Two new species of *Tetrastigma* (Miq.) Planch. (Vitaceae) from Thailand

Phongsakorn KOCHAIPHAT¹, Anna TRIAS-BLASI² & Pimwadee PORNPONGRUNGRUENG³,*

¹,³ Applied Taxonomic Research Center, Department of Biology, Faculty of Science, Khon Kaen University, Khon Kaen 40002, Thailand.
² Royal Botanic Gardens Kew, Richmond, Surrey TW9 3AE, England, U.K.

* Corresponding author: ppimwa@kku.ac.th
  ¹ Email: phongsakorn.s@gmail.com
  ² Email: a.triasblas@kew.org

Abstract. Two new species of *Tetrastigma* from Thailand, *T. calcicola* Kochaiph. & Trias-Blasi sp. nov. and *T. jaichagunii* C.L.Li ex Kochaiph. & Trias-Blasi sp. nov. are described and illustrated. *Tetrastigma calcicola* sp. nov. is a slender climber restricted to the open areas on limestone mountains at high elevation in the northern part of Thailand. The other species, *T. jaichagunii* sp. nov., is similar to *T. harmandii* Planch., but differs from it by having more densely verrucose young branches, broader leaflets, 4-lobed thick discs, bigger globose berries and oblongoid seeds. This species occurs along streams or in forest margins in evergreen forest and it is widely distributed in several parts of Thailand.

Keywords. *Tetrastigma*, taxonomy, Thailand, revision, Vitaceae.

Introduction

*Tetrastigma* Planch. (Vitaceae) is a genus comprising approximately 95 species, distributed in tropical and subtropical Asia with a few of them reaching Australia (Planchon 1887; Latiff 1983; Chen *et al.* 2011; Trias-Blasi *et al.* 2012; Wen 2007). It can be easily distinguished from other genera of Vitaceae by its polygamo-dioecy, 4-merous flowers, 4-lobed or 4-parted stigma, and absent or very short styles. Twenty-six species have been recorded in Thailand (Kochaiphat *et al.* 2014), of which five are endemic.

During preparation of the revision of *Tetrastigma* for the Flora of Thailand account, the first author came across several specimens collected from Doi Tung and Tham Luang Khun Nam Nang Non Forest Park (Chiang Rai province) with a unique combination of characters that did not match any previously described species.

In addition, a number of specimens representing a distinct taxon were found. Some were annotated as *Tetrastigma jaichagunii* by the late Prof. C.L. Li, however, no formal description had been published...
for this name. Therefore, this species is described here as new species and the name *T. jaichagunii* is applied.

**Material and methods**

This study is based on the investigation of the herbarium specimens from relevant major herbaria as well as field collections and observations in Thailand. Herbarium specimens from the following herbaria were examined: AAU, ABD, BCU, BK, BKF, BM, C, CMU, CMUB, E, K, KLU, L, P, PSU, QBG and TCD. The herbarium abbreviations follow Thiers (continuously updated). Voucher specimens collected from field surveys were made following the method of Bridson & Forman (1989) and were deposited at KLU, BKF and QBG. The vegetative parts were measured in a dry state. Reproductive parts were rehydrated by boiling in water. Measurements were made under light microscope. The morphological terminology generally follows Beentje (2010), Wen (2007) and Jackes (1989); and for berry and seed terminology follows Latiff (1983) and Chen & Manchester (2011).

**Taxonomy**

Class Equisitopsida C.Agardh (Agardh *et al.* 1825)  
Subclass Magnoliidae Novák ex Takht. (Takhtajan 1967)  
Superorder Rosanae Takht. (Takhtajan 1967)  
Order Vitales Juss. ex Bercht. & J.Presl (Berchtold & Presl 1820)  
Family Vitaceae Juss. (Jussieu 1789) nom. cons.  
Genus *Tetrastigma* (Miq.) Planch. (Planchon 1887)  

Two *Tetrastigma* from Thailand, *T. calcicola* sp. nov. and *T. jaichagunii* sp. nov., are described herein as new species. Accordingly, the key to *Tetrastigma* in Thailand (Kochaiphat *et al.* 2014) has been revised from couplet 16 as follows.

**Key to the species of *Tetrastigma* in Thailand**

1. Tendrils 5–7 palmately branched; leaves palmately 3-foliolate ......... *T. triphyllum* (Gagnep.) W.T.Wang  
   – Tendrils simple or bifurcate; leaves simple, palmately 3–5(–7)-foliolate or pedately 5–7(–9)-foliolate ................................................................. 2

2. Inflorescences on old stems (cauliflorous plants), more than 5 inflorescences per nodes ............................ *T. cauliﬂorum* Merr.  
   – Inflorescences on young branches, 1–3 inflorescences per nodes ...................................................... 3

3. Young branches with 4–5 sharp ridges ...................................... *T. quadrangulum* Gagnep. & Craib  
   – Young branches round or nearly round ........................................................................................ ...... 4

4. Leaves palmately 3–5(–7)-foliolate or mixed with simple leaves or all leaves simple ............ 5  
   – Leaves pedately 5–7(–9)-foliolate rarely mixed with 3-foliolate ......................................................... 16

5. Stems verrucose or with corky protuberances ................................................................. 6  
   – Stems smooth, pubescent or with flaky cork ............................................................................. 8

6. Stems with corky protuberances; leaves ovate to elliptic; stigma distinctly 4-lobed ............... 7  
   – Stems verrucose; leaves lanceolate; stigma peltate ................................................................. *T. harmandii* Planch.

7. Leaves fleshy; stigma cruciform; berries ellipsoid when dry ............ *T. cruciatum* Craib & Gagnep.  
   – Leaves coriaceous or papyraceous; stigma pointed lobes; berries pyriform when dry .................. ........................................................................ *T. assimile* (Kurz) C.L.Li ex Kochaiph. & Trias-Blasi
KOCHAIPHAT P. et al., New species of *Tetrastigma* from Thailand

8. Shrubs, creeping, erect or decumbent ................................................................. 9
   – Lianas ........................................................................................................... 10

9. Leaves simple or mixed with palmately 3(−5)-foliolate; pedicel 0.4–0.6 cm long .......................................................... *T. bambusetorum* Craib
   – Leaves palmately 3-foliolate; pedicel 0.8–1.2 cm long .......................... *T. apiculatum* Gagnep.

10. Leaflets glabrous .......................................................................................... 11
    – Leaflets pubescent or hirsute at least along the midrib on lower leaf surface .......... 15

11. Female flower disc conspicuous, thick and adnate to lower part of ovary .............. 12
    – Female flower disc inconspicuous ............................................................. 14

12. Terminal leaflets broadly elliptic to rhombic; berries pyriform when dry ......................................................... *T. pedunculare* (Wall. ex M.A.Lawson) Planch.
    – Terminal leaflets elliptic, ovovalate or lanceolate; berries ellipsoid when dry .......... 13

13. Leaves coriaceous or subcoriaceous ............................................................... *T. erubescens* Planch.

14. Leaflets broadly ovate or broadly elliptic, apex caudate ..................... *T. campylocarpum* (Kurz) Planch.
    – Leaflets lanceolate, apex attenuate .............................................. *T. planicaule* (Hook.f.) Gagnep.

15. Ovary brownish hirsute; leaves palmately 5-foliolate ............... *T. obovatum* (M.A.Lawson) Gagnep.
    – Ovary glabrous; leaves palmately 3-foliolate .................................... *T. dubium* (M.A.Lawson) Planch.

16. Leaves 5-foliolate, rarely mixed with 7-foliolate ................................................. 17
    – Leaves 7(−9)-foliolate, rarely mixed with 5-foliolate .............................. 29

17. Branches glabrous; leaflets glabrous on both surfaces ................................. 18
    – Branches more or less pubescent; leaflets pubescent at least along the midvein on lower leaf surface ......................................................... 26

18. Secondary branches of peduncle 2 .................................................... *T. baenzigeri* C.L.Li
    – Secondary branches of peduncle more than 2 ........................................ 19

19. Berries pyriform or triangular when dry ...................................................... 20
    – Berries globose, ovoid or ellipsoid when dry ........................................ 21

20. Terminal leaflets ovo-v lanceolate, 3–4 × 6–9 cm; berries pyriform when dry ... *T. pyriforme* Gagnep.
    – Terminal leaflets obovate or elliptic, 4–5.5 × 9–12 cm; berries triangular when dry ......................................................... *T. rumicispermum* (M.A.Lawson) Planch.

21. Inflorescences compound umbel on pseudo-terminal branch or axile, umbelliform, loose; tendrils bifurcate ......................................................... *T. serrulatum* (Roxb.) Planch.
    – Inflorescences compound umbel on axile, globose, compact; tendrils unbranched .......... 22

22. Female flower disc inconspicuous ................................................................. *T. pachyphyllum* (Hemsl.) Chun
    – Female flower disc conspicuous, thick and adnate to lower part of ovary .............. 23

23. Stigma peltate, rounded or slightly 4-lobed ..................................................... 24
    – Stigma cruciform, 4-lobed, obtuse, acute or pointed apex ................................ 25
24. Berries 1.8–3.0 × 1.5–2.5 cm; seed oblongoid; female flower disc 4-angled ...........................................<br>............................................................................................................... T. jaichagunii C.L.Li ex Kochaiph. & Trias-Blasi sp. nov.<br>– Berries 0.8–1.2 × 0.8–1.2 cm; seed ellipsoid; female flower disc rounded ........... T. harmandii Planch.

25. Stigmas 4 acute or pointed lobes, style tubular 0.5–0.8 mm long ... T. dubium (M.A.Lawson) Planch.<br>– Stigmas 4 obtuse lobes, style absent ....................... T. calcicola Kochaiph. & Trias-Blasi sp. nov.

26. Leaflets broadly elliptic or ovate ..................................................................................................... 27<br>– Leaflets narrowly elliptic or lanceolate ......................................................... T. dubium (M.A.Lawson) Planch.

27. Leaflets pubescent along nerve or at least along the midrib on the lower surface ....................... 28<br>– Leaflets pubescent on both surfaces ........................................ T. macrocorymbum Gagnep. ex J.Wen

28. Berries up to 1.5 cm in diameter .......................................................... T. pilosum C.L.Li<br>– Berries more than 2 cm in diameter .......................................................... T. siamense Gagnep. & Craib

29. Berries 2–2.5 cm in diameter .......................................................... T. teaniatum C.L.Li<br>– Berries 0.8–1.5 cm in diameter ..................................................................................... 30

30. Outer petals densely papillose ........................................ T. leucostaphylum (Dennst.) Alston ex Mabb.<br>– Outer petals glabrous ........................................................................................................ 31

31. Secondary vein almost 90° with midrib; old branches verrucose, light brown; stigma 4 pointed lobes ................................................................. T. delavayi Gagnep.<br>– Secondary vein angle nearly 45° with midrib; old branches flaky, grey; stigma 4 rounded lobes or nearly globose, not lobed ............................................. T. godefroyanum Planch.

**Tetrastigma calcicola** Kochaiph. & Trias-Blasi sp. nov.<br>Table 1, Figs 1–2

Diagnosis<br><br>*Tetrastigma calcicola* sp. nov. is most closely aligned to *T. pachyphyllum* (Hemsl.) Chun, but differs in having a 4-lobed disc adnate to the lower part of the ovary, and small berries with a smooth surface (Table 1).

Etymology<br><br>The specific epithet refers to the habitat of this species, which is only found on limestone mountains.

Type materials<br><br>**Holotype**<br>THAILAND: Chiang Rai, Tham Luang Khun Nam Nang Non Forest Park, 21 Mar. 2011, *M. Norsaengsri & N. Tathana 7810*, ♀ fl. (holo-: QBG!).

Table 1. Main morphological differences between *T. calcicola* Kochaiph. & Trias-Blasi sp. nov. and *T. pachyphyllum* (Hemsl.) Chun.

<table>
<thead>
<tr>
<th>Characters</th>
<th><em>T. calcicola</em> Kochaiph. &amp; Trias-Blasi sp. nov.</th>
<th><em>T. pachyphyllum</em> (Hemsl.) Chun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female flowers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedicels length</td>
<td>0.5–1.0 mm</td>
<td>2.0–3.0 mm</td>
</tr>
<tr>
<td>Petals size</td>
<td>1.5–1.8 × 0.8 mm</td>
<td>2.5–3.0 × 1.2–1.7 mm</td>
</tr>
<tr>
<td>Disc</td>
<td>4-lobed adnate to lower part of ovary</td>
<td>inconspicuous</td>
</tr>
<tr>
<td>Berries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td>globose to ellipsoid</td>
<td>globose</td>
</tr>
<tr>
<td>Size</td>
<td>0.8–1.0 × 0.7–0.8 cm</td>
<td>1.4–1.7 × 1.4–1.8 cm</td>
</tr>
<tr>
<td>Surface</td>
<td>smooth</td>
<td>coarse</td>
</tr>
<tr>
<td>Berries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>0.7–0.8 × 0.4–0.5 cm</td>
<td>0.9 × 0.5–0.7 cm</td>
</tr>
<tr>
<td>Endosperm shape in cross-section</td>
<td>[M]</td>
<td>[M]</td>
</tr>
</tbody>
</table>

**Description**

Slender climber. Stems terete, young branches terete, verrucose; mature stems corky; tendrils simple; stipules 2, deltate, c. 0.2 × 0.2 cm long, scale-like with age. Leaves compound, 3-foliolate or pedately 5-foliolate; petiole 0.8–5.0 cm long, glabrous, base slightly pulvinate; leaflets coriaceous; terminal leaflet petiolule 0.2–2.0 cm long, glabrous, terminal leaflet blade elliptic, obovate to oblanceolate, 2.0–8.0 × 1.0–3.5 cm, base cuneate, margins serrate with minute protruding vein tip, apex acute to acuminate, petiolules of lateral leaflet complex 0.1–1.0 cm long, glabrous, lateral leaflet petiolar, sessile to 0.6 cm long, glabrous, lateral leaflet blade elliptic, obovate to oblanceolate, 1.0–5.5 × 0.5–2.8 cm, base cuneate or asymmetrical, margins and apex as for terminal leaflet; veins conspicuous on lower sides, midrib protruding on both surfaces, glabrous, 1 main basal vein, 4–7 pairs of lateral veins. Inflorescences axillary on young stem, 1–2 per node, compound umbel, male plant not seen; female plant 1.0–2.5 cm in diameter, compact, glabrous; peduncles 0.3–1.0 cm, rarely puberulous. Female flowers' bud ovoid, 1.0–1.5 mm long; pedicels 0.5–1.0 mm long, papillose; calyx disciform, margins entire, papillose; petals ovate, 1.5–1.8 × 0.8 mm, apex slightly corniculate, outer surface densely papillose, margins entire; disc 4-lobed adnate to lower part of ovary; staminode clavate, c. 1.2 mm long; ovary conical, c. 0.8 × 0.8 mm; style sessile; stigma cruciform, 4-lobed, lobes obtuse, ciliate. Berries globose to ellipsoid, 0.8–1.0 × 0.7–0.8 cm, surface smooth, yellow or white when ripe, 1–3-seeded. Seeds ellipsoid, 0.7–0.8 × 0.4–0.5 cm, testa transversely rugulose on both sides, adaxial surface with a Y shaped furrow, abaxial surface with an oblong chalaza, endosperm ' [M] ' shaped in cross-section.

**Distribution**

Known only from Thailand (Fig. 2).

**Ecology and phenology**

In open area on limestone mountain, dry evergreen forest, altitude 1,300–1,450 m; flowering: February–March; fruiting: July–October.
Fig. 2. Distribution of *Tetrastigma calcicola* Kochaiph. & Trias-Blasi sp. nov. (■) and *T. jaichagunii* C.L.Li ex Kochaiph. & Trias-Blasi sp. nov. (●).
Conservation status
We suggest to treat this species as Data Deficient (DD) according to IUCN (2012), as this species is only known from a few herbarium specimens and only two localities have been recorded: Doi Tung and Tham Luang Khun Nam Nang Non Forest Park in Chiang Rai Province. Although the species seems to occur only in limestone mountains at high elevation, the number of populations and their sizes are not known so far.

Tetrastigma jaichagunii C.L.Li ex Kochaiph. & Trias-Blasi sp. nov.

Table 2, Figs 2–3
urn:lsid:ipni.org:names:77155116-1

Diagnosis
This species is similar to *T. harmandii* Planch., but differs from it by having more densely verrucose young branches, broader leaflets, 4-lobed thick discs, bigger globose berries and oblongoid seeds (Table 2). Some specimens were misidentified as *T. hookeri* Planch., an Indian species, but *T. hookeri* has narrow leaves and an inconspicuous disc in female flowers.

Etymology
We think that Prof. C.L. Li selected the specific epithet ‘Jaichagunii’ in honour of Mr Manit Jaichagun, from the CITES Scientific Authority in Thailand.

Type materials

Holotype
THAILAND. Trang, Khao Chong, 12 Mar. 1974, K. Larsen & S.S. Larsen 33238, ♀ fl. (holo-: AAU!, iso-: BKF!, L!, P!).

Paratypes

Description
Large climber. Stems flattened with age, young branches terete, verrucose; mature stems corky; tendrils simple; stipules 2, deltate, c. 0.4 × 0.3 cm, reduced to scale-like with age. Leaves compound, 3-foliolate or pedately 5(–7)-foliolate; petioles 4.0–19.0 cm long, verrucose, base pulvinate; leaflets papyraceous to subcoriaceous; terminal leaflet petiolule, 1–5.0 cm long, glabrous, terminal leaflet blade lanceolate, elliptic, to oblanceolate, 11.5–33.0 × 3.5–12.0 cm, base obtuse to cuneate, margins coarsely serrate with c. 0.5 protruding vein tip, apex acuminate to caudate, petiolules of lateral leaflet complex 1.0–3.5 cm long, glabrous, lateral leaflet petiolules, sessile–2.5 cm long, glabrous, lateral leaflet blade lanceolate, elliptic to broadly elliptic, oblong, 8.5–30 × 2.5–11.5 cm, base obtuse to cuneate or asymmetrical, margins and apex as terminal leaflet; veins conspicuous on lower sides, midrib protruding on both surfaces, glabrous, 1 main basal vein, 6–13 pairs of lateral veins. Inflorescences axillary on young stem, single, compound umbel; 2–3 cm in diameter, compact, umbelliform; peduncles 0.5–1.0 cm, puberulent, male plant not seen. Male flowers not seen. Female flowers’ bud ovoid, 2.0–3.0 mm long; pedicels 2.0–3.0 mm long, papillose; calyx disciform to cupuliform, margins undulate, ciliate; petals ovate to oblong, 2.2–3.0 ×
Table 2. Main morphological differences between *T. jaichagunii* C.L.Li ex Kochaiph. & Trias-Blasi sp. nov. and *T. harmandii* Planch.

<table>
<thead>
<tr>
<th>Characters</th>
<th><em>T. jaichagunii</em> C.L.Li ex Kochaiph. &amp; Trias-Blasi sp. nov.</th>
<th><em>T. harmandii</em> Planch.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female flowers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petals shape</td>
<td>ovate to oblong</td>
<td>ovate</td>
</tr>
<tr>
<td>Disc</td>
<td>thick, 4-angled</td>
<td>thick, rounded</td>
</tr>
<tr>
<td>Berries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>1.8–3.0 × 1.5–2.5 cm</td>
<td>0.8–1.2 × 0.8–1.2 cm</td>
</tr>
<tr>
<td>Seeds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td>oblongoid</td>
<td>ellipsoid</td>
</tr>
<tr>
<td>Size</td>
<td>1.2–1.4 × 1.0–1.2 cm</td>
<td>0.7–0.8 × 0.6–0.7 cm</td>
</tr>
<tr>
<td>Endosperm shape in cross-section</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.5–1.8 mm, apex hooded, outer surface densely papillose, margins entire; disc thick, 4-angled, adnate to ovary; staminode clavate–trullate, 0.5–1.0 mm long; ovary conical, 1.0–1.2 × 1.0–1.5 mm; style cylindrical, c. 0.5 mm long; stigma peltate, round or slightly 4-lobed, ciliate. Berries globose, 1.8–3.0 × 1.5–2.5 cm, surface smooth, green when young, yellow when ripe, 1–4-seeded. Seeds oblongoid, 1.2–1.4 × 1.0–1.2 cm, testa transversely rugose on both sides, adaxial surface with an oblong furrow, abaxial surface with a linear chalaza, apex bilobed, apical notch 1.0–3.0 mm, endosperm ‘†’ shaped in cross-section.

**Distribution**

Known only from Thailand (Fig. 2).

**Ecology and Phenology**

Along streams or in forest margins in evergreen forest; altitude 0–1,500 m; flowering: January–April; fruiting: June–January.

**Additional specimens examined**


Fig. 3. Tetrastigma jaichagunii C.L.Li ex Kochaiph. & Trias-Blasi sp. nov. A. Branch and female inflorescence. B. Infructescence. C. Ovary. D. Corolla, ventral view. E. Corolla, dorsal view. F. Corolla, lateral view. G. Seed, ventral view. H. Seed, dorsal view. I. Seed, transversal section. Drawn by Woranart Thammarong. A, C–F from K. Larsen & S.S. Larsen 33238; B from K. Larsen et al. 4537; G–I from J.F. Maxwell 85-1060.
KOCHAIPHAT P. et al., New species of Tetrastigma from Thailand


Conservation status
This species has rather large populations and is widely distributed in several parts of the country. Therefore, it is considered Least Concern (LC).

Discussion
Tetrastigma calcicola sp. nov. and T. jaichagunii sp. nov. are distinct from the other previously described species. The major characters for recognising the species are female flowers and fruits. Tetrastigma calcicola sp. nov. differs from its closest relative, T. pachyphyllum, by its 4-lobed disc that is adnate to the lower part of the ovary, and small berries with a smooth surface. Tetrastigma jaichagunii sp. nov. can be separated from T. harmandii by its more densely verrucose young branches, broader leaflets, 4-lobed thick discs, bigger globose berries and oblongoid seeds.

Currently, these two new species are known only from Thailand. Tetrastigma calcicola sp. nov. is restricted to limestone mountains at high elevation in the northern part of Thailand, while T. jaichagunii sp. nov. has a wider range of distribution. The latter species has only been recorded from evergreen forest in several parts of Thailand in large populations. However, it seems possible that it might be found in neighbouring countries such as Myanmar or Laos if a more extensive field survey is carried out in the future.

Acknowledgements
This work was supported by the Graduate School, Khon Kaen University and Science Achievement Scholarship of Thailand (SAST). The first author would like to thank Prof. Dr. John A.N. Parnell and other staff at TDC for their kind help and also grateful to the staff of AAU, ABD, BCU, BK, BKF, BM, C, CMU, CMUB, E, K, KKU, L, P, PSU, QBG and TCD for their help and for the loan of/or access to specimens. Thanks to Mr. Woranart Thammarong for the illustrations.

References
Berchtold B.V. von & Presl J.S. 1820. O přírozenosti rostlin, aneb rostlinár, obsahující: gedanj on žiwobytyj rostlinněm pro sebe a z ohledu giných žiwok, podlé stawu nyněgssýbo znánj; k rozssjřenj


