

CONTENTS

|                       |      |
|-----------------------|------|
|                       | Page |
| ACKNOWLEDGEMENTS      | iii  |
| ABSTRACT (ENGLISH)    | iv   |
| ABSTRACT (THAI)       | v    |
| LIST OF TABLES        | ix   |
| LIST OF FIGURES       | xi   |
| LIST OF ABBREVIATIONS | xiv  |

|                                                  |      |
|--------------------------------------------------|------|
| CHAPTER                                          | Page |
| I INTRODUCTION                                   |      |
| 1. Introduction                                  | 1    |
| 2. Objectives                                    | 3    |
| II LITERATURE REVIEWS                            |      |
| 2.1 The Genus <i>Cannabis</i>                    |      |
| 2.1.1 Introduction                               | 4    |
| 2.1.2 Taxonomy                                   | 5    |
| 2.1.3 Morphology                                 | 6    |
| 2.1.4 Structure and Biosynthesis of Cannabinoids | 11   |
| 2.2 The <i>Cannabis</i> Products                 |      |
| 2.2.1 Illicit <i>Cannabis</i> Products           | 14   |
| 2.2.2 Hemp Products                              | 16   |
| 2.3 Testing of <i>Cannabis</i>                   |      |
| 2.3.1 Physical Characteristics                   | 19   |
| 2.3.2 Color test                                 | 19   |

## CONTENTS (CONT.)

| CHAPTER                                                                                 | Page |
|-----------------------------------------------------------------------------------------|------|
| 2.3.3 Chromatography                                                                    | 20   |
| 2.4 Classification and Discrimination of <i>Cannabis</i> type                           | 21   |
| 2.5 The study of forensic DNA Markers                                                   | 22   |
| <b>III MATERIALS AND METHODS</b>                                                        |      |
| 3.1 Plant Samples                                                                       | 24   |
| 3.2 Fast Blue B salt test                                                               | 26   |
| 3.3 Thin-layer chromatography                                                           |      |
| 3.3.1 Preliminary test of TLC solvent system                                            | 26   |
| 3.3.2 TLC development of samples                                                        | 27   |
| 3.4 DNA Preparation                                                                     | 27   |
| 3.5 DNA Quantitation                                                                    |      |
| 3.5.1 UV-VIS Spectrophotometer                                                          | 28   |
| 3.5.2 Yield Gel method                                                                  | 29   |
| 3.6 DNA Amplification                                                                   |      |
| 3.6.1 Drug-type Marker (g and h)                                                        | 29   |
| 3.6.2 Universal Primer (C and D) and <i>Cannabis sativa</i> -specific Primers (G and H) | 29   |
| 3.6.3 Universal Primer (C and F                                                         | 30   |
| 3.7 Detection of PCR Products                                                           | 30   |
| 3.8 Purification of PCR Products                                                        | 31   |
| 3.9 Analysis and comparison of sequences                                                | 31   |
| <b>IV RESULTS</b>                                                                       |      |
| 4.1 Identification of authentic drug-type and fiber-type sample                         |      |

CONTENTS (CONT.)

| CHAPTER                                                                                 | Page |
|-----------------------------------------------------------------------------------------|------|
| 4.1.1 <i>Cannabis</i> presumptive testing by Fast Blue B salt                           | 33   |
| 4.1.2 <i>Cannabis</i> confirmatory testing by TLC                                       | 33   |
| 4.1.3 <i>Cannabis</i> confirmatory identification by DNA                                | 35   |
| 4.2 Identification of <i>Cannabis</i> samples using a combination of TLC and DNA method | 37   |
| 4.3 Test of <i>Cannabis sativa</i> sample from various sources in Thailand              |      |
| 4.3.1 Fast Blue B salt test                                                             | 38   |
| 4.3.2 Thin Layer Chromatography                                                         | 38   |
| 4.3.3 DNA detection using Drug-type Marker (g and h)                                    | 48   |
| 4.4 Test for intraspecific variation between drug-type and fiber-type strain            | 52   |
| V DISCUSSIONS                                                                           | 53   |
| VI CONCLUSIONS AND SUGGESTIONS                                                          | 58   |
| REFERENCES                                                                              | 60   |
| APPENDIX                                                                                | 64   |
| BIOGRAPHY                                                                               | 69   |