**Table S1:** List of sample information of the mitogenomes of 65 published moth species of Lepidoptera;

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| --- | --- | --- | --- | --- |
| No. | Superfamily | Family | Species | Accession no. |
| 1 | Bombycoidea | Saturniidae | *Antheraea pernyi* | NC\_004622 |
| 2 | Saturniidae | *Antheraea yamamai* | NC\_012739 |
| 3 | Saturniidae | *Actias selene* | NC\_018133 |
| 4 | Saturniidae | *Samia cynthia* | NC\_017869 |
| 5 | Saturniidae | *Samia canningi* | NC\_024270 |
| 6 | Saturniidae | *Neoris haraldi* | NC\_036765 |
| 7 | Sphingidae | *Macroglossum stellatarum* | NC\_037441 |
| 8 | Sphingidae | *Manduca sexta* | NC\_010266 |
| 9 | Sphingidae | *Ampelophaga rubiginosa* | KT153024 |
| 10 | Bombycidae | *Bombyx mori* | NC\_002355 |
| 11 | Bombycidae | *Bombyx mandarina* | NC\_003395 |
| 12 | Lasiocampoidea | Lasiocampidae | *Dendrolimus houi* | NC\_039840 |
| 13 | Lasiocampidae | *Dendrolimus punctatus* | MK886799 |
| 14 | Lasiocampidae | *Dendrolimus tabulaeformis* | KJ913817 |
| 15 | Lasiocampidae | *Dendrolimus kikuchii* | NC\_036347 |
| 16 | Noctuoidea | Lymantriidae | *Gynaephora jiuzhiensis* | NC\_036738 |
| 17 | Lymantriidae | *Lymantria diapar* | NC\_012893 |
| 18 | Lymantriidae | *Euproctis similes* | NC\_035886 |
| 19 | Lymantriidae | *Gynaephora aureata* | NC\_029162 |
| 20 | Noctuidae | *Agrotis ipsilon* | KF163965 |
| 21 | Noctuidae | *Spodoptera frugiperda* | KM362176 |
| 22 | Noctuidae | *Spodoptera litura* | KF701043 |
| 23 | Notodontidae | *Phalera flavescens* | NC\_016067 |
| 24 | Notodontidae | *Clostera anachoreta* | NC\_034740 |
| 25 | Geometroidea | Geometridae | *Ectropis obliqua* | NC\_036717 |
| 26 | Geometridae | *Abraxas suspecta* | NC\_034804 |
| 27 | Pyraloidea | Crambidae | *Omiodes indicata* | NC\_039177 |
| 28 | Crambidae | *Dichocrocis punctiferalis* | NC\_021389 |
| 29 | Crambidae | *Diatraea saccharalis* | NC\_013274 |
| 30 | Crambidae | *Chilo suppressalis* | NC\_015612 |
| 31 | Pyralidae | *Galleria mellonella* | NC\_028532 |
| 32 | Pyralidae | *Ephestia elutella* | NC\_039716 |
| 33 | Gelechioidea | Gelechiidae | *Dichomeris ustalella* | NC\_029810 |
| 34 | Gelechiidae | *Sitotroga cerealella* | NC\_041123 |
| 35 | Zygaenoidea | Zygaenidae | *Histia rhodope* | PQ221018 |
| 36 | Zygaenidae | *Eterusia aedea* | NC\_038208 |
| 37 | Zygaenidae | *Pidorus atratus* | NC\_037909 |
| 38 | Zygaenidae | *Erasmia pulchella* | NC\_072611 |
| 39 | Zygaenidae | *Amesia sanguiflua* | NC\_046467 |
| 40 | Zygaenidae | *Rhodopsona rubiginosa* | NC\_025761 |
| 41 | Limacodidae | *Parasa consocia* | NC\_034993 |
| 42 | Limacodidae | *Monema flavescens* | NC\_032683 |
| 43 | Limacodidae | *Narosa fulgens* | OP919326 |
| 44 | Limacodidae | *Thosea sinensis* | NC\_061059 |
| 45 | Cossoidea | Metarbelidae | *Zeuzera multistrigata* | MF\_491642 |
| 46 | Cossidae | *Eogystia hippophaecolus* | NC\_023936 |
| 47 | Thyridoidea | Thyrididae | *Pyrinioides aurea* | NC\_028548 |
| 48 | Thyrididae | *Glanycus foochowensis* | MH332775 |
| 49 | Hesperioidea | Hepialidae | *Thitarodes pui* | NC\_023530 |
| 50 | Hepialidae | *Thitarodes renzhiensis* | NC\_018094 |
| 51 | Hepialidae | *Napialus hunanensis* | NC\_024424 |
| 52 | Hepialidae | *Ahamus yunnanensis* | NC\_018095 |
| 53 | Yponomeutoidea | Yponomeutidae | *Prays oleae* | NC\_025948 |
| 54 | Lyonetiidae | *Leucoptera malifoliella* | NC\_018547 |
| 55 | Plutellidae | *Plutella xylostella* | NC\_025322 |
| 56 | Plutellidae | *Plutella australiana* | NC\_039687 |
| 57 | Tortricoidea | Tortricidae | *Adoxophyes honmai* | NC\_008141 |
| 58 | Tortricidae | *Adoxophyes orana* | NC\_021396 |
| 59 | Tortricidae | *Choristoneura longicellana* | NC\_019996 |
| 60 | Tortricidae | *Acleris fimbriana* | NC\_018754 |
| 61 | Tortricidae | *Grapholita molesta* | NC\_014806 |
| 62 | Tortricidae | *Cydia pomonella* | NC\_020003 |
| 63 | Tortricidae | *Spilonota lechriapis* | NC\_014294 |
| 64 | Papilionoidea (outgroup) | Papilionidae | *Papilio slateri* | NC\_037874 |
| 65 | Papilionidae | *Luehdorfia chinensis* | NC\_027672 |

Note: different colors indicate different family.