μm radially wide; abaxial ones smaller 8-24 (16) μm tangentially long and 6-16 (12) μm radially wide, cytoplasm scanty; stomata restricted to the abaxial side slightly below the level of epidermal cells; trichomes, as those described on the surface.

Mesophyll: Predominantly of palisade tissue. *Palisade*: 2-layered on the adaxial and 1-layered on the abaxial side, interrupted at veins. Cells hypodermal, columnar, but those on the abaxial loose irregular with large intercellular spaces. 16-30-40 μm long and 6-10-13 μm wide on the adaxial; 12-16-20 μm long and 6-8-10 μm wide on the abaxial; chloroplasts abundant, *Spongy*: 1-layered, interspersed between abaxial and adaxial palisade; cells circular, oval, and oblong; 8-16-22 μm in diameter; intercellular spaces large; chloroplasts few. *Collenchyma* at midvein hypodermal, 1-2 layered throughout on the abaxial and in a group of few cells on the adaxial, lamellar; 5-10-13 μm in diameter. *Parenchyma* at midvein scanty, 4-6 layered on the abaxial and 3-5 layered on the adaxial, cells isodiametric to anisodiametric, with narrow intercellular spaces, circular to oval, few elongated, 10-15-24 μm in diameter, contents scanty. *Sclerenchyma* as continuous pericyclic fibrous tissue surrounding the midvein bundle, 2-4 layered on the abaxial and 2-3 layered cap on the adaxial, walls thick; contents dense, encrusted with crystals of calcium oxalate. Wing bundles also surrounded by pericyclic fibres.

Vascular system: Midvein of a single large oval shaped bundle; secondary and tertiary vein bundles oval to circular, towards the adaxial side; conjoint, collateral

and pericyclic. Tracheary elements 38-46 in no. in the midvein; arranged in radial rows; cells polygonal, 6-15-24 μm in diameter. Secondary wall thickenings of the elements, helical, annular and pitted. Annular rings free, helices single and double; pits narrowly bordered; elongated and alternate; perforations simple.

Histochemistry

Starch, suberin, tannin, cyanogenic glycosides, fixed oils and fats absent. Lignin is present in pericyclic fibers and walls of tracheary elements. Calcium oxalate is present in epidermis and pericyclic fibers. Alkaloids present in ground tissue and mesophyll.

Powder Analysis

Microscopy: The observed elements in the powder are diagrammatically represented. (Fig. 1.13-21) and tabulated in Table No. 1.

Organoleptic Characters

Colour	Olive green
Taste	Acrid
Odour	No characteristic
Touch	Smooth

Tests of the Powder Extracts*Colour Reactions*

1. Water extract treated with N/10 Iodine Turned bluish black
2. Water extract treated with 10% FeCl₃ No change was observed
3. Water extract treated with 50% Na OH No change was observed

Fluorescence tests

1. Powder under UV light Dark red in colour
2. Water extract under UV light Slight reddish in colour

Chemical Constituents

Saponins, anthraquinones, tannins and starch are absent while lignin and alkaloids are present.

Root

Morphology: Cylindrical, tortuous, hard, woody; bark fragile, brownish black externally and yellowish internally.

BARK: (Fig. 2.1)

Phellem: In transection, 15-25 layered, cells tangentially elongated, rectangular, walls thin suberised, 30-64 μm long tangentially and 7-22 μm wide radially; compact without intercellular spaces. Cytoplasm dense; cells of the outer borke frequently fractured, dark brown to black in colour and inner ones yellowish brown.

Phelloderm: A broad zone of many parenchyma in successive rings of 10-20 cells in radius; cells polygonal, few oval to circular and squarish; compactly arranged with few intercellular spaces. Walls slightly thick;

cytoplasm scanty; interrupted by a continuous layer or in patches of stone cells encrusted with calcium oxalate crystals.

Secondary phloem: Broad zones of 15-20 layers in radius, interrupted by medullary rays; cells tangentially elongated, few isodiametric, 15-38 μm in diameter; walls thin, contents scanty but in few with prismatic crystals, intercellular spaces narrow; rays abundant multi-seriate, 15-25 celled in length, 4-12 cells wide; thin walled, single pitted, contents scanty.

Wood: In transection scanty, growth rings present; yellow turning to brownish yellow on exposure; diffuse porous. (Fig. 2.2).

Vessels: Mostly solitary, few clustered in radial multiples or tangentially aligned, numerous to very numerous, 16-128 μm in diameter, 40-192 μm in height; wall 5-10 μm thick; truncate, perforation plate horizontal and in some the rim or perforation is produced into a beak; pits elongated, bordered, alternate. (Fig. 2.2, 4-7, 11, 12).

Tracheids: 72-152 μm long, 16-24 μm in diameter; wall 7-12 μm thick; pits bordered, alternate elongated in 2-4 rows. (Fig. 2.3, 4, 8-10, 14, 17).

Fibers: Scanty; non-libriform, septate and non-septate; 336-1120 μm long, wall 5-8 μm thick, pits simple, horizontal to oblique. (Fig. 2.13, 22).

Axiate parenchyma: Abundant, paratracheal and apotracheal, banded, contents dense with starch and prismatic crystals of calcium oxalate, simple pitted. (Fig. 2.2, 18, 19).

Ray parenchyma: Abundant, multiseriate, occasionally uniseriate; 3-14 cells wide and upto 45 cells high; rays twisted among the tracheary elements homocellular 8-15-32 μm in diameter in tangential view; cells rectangular to squarish; 18-30-64 μm long and 12-18-40 μm wide in radial view; simple pitted, cytoplasm dense with starch grains and crystals of calcium oxalate. (Fig. 2.2-4, 15, 16, 20, 21).

Histochemistry

Starch, alkaloids and calcium oxalate present in the axial and ray parenchyma cells; tannin and suberin

present in the periderm and in sclereids. Lignin present in the periderm and phellem of the bark, tracheary elements and fibers of the wood.

Powder Analysis

Microscopy : The observed microscopic elements in powder are diagrammatically represented (Fig. 2.23-36) and tabulated in Table No. 2.

Organoleptic Characters

Colour	Creamish yellow
Taste	Acrid
Odour	No characteristic
Touch	Coarse.

Extracts of the Powder

Colour reactions: Water extract with N/10 Iodine turned blue in colour; while 10% FeCl_3 showed no change and 50% NaOH decolourised the extract.

Fluorescence tests: Both powder and water extracts did not change when exposed to UV light.

Chemical Constituents: Saponins, lignins, starch, alkaloids, tannin and calcium oxalate is present, while anthroquinones are absent.

Acknowledgements

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TABLE 1

MICROSCOPIC OBSERVATIONS OF *ABRUS PRECATORIUS* LINN. LEAF POWDER (10×20)

Field No.	Pieces of epidermal tissue	Pieces of palisade tissue	Pieces of spongy tissue	Pieces of tracheary elements	Pieces of pericyclic fibers	Stomata	Pieces of parenchyma	Pieces of collenchyma	Pieces of trichome	Crystals	Unidentified elements
1.	4	2	—	1	2	—	—	2	2	Few	Several
2.	5	3	—	3	1	2	1	—	2	Few	Several
3.	3	5	1	3	3	1	1	1	1	Few	Several
4.	4	2	1	2	1	1	—	—	4	Few	Several
5.	3	1	—	2	—	—	1	—	—	Few	Several

TABLE 2

MICROSCOPIC OBSERVATIONS OF *ABRUS PRECATORIUS* LINN. ROOT POWDER (10×20)

Field No.	Pieces of periderm	Pieces of phellem	Pieces of crystalliferous phellem	Pieces of tracheary elements	Pieces of ray tissue	Pieces of axial parenchyma	Pieces of fibers	Crystals	Starch grains	Unidentified elements
1.	2	1	1	4	5	2	1	Few	Few	Several
2.	3	3	2	5	3	3	2	Few	Few	Several
3.	2	1	1	2	2	—	3	Few	Few	Several
4.	1	2	—	2	4	2	2	Few	Few	Several
5.	2	1	1	6	2	1	2	Few	Few	Several

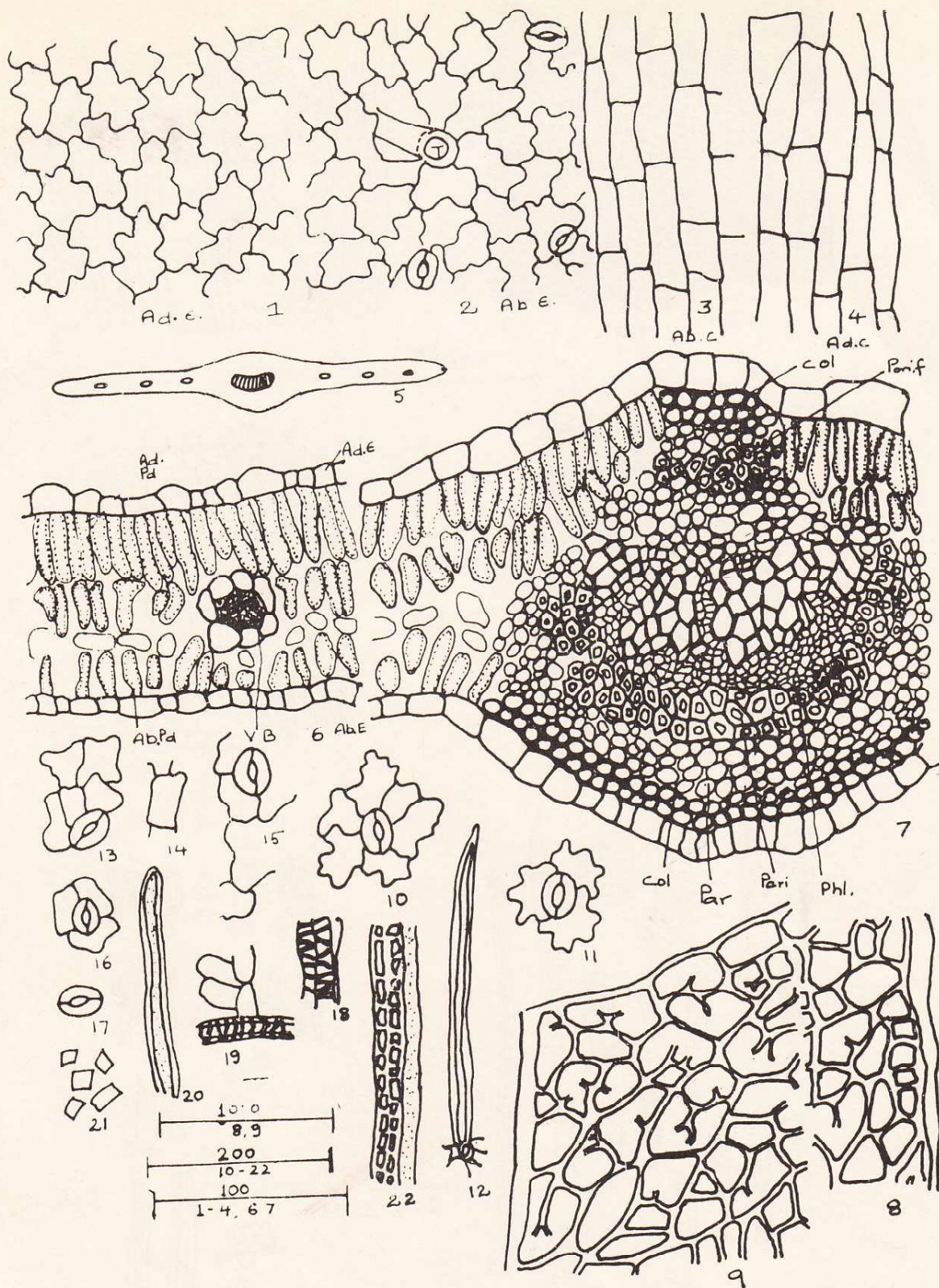


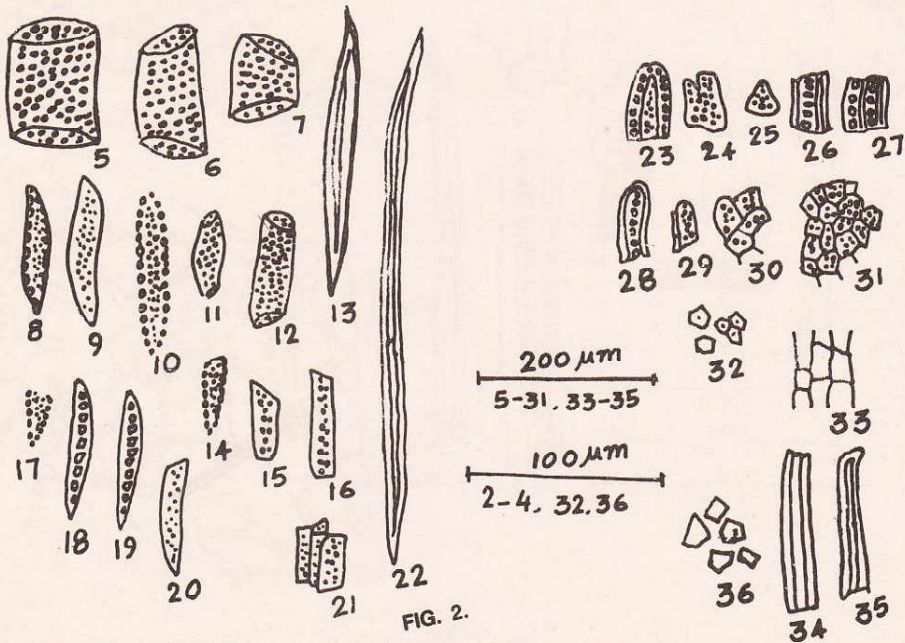
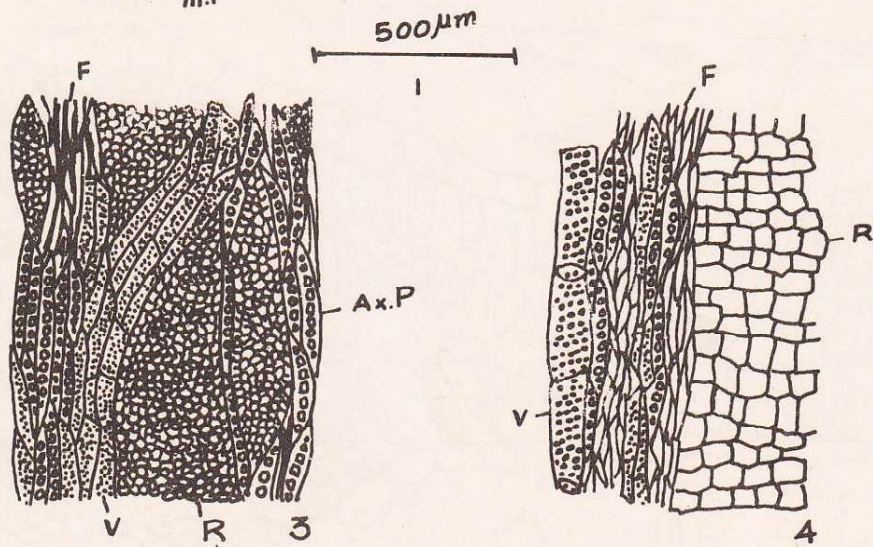
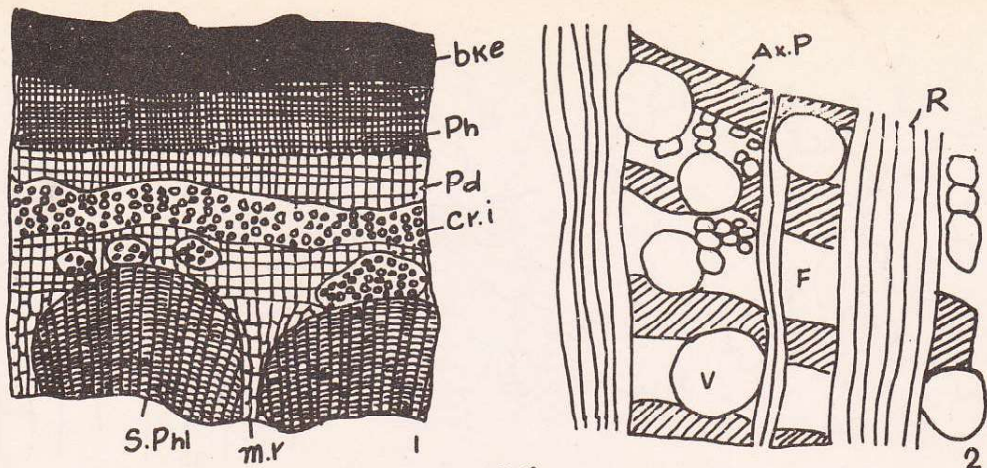
FIG. 1

LEAF/LET

1. Adaxial surface, epidermis; 2. Abaxial surface, epidermis; 3. Abaxial surface, costal; 4. Adaxial surface, costal; 5. Diagrammatic, Leaf/let in T.S.; 6. Lamina wing in T.S.; 7. Midvein in T.S.; 8. & 9. Leaf venation; 10. & 11. Stomatal types; 12. Conical hair; 13-22. Fragments of leaf/let elements in powder.

Abbreviations:

Ad.E — Adaxial epidermis; Ab.E — Abaxial epidermis;
 Ab.C — Abaxial costal cells; Ad.C — Adaxial costal cells;
 Ad.Fd — Adaxial palisade; Ab.Pd — Abaxial palisade;
 Col — Collenchyma; Par — Parenchyma; Per — Pericycle;
 Phl — Phloem; Per.f — Pericyclic fibers; VB — Vascular bundle.



1. T.S. of Root Bark, 2. T.S. of Wood, 3. T.L.S. of Wood, 4. R.L.S. of Wood, 5.-7. 11. & 12. Vessel Types, 8.-10. & 14., 17. Tracheids, 15., 16., 20., 21. Fibers, 23.-36. Fragments of Elements in Powder.

Abbreviations

Ax. P — Axial Parenchyma,
Cr. i — Crystalliferous Idioblasts,

B Ke — Borke,
F — Fibers,
Ph — Phellem,
Pd — Phelloderm,
S. Phl — Secondary Phloem,
R — Ray Parenchyma,
V — Vessel.