

CHAPTER 5 DISCUSSION AND CONCLUSION

5.1 Diversity and taxonomy of Odonata in Doi Suthep-Pui National Park

Previous checklist and subsequent additional records listed 126 species (58 Zygoptera and 69 Anisoptera) from Doi Suthep-Pui National Park (Hämäläinen and Pinratana, 1991, 2000; Hoess, 2002, 2007). This study provided 83 species from eleven sites with altitude ranging from 400 to 1,400 meters in Doi Suthep-Pui National Park, Chiang Mai province. Among these, eight species (3 Zygoptera and 5 Anisoptera) were reported as new records for the park. This increased the total number of odonate species in Doi Suthep-Pui National park to 134.

The eight new records were *Ceriagrion indochinense*, *Ischnura aurora aurora*, *Mortonagrion aborensense*, *Polycanthagyna erythromelas*, *Cratilla lineata calverti*, *Hylaeothemis clementia*, *Potamarcha congener*, and *Tramea transmarina euryale*. Most species are lowland species. *Hylaeothemis clementia* was the second record for Thailand after the first record from Fang (Asahina and Kitagawa, 1992). It agreed well with the description of Thai specimen (Asahina and Kitagawa, 1992) but was slightly different from the Chinese specimen (Fang *et al.*, 2009).

The highest number of species was found in Mon Tha Than waterfall where 44 species were recorded. Conversely, Mok Fa waterfall had the lowest number of species with only 12 observed species. Mon Tha Than waterfall also had the highest value of diversity index (H') and richness index (R) which was 3.364 and 6.257, respectively. In contrast, Mok Fa waterfall had the lowest value of H' and R which was 2.195 and 1.957, respectively. The value of evenness index (E) was highest in Mae Sa waterfall (0.929), whereas Pha Lad stream had the lowest value which was 0.857. This well reflected of the great diversity and environment of Mon Tha Than waterfall. As in other surveys, family Libellulidae was ranked as the most dominant family (Norma-Rashid *et al.*, 2001; Wahizatul-Afzan *et al.*, 2006).

There are 51 species in 11 families were not recorded in this study. Biotic and abiotic factors affected to this absence or shift of phenology. In eurytopic species, it may be caused by change of landscape, climate change, and human disturbance (Dingemanse and Kalkman, 2008; Orr, 2003). The area of the park is narrower than the past and some areas were changed to zoo, park, and houses. Because the stenotopic species were very stricted in distribution and the specific environment, such as, topography, stream velocity, substrate, water chemistry, water temperature, surrounding vegetations, and degree of shading (Orr, 2003), changes in this environments caused some species disappear for many years. For example, *Cryptophaea saukra* is an endemic species of Thailand and known so far from Doi Suthep mountain. It lives at well shaded montane streamlet at the altitude of 1,150-1,200 meters. There has been no any recent record of this species. The latest record was made in 1996 (Hämäläinen, 2003).

5.2 Checklist of Odonata in Doi Suthep-Pui National Park

A total of 134 species have been recorded in Doi Suthep-Pui National Park. The list divided into Zygoptera and Anisoptera, respectively. Within each suborder, families, genera and species are arranged in alphabetic order.

SUBORDER ZYGOPTERA

Family Calopterygidae Selys, 1850

1. *Caliphaea thailandica* Asahina, 1976
2. *Matrona nigripectus* Selys, 1879
3. *Mnais andersoni* McLachlan in Selys, 1873
4. *Neurobasis chinensis* (Linnaeus, 1758)
5. *Noguchiphaea yoshikoae* Asahina, 1976
6. *Vestalaria smaragdina* (Selys, 1879)
7. *Vestalis gracilis* (Rambur, 1842)

Family Chlorocyphidae Cowley, 1937

8. *Aristocypha fenestrella* (Rambur, 1842)
9. *Heliocypha biforata* (Selys, 1859)
10. *Heliocypha perforata limbata* (Selys, 1879)
11. *Libellago lineata* (Burmeister, 1839)

Family Chlorolestidae Fraser, 1960

12. *Megalestes kurahashii* Asahina, 1985

Family Coenagrionidae Kirby, 1890

13. *Aciagrion pallidum* Selys, 1891
14. *Agriocnemis femina femina* (Brauer, 1868)
15. *Agriocnemis lacteola* Selys, 1877
16. *Agriocnemis nana* (Laidlaw, 1914)
17. *Agriocnemis pygmaea* (Rambur, 1842)
18. *Agriocnemis rubescens rubeola* Selys, 1877
19. *Ceriagrion azureum* (Selys, 1891)
20. *Ceriagrion chaoi* Schmidt, 1964
21. *Ceriagrion fallax pendleburyi* Laidlaw, 1931
22. *Ceriagrion indochinense* Asahina, 1967
23. *Ceriagrion malaisei* Schmidt, 1964
24. *Ceriagrion praetermissum* Lieftinck, 1929
25. *Ischnura aurora aurora* (Brauer, 1865)
26. *Ischnura senegalensis* (Rambur, 1842)
27. *Mortonagrion aborense* (Laidlaw, 1914)
28. *Onychargia atrocyana* (Selys, 1865)
29. *Pseudagrion australasiae* Selys, 1876
30. *Pseudagrion microcephalum* (Rambur, 1842)
31. *Pseudagrion pruinosum* (Burmeister, 1839)
32. *Pseudagrion rubriceps rubriceps* Selys, 1876

Family Euphaeidae Selys, 1853

33. *Anisopleura furcata* Selys, 1891
34. *Cryptophaea saukra* Hämäläinen, 2003
35. *Euphaea masoni* Selys, 1879
36. *Euphaea ochracea* Selys, 1859

Family Lestidae Calvert, 1901

37. *Lestes elata* Hagen in Selys, 1862
38. *Lestes platystyla* Rambur, 1842
39. *Orolestes octomaculata* Martin, 1902

Family Megapodagrionidae Tillyard, 1917

40. *Burmargiolestes melanothorax* (Selys, 1891)
41. *Rhinagrion mima* (Karsch, 1891)

Family Philogangidae Kennedy, 1925

42. *Philoganga loringae* Fraser, 1927

Family Platycnemididae Tillyard, 1917

43. *Calicnemia erythromelas* (Selys, 1891)
44. *Calicnemia imitans* Lieftinck, 1948
45. *Calicnemia miles* (Laidlaw, 1917)
46. *Coeliccia chromothorax* (Selys, 1891)
47. *Coeliccia didyma didyma* (Selys, 1863)
48. *Coeliccia doisuthepensis* Asahina, 1984
49. *Coeliccia loogali* Laidlaw, 1932
50. *Coeliccia poungyi* Fraser, 1924
51. *Copera ciliata* (Selys, 1863)
52. *Copera marginipes* (Rambur, 1842)
53. *Copera vittata* (Selys, 1863)

Family Platystictidae Tillyard & Fraser, 1938

54. *Drepanosticta anasephala* Fraser, 1933
55. *Protosticta curiosa* Fraser, 1934
56. *Protosticta grandis* Asahina, 1985
57. *Protosticta khaosoidaoensis* Asahina, 1984

Family Protoneuridae Tillyard, 1917

58. *Prodasineura auricolor* (Fraser, 1927)
59. *Prodasineura autumnalis* (Fraser, 1922)
60. *Prodasineura doisuthepensis* Hoess, 2007
61. *Prodasineura* sp. [nec. *verticalis* Selys, 1860]

SUBORDER ANISOPTERA

Family Aeshnidae Rambur, 1842

62. *Anax guttatus* (Burmeister, 1839)
63. *Anax immaculifrons* Rambur, 1842
64. *Anax indicus* Lieftinck, 1942
65. *Gynacantha subinterrupta* Rambur, 1842
66. *Heliaeschna uninervulata* Martin, 1909
67. *Planaeschna intersedens* (Martin, 1909)
68. *Polycanthagyna erythromelas* (McLachlan, 1896)
69. *Tetracanthagyna waterhousei* McLachlan, 1898

Family Chlorogomphidae Tillyard, 1917

70. *Chlorogomphus arooni* Asahina, 1981

Family Corduliidae Kirby, 1890

71. *Epophthalmia frontalis frontalis* Selys, 1871
72. *Idionyx selysi* Fraser, 1926
73. *Idionyx* sp. 1 [nec. *optata* Selys, 1878]
74. *Idionyx* sp. 2
75. *Macromia cupricincta* Fraser, 1924
76. *Macromia moorei malayana* Laidlaw, 1928
77. *Macromia* sp. 1
78. *Macromia* sp. 2
79. *Macromidia genialis shanensis* Laidlaw, 1923

Family Gomphidae Rambur, 1842

80. *Amphigomphus somnuki* Hämäläinen, 1996
81. *Anisogomphus* sp.
82. *Asiagomphus xanthenatus xanthenatus* (Williamson, 1907)
83. *Burmagomphus divaricatus* Lieftinck, 1964
84. *Burmagomphus williamsoni williamsoni* Förster, 1914
85. *Gomphidictinus perakensis* (Laidlaw, 1902)
86. *Heliogomphus selysi* Fraser, 1925
87. *Heliogomphus* sp.
88. *Ictinogomphus decoratus melaenops* (Selys, 1858)
89. *Leptogomphus gestroi* Selys, 1891
90. *Macrogomphus matsukii* Asahina, 1986
91. *Onychogomphus duaricus* Fraser, 1924
92. *Orientogomphus minor* Laidlaw, 1931
93. *Paragomphus capricornis* (Förster, 1914)
94. *Phaenandrogomphus asthenes* Lieftinck, 1964

Family Libellulidae Rambur, 1842

95. *Aethriamanta aethra* Ris, 1912
96. *Aethriamanta brevipennis* (Rambur, 1842)
97. *Brachydiplax chalybea chalybea* Brauer, 1868

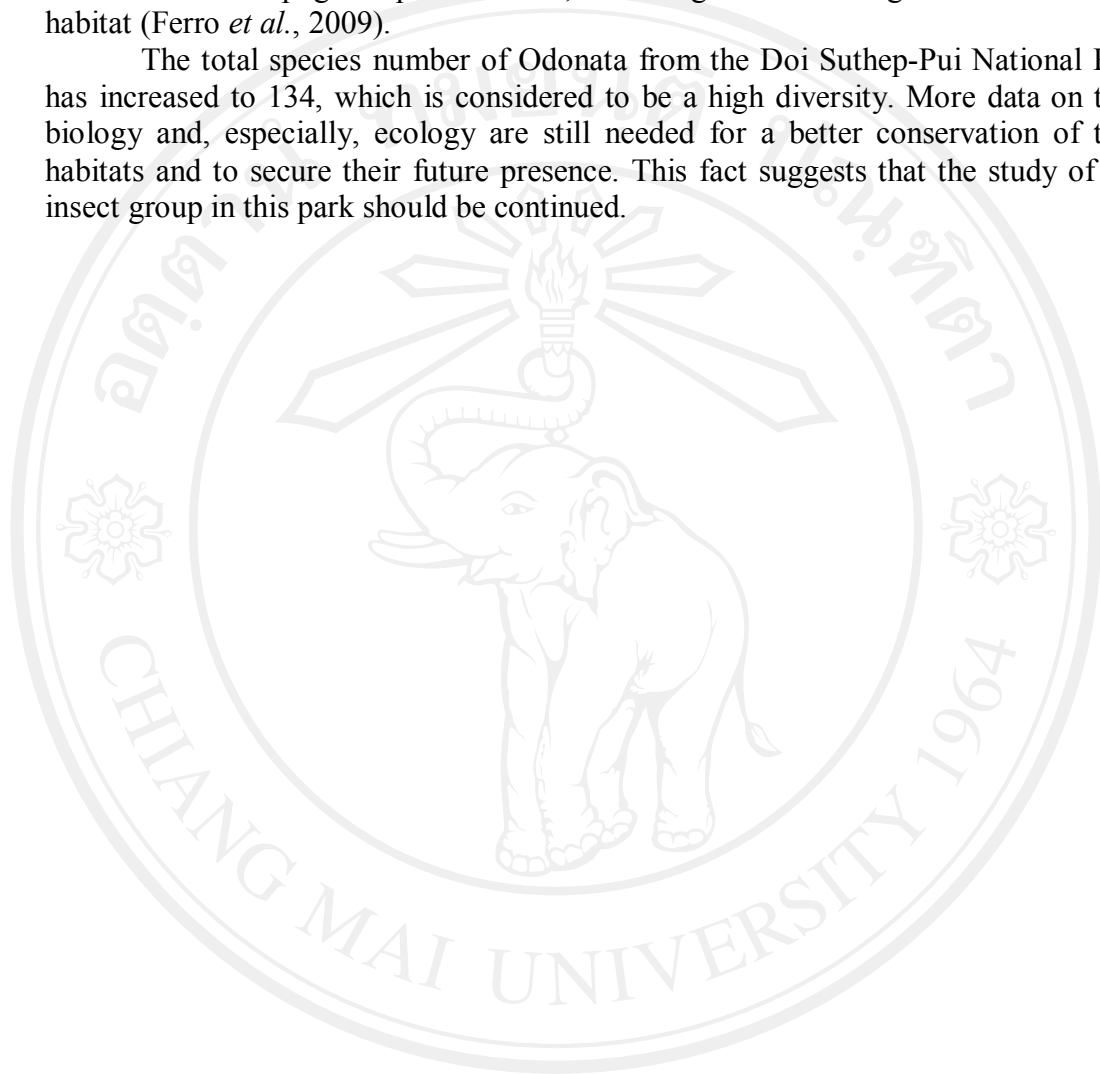
98. *Brachydiplax farinosa* Krüger, 1902
99. *Brachydiplax sobrina* (Rambur, 1842)
100. *Brachythemis contaminata* (Fabricius, 1793)
101. *Camacinia gigantea* (Brauer, 1867)
102. *Cratilla lineata calverti* Förster, 1903
103. *Crocothemis servilia servilia* (Drury, 1770)
104. *Diplacodes trivialis* (Rambur, 1842)
105. *Hydrobasileus croceus* (Brauer, 1867)
106. *Hylaeothemis clementia* Ris, 1909
107. *Indothemis carnatica* (Fabricius, 1798)
108. *Neurothemis fulvia* (Drury, 1773)
109. *Neurothemis intermedia atalanta* Ris, 1919
110. *Neurothemis tullia tullia* (Drury, 1773)
111. *Onychothemis testacea testacea* Laidlaw, 1902
112. *Orthetrum chrysis* (Selys, 1891)
113. *Orthetrum glaucum* (Brauer, 1865)
114. *Orthetrum japonicum internum* McLachlan, 1894
115. *Orthetrum luzonicum* (Brauer, 1868)
116. *Orthetrum pruinosum neglectum* (Rambur, 1842)
117. *Orthetrum sabina sabina* (Drury, 1770)
118. *Orthetrum triangulare triangulare* (Selys, 1878)
119. *Pantala flavescens* (Fabricius, 1798)
120. *Potamarcha congener* (Rambur, 1842)
121. *Pseudothemis jorina* Förster, 1904
122. *Rhodothemis rufa* (Rambur, 1842)
123. *Rhyothemis phyllis phyllis* (Sulzer, 1776)
124. *Rhyothemis plutonia* Selys, 1883
125. *Rhyothemis triangularis* Kirby, 1889
126. *Rhyothemis variegata variegata* (Linnaeus, 1763)
127. *Tetrathemis platyptera* Selys, 1878
128. *Tholymis tillarga* (Fabricius, 1798)
129. *Tramea transmarina euryale* Selys, 1878
130. *Trithemis aurora* (Burmeister, 1839)
131. *Trithemis festiva* (Rambur, 1842)
132. *Trithemis pallidinervis* (Kirby, 1889)
133. *Urothemis signata* (Rambur, 1842)
134. *Zygonyx iris malayana* Laidlaw, 1902

5.3 Future research on Odonata in Thailand

Dragonflies and damselflies have shown to be useful for nature conservation and environment management and are often used as indicators of environment health (Clausnitzer *et al.*, 2009; Eak-Amnuay, 1996; Ferro *et al.*, 2009; Kalkman *et al.*, 2008; Ratanabhumma, 2007). Although they are less sensitive to water quality than some other aquatic insects, their conspicuousness makes them valuable for rapid assessment of water quality (Tang *et al.*, 2010). Recently, Odonata is the first insect order used in a global assessment of biodiversity loss (Clausnitzer *et al.*, 2009). This shows the

importance of Odonata to environment and human both in direct and indirect ways. Therefore, the accurate data on taxonomy and distribution are very important for evaluation, conservation, roles in the community, range expansion or contraction, and reaction to anthropogenic perturbations, including climate change and alteration of habitat (Ferro *et al.*, 2009).

The total species number of Odonata from the Doi Suthep-Pui National Park has increased to 134, which is considered to be a high diversity. More data on their biology and, especially, ecology are still needed for a better conservation of their habitats and to secure their future presence. This fact suggests that the study of this insect group in this park should be continued.



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

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