


อนุกรมวิธานของไรต์หัววงศ์ Cunaxidae (Acari) ในภาคกลางของประเทศไทย



นายมารุต เฟื่องอาวรณ์

ศูนย์วิทยพัทยากร

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

สาขาวิชาสัตววิทยา ภาควิชาชีววิทยา

คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

ปีการศึกษา 2546

ISBN 974-17-5540-6

ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

TAXONOMY OF THE PREDATORY MITE FAMILY CUNAXIDAE (ACARI)
IN CENTRAL THAILAND



Mr. Marut Fuangarworn


ศูนย์วิทยทรัพยากร

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science in Zoology


Department of Biology
Faculty of Science
Chulalongkorn University
Academic Year 2003
ISBN 974-17-5540-6

Thesis Title Taxonomy of the predatory mite family Cunaxidae (Acari) in central Thailand
By Mr. Marut Fuangarworn
Field of Study Zoology
Thesis Advisor Associate Professor Chariya Lekprayoon


Accepted by the Faculty of Science, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master 's Degree


..... Dean of Faculty of Science
(Professor Dr. Piamsak Menasveta)

THESIS COMMITTEE


..... Chairman
(Professor Dr. Siriwat Wongsiri)


..... Thesis Advisor
(Associate Professor Chariya Lekprayoon)


..... Member
(Associate Professor Dr. Somsak Panha)


..... Member
(Mrs. Vatana Charanasri)

มารุต เพื่ออวารณ์ : อนุกรมวิธานของไรตัวห้ำวงศ์ Cunaxidae (Acari) ในภาคกลางของประเทศไทย. (TAXONOMY OF THE PREDATORY MITE FAMILY CUNAXIDAE (ACARI) IN CENTRAL THAILAND) อ. ที่ปรึกษา : รองศาสตราจารย์จรรยา เล็กประยูร, 210 หน้า. ISBN 974-17-5540-6.

การศึกษานุกรมวิธานของไรตัวห้ำวงศ์ Cunaxidae จากตัวอย่างที่เก็บได้ในภาคกลางของประเทศไทยระหว่างเดือนตุลาคม พ.ศ. 2545 ถึงเดือนกันยายน พ.ศ. 2546 พบไรวงศ์นี้ 4 วงศ์ย่อย 9 สกุล 33 ชนิด โดยวงศ์ย่อย Bonziinae มีเพียงหนึ่งสกุลคือ *Neoscirula* ซึ่งมี 2 ชนิด วงศ์ย่อย Coleoscirinae มี 3 สกุล คือ *Coleoscirus* *Pseudobonzia* และ *Scutascirus* สกุลละ 5, 3 และ 1 ชนิดตามลำดับ วงศ์ย่อย Cunaxiinae มี 3 สกุล คือ *Armascirus* *Cunaxa* และ *Dactyloscirus* สกุลละ 2, 9 และ 2 ชนิดตามลำดับ และวงศ์ย่อย Cunaxoidinae มี 2 สกุล คือ *Neocunaxoides* และ *Pulaeus* สกุลละ 4 และ 5 ชนิดตามลำดับ โดยทั้ง 33 ชนิด ใน 9 สกุลดังกล่าวนี้ พบว่า 16 ชนิดเป็นการรายงานครั้งแรก (first record) สำหรับประเทศไทย และมี 15 รูปแบบสัณฐานที่ไม่สามารถวินิจฉัยได้ การศึกษาครั้งนี้ได้จัดทำแนวทางสำหรับการจำแนก (key) วงศ์ย่อย สกุล และชนิด พร้อมคำบรรยายลักษณะและภาพประกอบของทุกชนิด โดยใช้ลักษณะต่างๆ ของไรเพศเมียในการวินิจฉัยสกุลและชนิด เช่นลักษณะของเส้นขน (setae) บริเวณด้านล่าง (ventral) ของไฮโปสโตม (hypostome) จำนวนปล้องและการเรียงตัวของเส้นขนบนพาลไพ (palpi) รูปร่างของทาร์ไซ (tarsi) จำนวนและลักษณะของแผ่นแข็งบนส่วนอิดิโอโซมา (idiosoma) จำนวนและความยาวของเส้นขนบริเวณด้านหลังและการเรียงตัวของเส้นขนบนปล้องขา เป็นต้น และพบไรตัวห้ำวงศ์ Cunaxidae มากที่สุดในดินและซากพืชทับถมบนพื้นดิน

ภาควิชา.....ชีววิทยา.....ลายมือชื่อนิสิต.....
สาขาวิชา.....สัตววิทยา.....ลายมือชื่ออาจารย์ที่ปรึกษา.....
ปีการศึกษา.....2546.....

4472374023 : MAJOR ZOOLOGY

KEY WORD: TAXONOMY / PREDATORY MITES / CUNAXIDAE / ACARI / THAILAND

MARUT FUANGARWORN : TAXONOMY OF THE PREDATORY MITE FAMILY CUNAXIDAE (ACARI) IN CENTRAL THAILAND. THESIS ADVISOR : ASSOCIATE PROFESSOR CHARIYA LEKPRAYOON, 210 pp. ISBN 974-17-5540-6.

The study of the predatory mite family Cunaxidae in central Thailand was conducted during October 2002 – September 2003. Four subfamilies, 9 genera and 33 species were found. The subfamily Bonziinae was represented by the genus *Neoscirula* with 2 species. Coleoscirinae was represented by 3 genera: *Coleoscirus* with 5; *Pseudobonzia* with 3 and *Scutascirus* with 1 species. Cunaxiinae was represented by 3 genera: *Armascirus* with 2; *Cunaxa* with 9 and *Dactyloscirus* with 2 species. Cunaxoidinae was represented by 2 genera: *Neocunaxoides* with 4 and *Pulaeus* with 5 species. Of the 33 recorded species, in 9 genera, 16 species were first record for Thailand and 15 unidentified species were found. Keys to subfamilies, genera and species were provided. All species were described and illustrated. Genus and species limits were based on female characters such as types of setae on ventral side of hypostome, numbers of palp segments and their chaetotaxy, shape of tarsi, numbers of dorsal setae, numbers and details of idiosomal shields, types and length of various dorsal setae, and chaetotaxy of legs. Most cunaxids species were found in soil and litter habitats.

DepartmentBiology.....

Field of studyZoology.....

Academic year2003.....

Student's signature.....*Marut Fuangarworn*.....

Advisor's signature.....*Charinya Lekprayoon*.....

ACKNOWLEDGMENTS

I express my sincere gratitude to my advisor, Associate Professor Chariya Lekprayoon, for her guidance and encouragement throughout the course of this study. Appreciation is express to the other advisory committee, Professor Dr. Siriwat Wongsiri, Associate Professor Dr. Somsak Panha, and Mrs. Watana Charanasri for their suggestion and discussions in this thesis.

I would like to thank Mrs. Watana Charanasi for the loan of specimens from the mite collection, Zoology and Entomology Division, Department of Agriculture and to Robert L. Smiley (USDA) for reviewing and verification on the description and illustration of cunaxid mites in this study.

I am grateful to Associate Professor Suthasanee Boonkong and the late Professor Dr. Pensri Tangkanasing for their excellent reprint collection and I also grateful to Drs. Alexander A. Khaustov, Jianzhen Lin, M. Mohanasundaram, Manaya Phiancharoen, Jochen Pflugfelder, Yui Sanchatjate, and Natapot Warrit for providing me additional papers about cunaxid mites.

Special thanks are due to Mr. Nuparb Srisawadi, Miss Kanchana Chantrapratad, and Mr. Mongkol Srisawadi, Mr. Surachai Leepitakrat, Miss Orawan Duangpakdee, Mr. Aslek Klakasikorn, Miss Somruk Mongkolchaichana for their helps in various aspects throughout the course of my research.

I am grateful to the scholarship awarded by the Development and Promotion of Science and Technology talents project of Thailand (DPST) for my study at Chulalongkorn University.

This work was supported by the TRF/BIOTEC Special Program for Biodiversity Researches and Training grant T_146006. Additional funds were provided from Department of Biology, Faculty of Science, and Center of Excellence in Entomology, Chulalongkorn University.

Finally, I express my sincere gratitude to my parents and grandma for their love and support. I would like to dedicate this thesis to them.

CONTENTS

| | Page |
|--|------|
| THAI ABSTRACT..... | iv |
| ENGLISH ABSTRACT..... | v |
| ACKNOWLEDGMENTS..... | vi |
| CONTENTS..... | vii |
| LIST OF TABLES..... | viii |
| LIST OF FIGURES..... | ix |
| Chapter | |
| 1 INTRODUCTION..... | 1 |
| 2 LITERATURE REVIEW..... | 3 |
| 3 MATERIALS AND METHODS..... | 12 |
| 4 RESULTS..... | 15 |
| - Key to the Subfamilies of the Cunaxidae in Central Thailand..... | 17 |
| - Subfamily Bonziinae..... | 18 |
| - Genus <i>Neoscirula</i> | 18 |
| - Subfamily Coleoscirinae..... | 28 |
| - Genus <i>Coleoscirus</i> | 29 |
| - Genus <i>Pseudobonzia</i> | 56 |
| - Genus <i>Scutascirus</i> | 69 |
| - Subfamily Cunaxiinae..... | 75 |
| - Genus <i>Armascirus</i> | 75 |
| - Genus <i>Cunaxa</i> | 86 |
| - Genus <i>Dactyloscirus</i> | 134 |
| - Subfamily of <i>Cunaxoidinae</i> | 144 |
| - Genus <i>Neocunaxoides</i> | 144 |
| - Genus <i>Pulaeus</i> | 165 |
| 5 DISCUSSION..... | 195 |
| 6 CONCLUSION AND RECOMMENDATIONS..... | 200 |
| REFERENCES..... | 201 |
| VITA..... | 210 |

LIST OF TABLES

| Table | | Page |
|--------------|---|-------------|
| 2-1 | Dorsal setal designation used by various authors for Bdellidae and Cunaxidae..... | 7 |
| 4-1 | Numbers of species belonging to the family Cunaxidae described to date (March, 2004) and number of species found in central Thailand..... | 15 |
| 4-2 | A comparison of main characters between species belonging to the genus <i>Neoscirula</i> | 24 |
| 4-3 | Variation in numbers of hysteroastral setae of <i>Coleoscirus</i> sp. 1 | 46 |
| 4-4 | A comparison of main characters between species belonging to the genus <i>Coleoscirus</i> | 55 |
| 4-5 | A comparison of main characters between species belonging to the genus <i>Pseudobonzia</i> | 69 |
| 4-6 | A comparison of main characters between species belonging to the genus <i>Armascirus</i> | 85 |
| 4-7 | A comparison of main characters between species belonging to the genus <i>Cunaxa</i> | 133 |
| 4-8 | A comparison of main characters between species belonging to the genus <i>Dactyloscirus</i> | 134 |
| 4-9 | A comparison of main characters between species belonging to the genus <i>Neocunaxoides</i> | 164 |
| 4-10 | A comparison of main characters between species belonging to the genus <i>Pulaeus</i> | 192 |
| 4-11 | Species list with habitats of cunaxid mites in central Thailand..... | 194 |

LIST OF FIGURES

| Figure | Page |
|---|------|
| 1. Dorsum of female Cunaxidae, <i>Cunaxa setirostris</i> (Hermann)..... | 8 |
| 2. Female Cunaxidae – A, venter of five-segmented palp Cunaxidae, <i>Cunaxa setirostris</i> (Hermann); B, three segmented palp; C, tip of chelicera; D, tip of tarsus. | 9 |
| 3. Collecting sites of Cunaxidae in central Thailand..... | 14 |
| 4. <i>Neoscirula ogawai</i> , female – A, dorsum; B, venter; C, chelicera; D, palp..... | 21 |
| 5. <i>Neoscirula ogawai</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 22 |
| 6. <i>Neoscirula</i> sp.1, female – A, dorsum; B, venter; C, palp; D, ventral hypostome; E, chelicera..... | 25 |
| 7. <i>Neoscirula</i> sp. 1, female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 26 |
| 8. Collecting sites of <i>Neoscirula ogawai</i> (circle), and <i>Neoscirula</i> sp.1 (triangle) in central Thailand..... | 27 |
| 9. <i>Coleoscirus bakeri</i> , female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp..... | 31 |
| 10. <i>Coleoscirus bakeri</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 32 |
| 11. Collecting sites of <i>Coleoscirus bakeri</i> in central Thailand..... | 33 |
| 12. <i>Coleoscirus simplex</i> , female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp; F, egg..... | 36 |
| 13. <i>Coleoscirus simplex</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 37 |
| 14. Collecting sites of <i>Coleoscirus simplex</i> in central Thailand..... | 38 |
| 15. <i>Coleoscirus tuberculatus</i> , female – A, dorsum; B, venter; C, chelicera; D,ventral hypostome; E, palp..... | 41 |
| 16. <i>Coleoscirus tuberculatus</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 42 |
| 17. Collecting sites of <i>Coleoscirus tuberculatus</i> in central Thailand..... | 43 |
| 18. <i>Coleoscirus</i> sp.1, female – A, dorsum; B, venter; C, chelicera; D,ventral hypostome; E, palp; F, egg. | 47 |
| 19. <i>Coleoscirus</i> sp 1, female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 48 |

LIST OF FIGURES (Cont.)

| Figure | Page |
|--|------|
| 20. Collecting sites of <i>Coleoscirus</i> sp. 1 in central Thailand..... | 49 |
| 21. <i>Coleoscirus</i> sp. 2, female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp; F, egg..... | 52 |
| 22. <i>Coleoscirus</i> sp. 2, female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 53 |
| 23. Collecting sites of <i>Coleoscirus</i> sp. 2 in central Thailand..... | 54 |
| 24. <i>Pseudobonzia clathratus</i> , female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp..... | 58 |
| 25. <i>Pseudobonzia clathratus</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 59 |
| 26. <i>Pseudobonzia gruezoi</i> , female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp..... | 62 |
| 27. <i>Pseudobonzia gruezoi</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV. | 63 |
| 28. <i>Pseudobonzia</i> sp.1, female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp..... | 66 |
| 29. <i>Pseudobonzia</i> sp. 1, female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 67 |
| 30. Collecting sites of <i>Pseudobonzia</i> sp.1 (circle), <i>P. clathratus</i> (triangle), and <i>P. gruezoi</i> (asterisk) in central Thailand... | 68 |
| 31. <i>Scutascirus pentascutellus</i> , female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp..... | 72 |
| 32. <i>Scutascirus pentascutellus</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV. | 73 |
| 33. Collecting sites of <i>Scutascirus pentascutellus</i> in central Thailand..... | 74 |
| 34. <i>Armascirus taurus</i> , female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp..... | 78 |
| 35. <i>Armascirus taurus</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 79 |
| 36. <i>Armascirus</i> sp. 1., female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp..... | 82 |
| 37. <i>Armascirus</i> sp. 1, female – A, Leg I; B, Leg II; C, Leg III; D, Leg IV... | 83 |

LIST OF FIGURES (Cont.)

| Figure | Page |
|--|------|
| 38. Collecting sites of <i>Armscirus taurus</i> (circle), and <i>Armscirus</i> sp.2 (triangle) in central Thailand..... | 84 |
| 39. <i>Cunaxa grobleri</i> , female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp..... | 89 |
| 40. <i>Cunaxa grobleri</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 90 |
| 41. Collecting sites of <i>Cunaxa grobleri</i> in central Thailand..... | 91 |
| 42. <i>Cunaxa lukoschusi</i> , female – A, dorsum; B, venter; C, palp; D, ventral hypostome; E, chelicera. | 94 |
| 43. <i>Cunaxa lukoschusi</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV... | 95 |
| 44. Collecting sites of <i>Cunaxa lukoschusi</i> in central Thailand..... | 96 |
| 45. <i>Cunaxa romblonensis</i> , female – A, dorsum; B, venter; C, ventral hypostome; D, palp; E, chelicera. | 99 |
| 46. <i>Cunaxa romblonensis</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV. | 100 |
| 47. Collecting sites of <i>Cunaxa romblonensis</i> in central Thailand..... | 101 |
| 48. <i>Cunaxa setirostris</i> , female – A, dorsum; B, venter; C, ventral hypostome; D, palp; E, chelicera..... | 105 |
| 49. <i>Cunaxa setirostris</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 106 |
| 50. Collecting sites of <i>Cunaxa setirostris</i> in central Thailand..... | 107 |
| 51. <i>Cunaxa venusae</i> , female – A, dorsum; B, venter; C, palp; D, ventral hypostome; E, chelicera. | 110 |
| 52. <i>Cunaxa venusae</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 111 |
| 53. Collecting sites of <i>Cunaxa venusae</i> in central Thailand..... | 112 |
| 54. <i>Cunaxa vizcayana</i> , female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp..... | 115 |
| 55. <i>Cunaxa vizcayana</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 116 |
| 56. Collecting sites of <i>Cunaxa vizcayana</i> in central Thailand..... | 117 |
| 57. <i>Cunaxa</i> sp. 1, female – A, dorsum; B, venter; C, chelicerae; D, palp; E, ventral hypostome..... | 120 |

LIST OF FIGURES (Cont.)

| Figure | Page |
|---|------|
| 58. <i>Cunaxa</i> sp. 1, female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 121 |
| 59. Collecting sites of <i>Cunaxa</i> sp. 1 in central Thailand..... | 122 |
| 60. <i>Cunaxa</i> sp. 2, female – A, dorsum; B, venter; C, chelicerae; D, ventral hypostome; E, palp..... | 125 |
| 61. <i>Cunaxa</i> sp. 2, female – A, leg I; B, leg II; D leg III; C, leg IV; E, tarsi I; F, tarsi II; G, tarsi III; H, tarsi IV..... | 126 |
| 62. Collecting sites of <i>Cunaxa</i> sp. 2 in central Thailand..... | 127 |
| 63. <i>Cunaxa</i> sp. 3, female – A, dorsum; B, venter; C, palp; D, ventral gnathosoma; E, chelicerae..... | 130 |
| 64. <i>Cunaxa</i> sp. 3, female – A, leg I; B, leg II; D, leg III; C, leg IV..... | 131 |
| 65. Collecting sites of <i>Cunaxa</i> sp. 3 in central Thailand..... | 132 |
| 66. <i>Dactyloscirus</i> sp. 1, female – A, dorsum; B, venter; C, palp; D, ventral hypostome; E, chelicera..... | 137 |
| 67. <i>Dactyloscirus</i> sp. 1, female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 138 |
| 68. <i>Dactyloscirus</i> sp. 2, female – A, dorsum; B, venter; C, palp; D, ventral hypostome; E, chelicera..... | 141 |
| 69. <i>Dactyloscirus</i> sp. 2, female – A, leg I; B, leg II; C, leg III; D, leg IV... | 142 |
| 70. Collecting sites of <i>Dactyloscirus</i> sp.1 (triangle), and <i>Dactyloscirus</i> sp.2 (circle) in central Thailand. | 143 |
| 71. <i>Neocunaxoides neopectinatus</i> , female – A, dorsum; B, venter; C, palp; D, ventral hypostome..... | 147 |
| 72. <i>Neocunaxoides neopectinatus</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 148 |
| 73. Collecting site of <i>Neocunaxoides neopectinatus</i> in central Thailand..... | 149 |
| 74. <i>Neocunaxoides philippinensis</i> , female – A, dorsum; B, venter; C, palp; D, ventral hypostome..... | 152 |
| 75. <i>Neocunaxoides philippinensis</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 153 |
| 76. Collecting sites of <i>Neocunaxoides philippinensis</i> in central Thailand..... | 154 |

LIST OF FIGURES (Cont.)

| Figure | Page |
|--|------|
| 77. <i>Neocunaxoides</i> sp. 1, female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp..... | 157 |
| 78. <i>Neocunaxoides</i> sp. 1, female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 158 |
| 79. <i>Neocunaxoides</i> sp. 2, female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp; F, anal region..... | 161 |
| 80. <i>Neocunaxoides</i> sp. 2, female – A, leg I; B, leg II; C, leg III; D, leg IV.... | 162 |
| 81. Collecting sites of <i>Neocunaxoides</i> sp. 1 (circle), and <i>Neocunaxoides</i> sp. 2 (triangle) in central Thailand..... | 163 |
| 82. <i>Pulaeus lenis</i> , female – A, dorsum; B, venter; C, palp; D, ventral hypostome; E, chelicera..... | 168 |
| 83. <i>Pulaeus lenis</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV. | 169 |
| 84. Collecting sites of <i>Pulaeus lenis</i> in central Thailand..... | 170 |
| 85. <i>Pulaeus villacarlosae</i> , female – A, dorsum; B, venter; C, palp; D, ventral hypostome..... | 174 |
| 86. <i>Pulaeus villacarlosae</i> , female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 175 |
| 87. Collecting sites of <i>Pulaeus villacarlosae</i> in central Thailand..... | 176 |
| 88. <i>Pulaeus</i> sp.1, female – A, dorsum; B, venter; C, chelicera; D, ventral hypostome; E, palp..... | 179 |
| 89. <i>Pulaeus</i> sp. 1, female – A, leg I; B, leg II; C, leg III; D, leg IV. | 180 |
| 90. Collecting sites of <i>Pulaeus</i> sp. 1 in central Thailand..... | 181 |
| 91. <i>Pulaeus</i> sp. 2, female – A, dorsum; B, venter; C, palp; D, ventral hypostome; E, chelicera..... | 184 |
| 92. <i>Pulaeus</i> sp. 2, female – A, leg I; B, leg II; C, leg III; D, leg IV. | 185 |
| 93. Collecting sites of <i>Pulaeus</i> sp. 2 in central Thailand..... | 186 |
| 94. <i>Pulaeus</i> sp. 3, female – A, dorsum; B, venter; C, palp; D, ventral hypostome..... | 189 |
| 95. <i>Pulaeus</i> sp. 3, female – A, leg I; B, leg II; C, leg III; D, leg IV..... | 190 |
| 96. Collecting sites of <i>Pulaeus</i> sp. 3 in central Thailand..... | 191 |