The potential invasion risk of the tomato leafminer *Tuta absoluta* in China

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OUTLINE

1. Spread of *Tuta absoluta* in Asia
2. Possible invasion pathway into China
3. Potential establishment in China
4. Quarantine blank & monitoring efforts in China
5. Conclusion

Tuta absoluta (Meyrick)

Common name

South American tomato pinworm

South American tomato leafminer

Taxonomy

Lepidoptera, Gelechiidae

Synonym

Phthorimaea absoluta (Meyrick) 1917

Gnorimoschema absoluta (Clarke) 1962

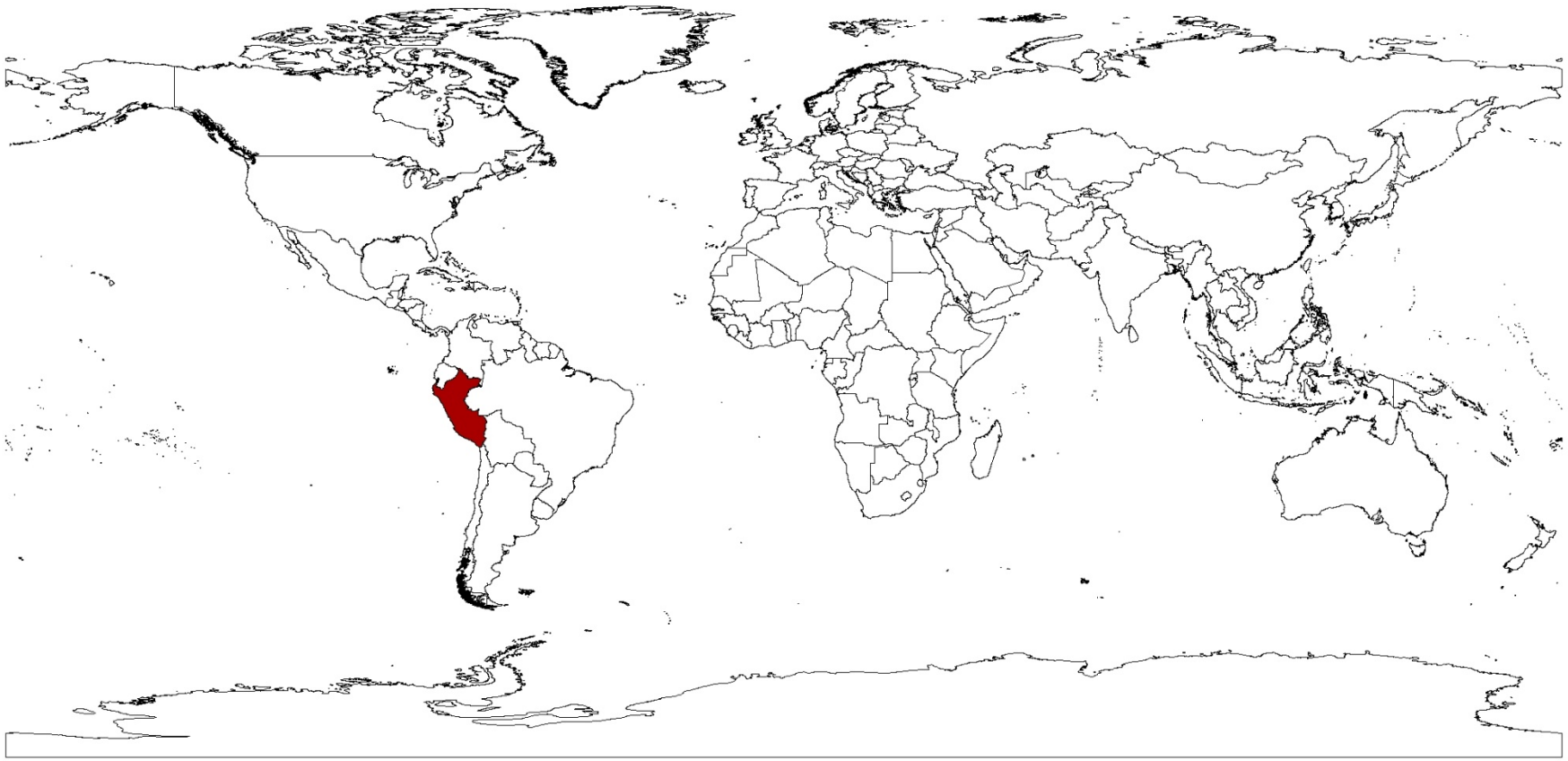
Scrobipalpula absoluta (Povolny) 1964

Scrobipalpuloides absoluta (Povolny) 1987

Tuta absoluta (Meyrick) 1994

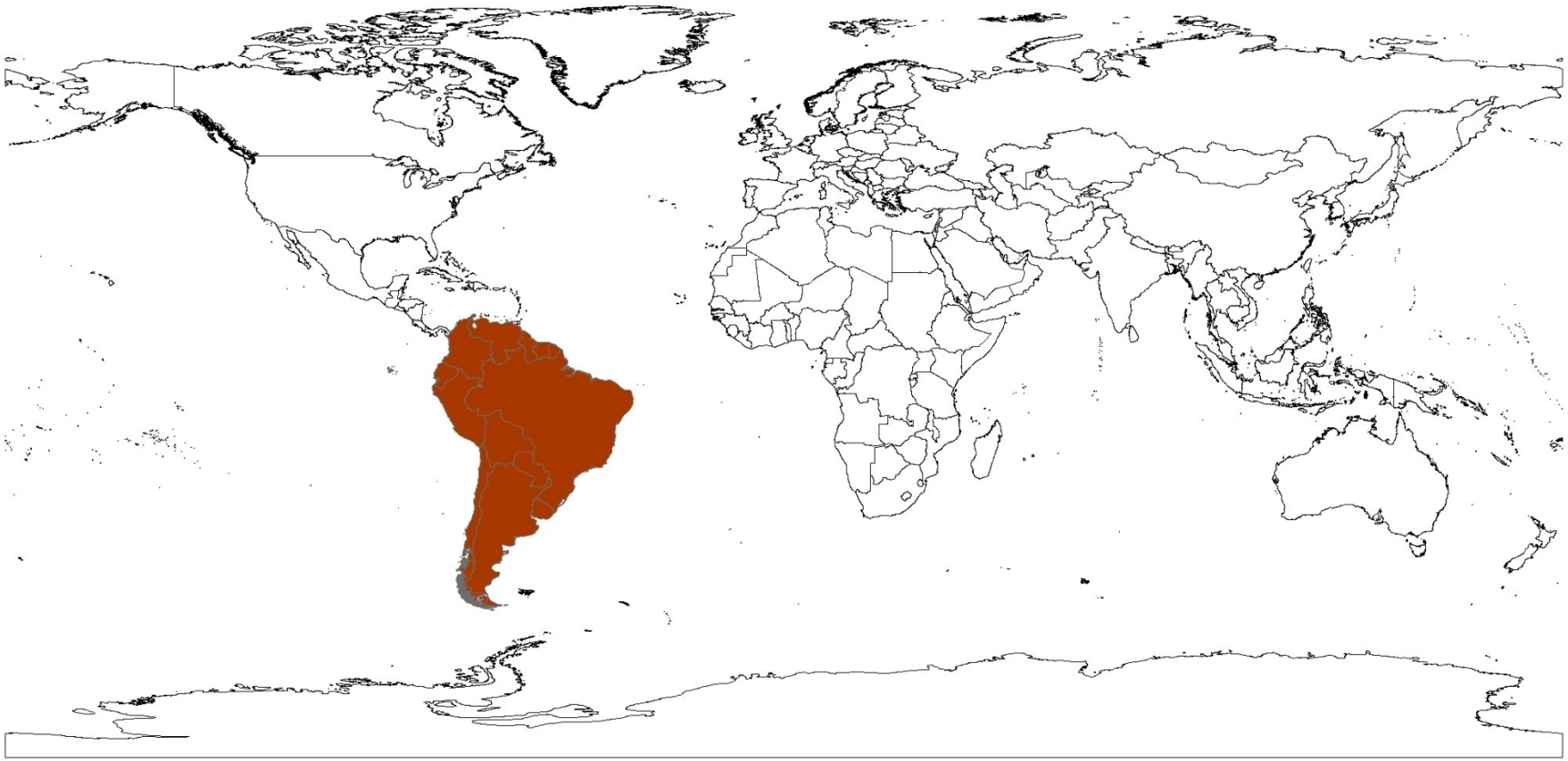
(CABI-Invasive Species Compendium, 2017)

Probably native to Peru, South America



(Desneux et al., 2010, 2011)

Before 2007, limited in South America

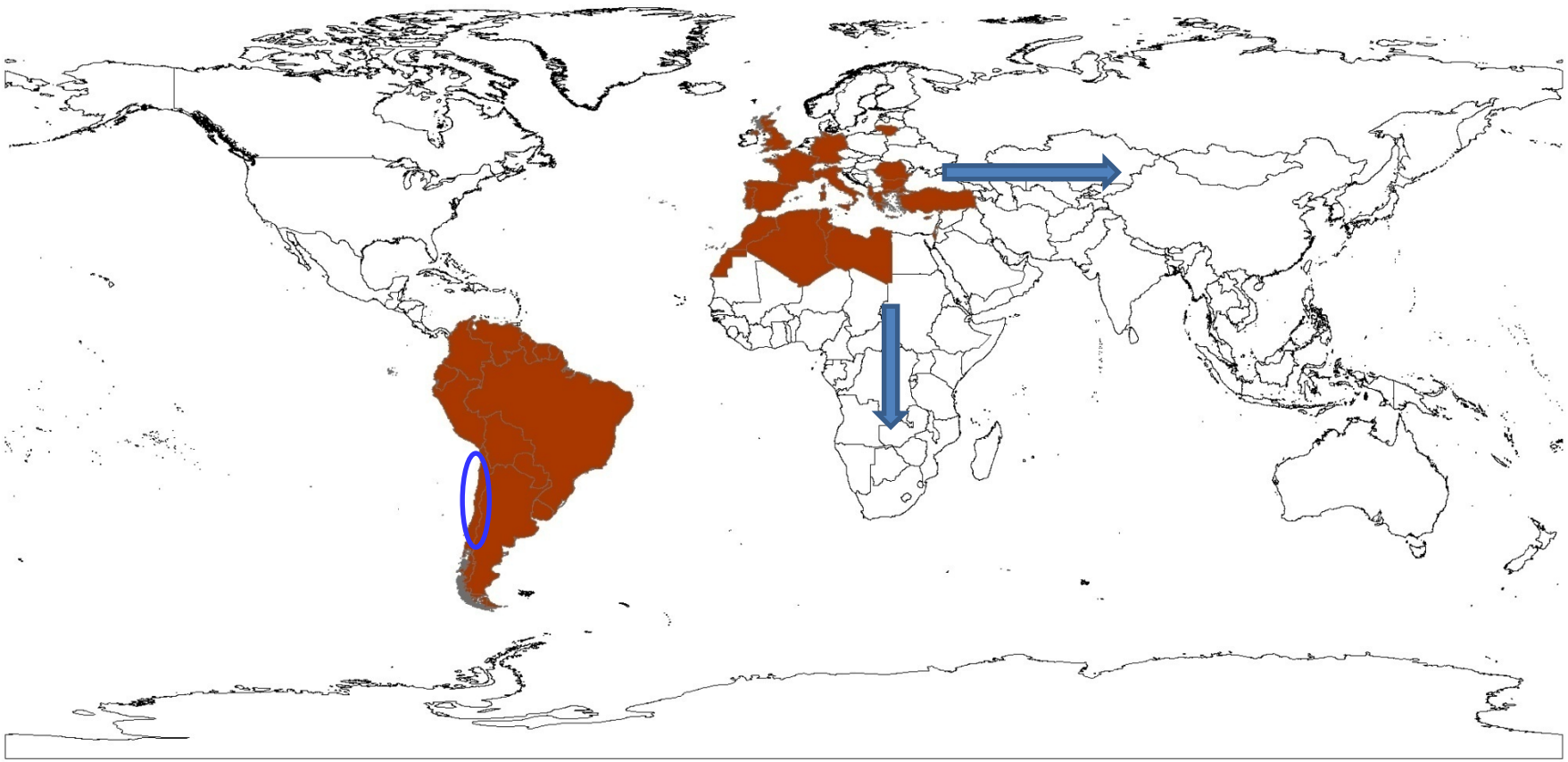


(Desneux et al., 2010, 2011)

2006: beginning the invasion of Europe

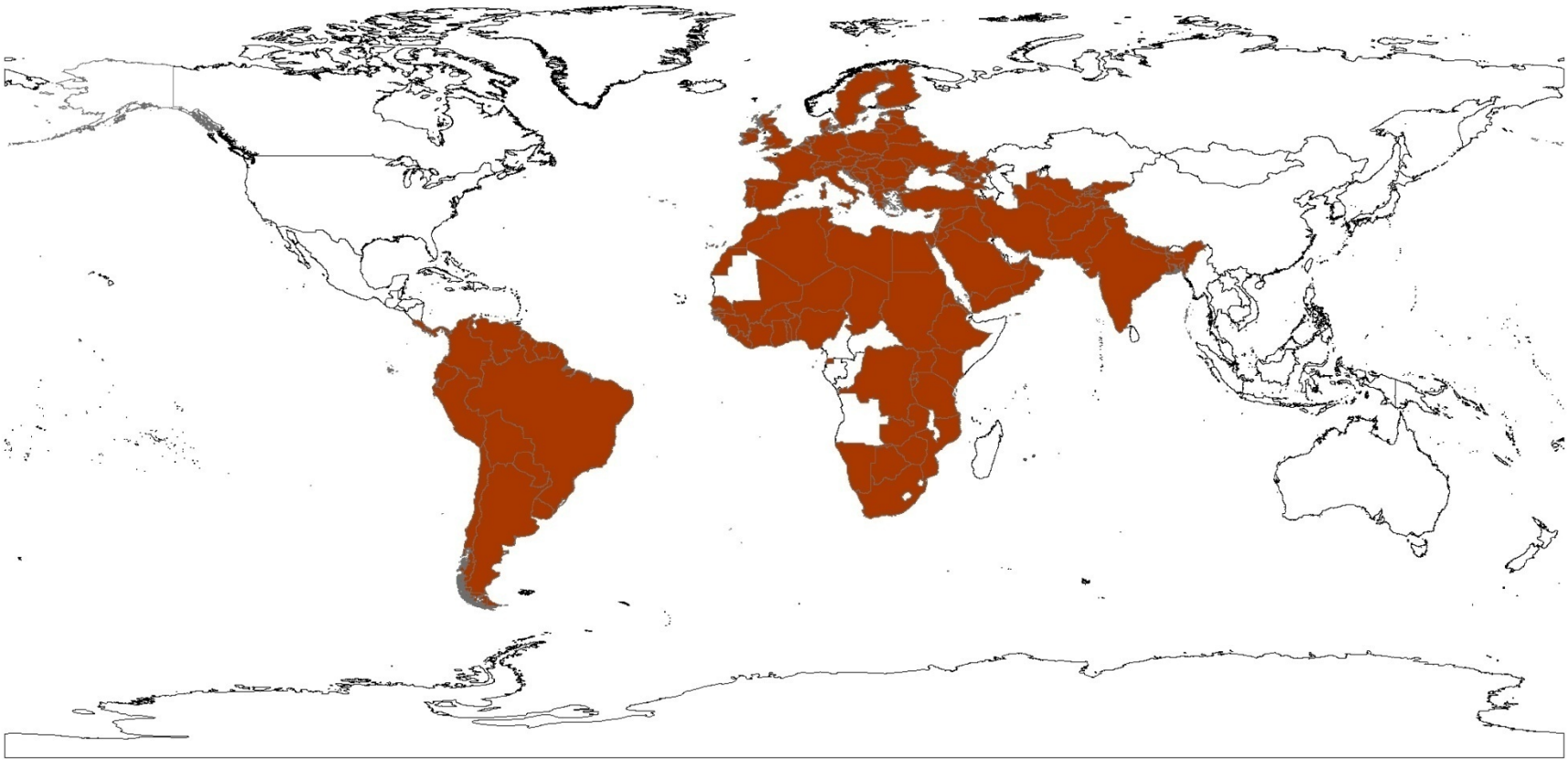
(Urbaneja et al., 2008)

2006-2009: invading the Europe and Mediterranean countries



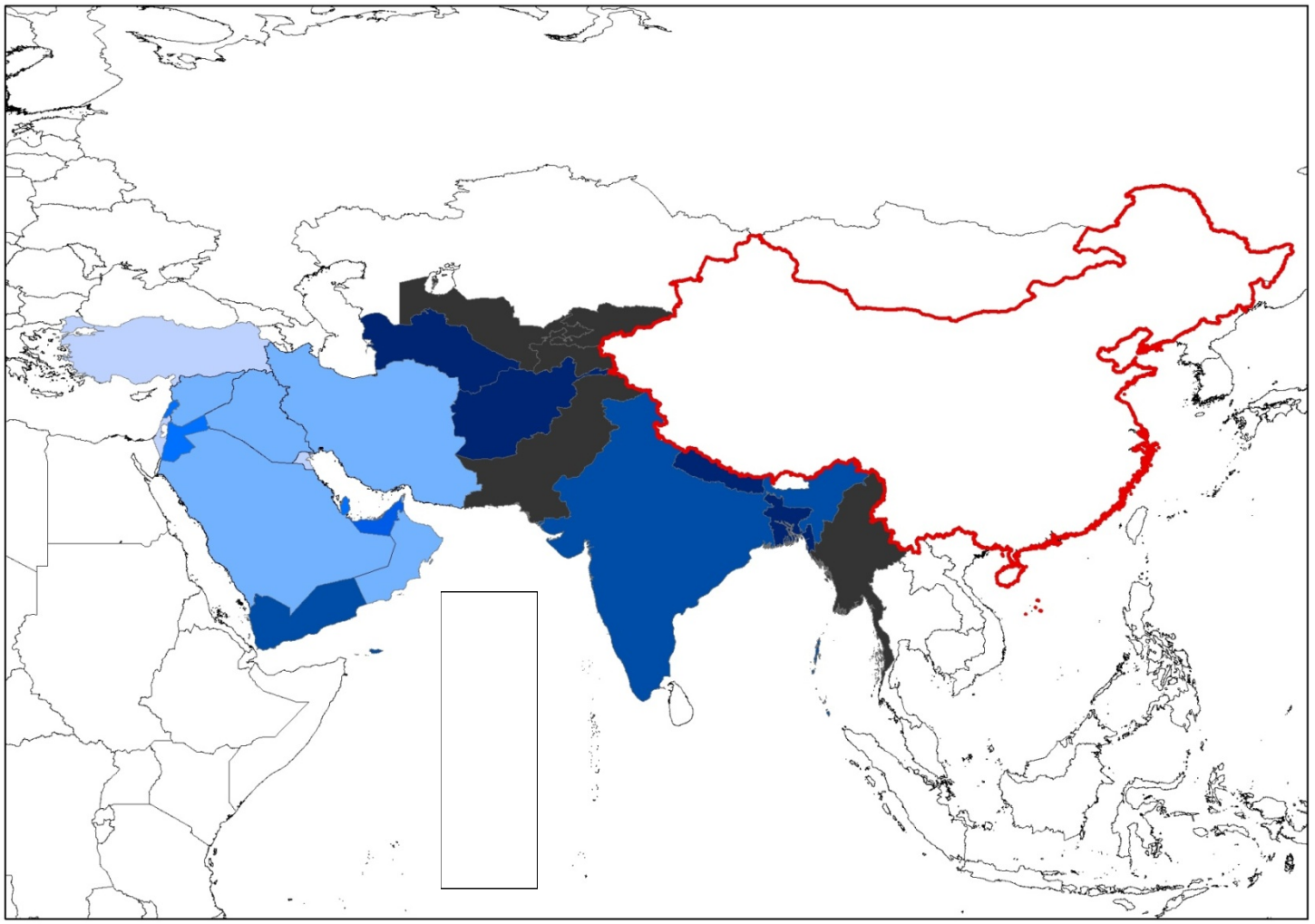
(Guillenaud et al, 2015)

2017: More than 80 countries recorded



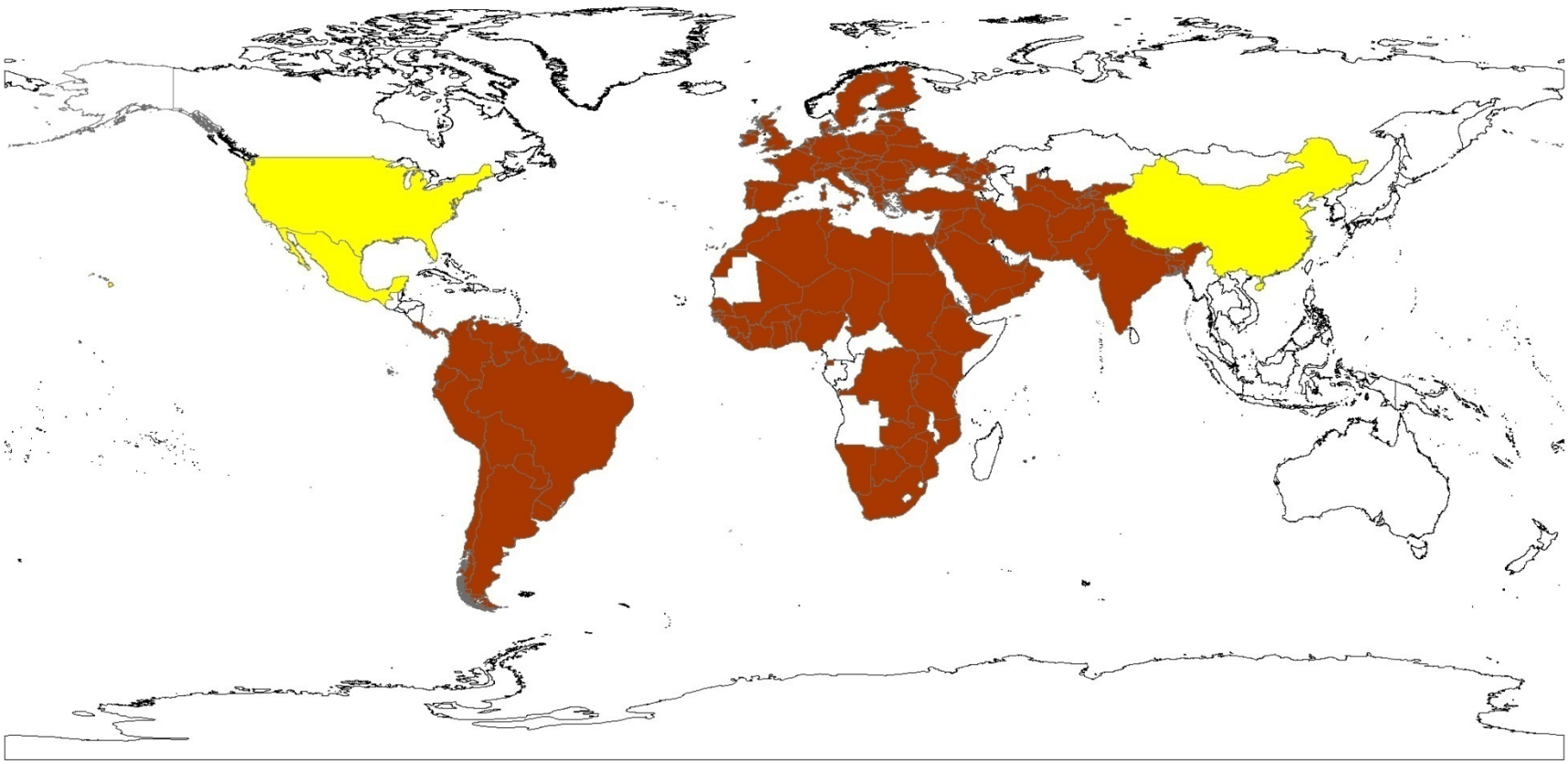
(Campos et al. 2017, Biondi et al. in press)

2009-2017 : further invasion in West & Central Asia



(Xian et al., 2017)

New areas in High risk



(Biondi et al. in press)

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Potential invasion pathway

- Long-distance transmission

  International agricultural trade

  Tomato fruits and plants

  Production facilities and packages

  Transportation vehicles

- Short-distance dispersal

  Natural factors (wind/water)

  Larva crawling and adult flight

(Desneux et al. 2010, 2011, Biondi et al. in press)

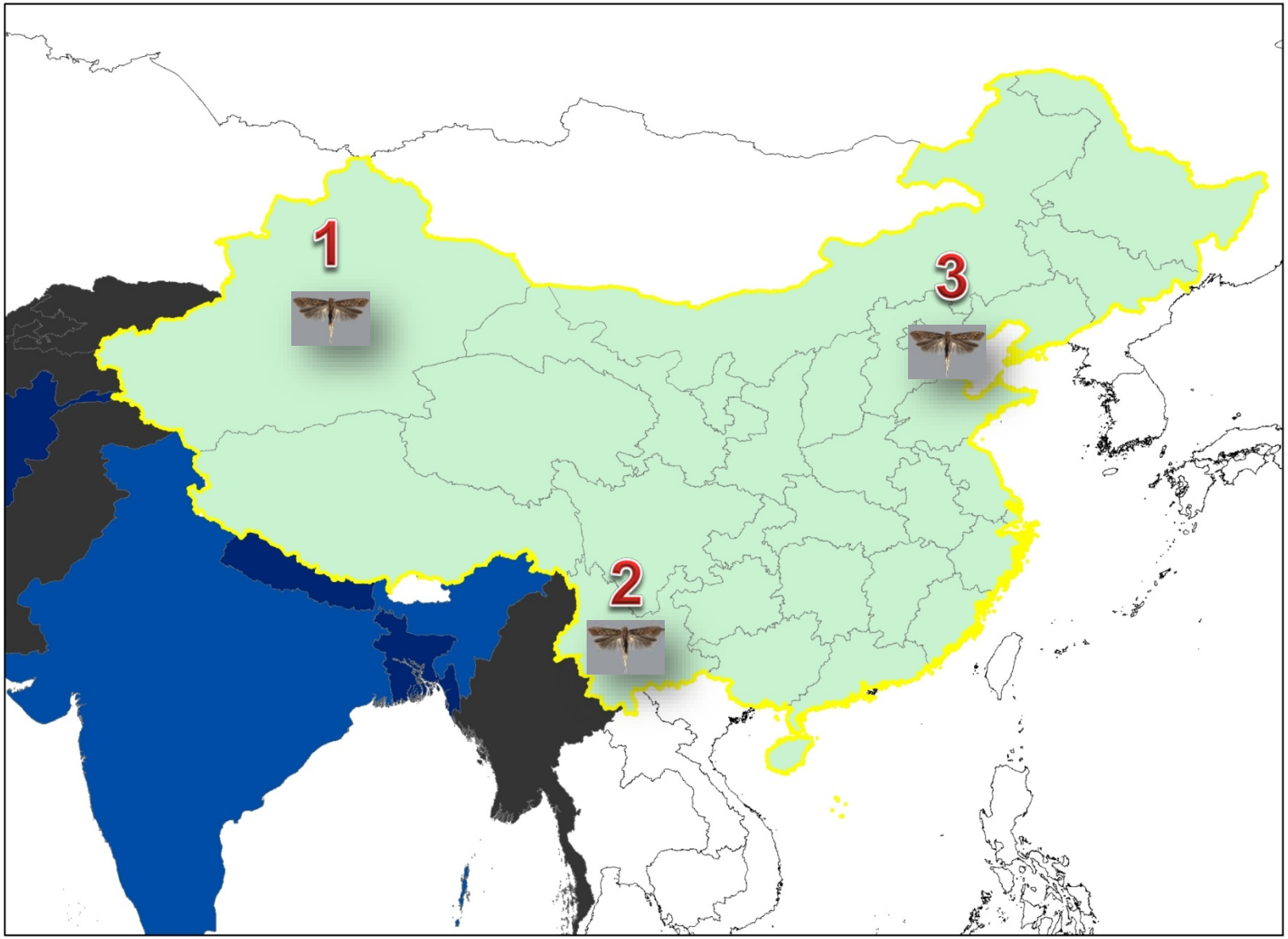
Potential invasion pathway

Speculation of the most likely pathways:

- International traffic (fresh tomatoes)
- Border trade points (tomato fruits and plants)
- Unofficial introduction (tomato fruits and plants)

(http://www.pestchina.com, 2017)

Possible first detection of *T. absoluta* in mainland China



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Potential establishment

- Host plants availability
- Climate suitability

Host plants

- >30 plants, 9 families, mainly Solanaceae

Native host

Lycopersicon esculentum

Sub-optimal host

Solanum tuberosum

Occasional host

Solano melongena

Main wild host

Solanum nigrum

- **Reports on non-Solanacaous plants**

Asteraceae

Common sowthistle

Amaranthaceae

Slender amaranth

Chenopodiaceae

Beetroot

Convolvulaceae

Field bindweed

Damage






- leaves up to 100%
- decreases of photosynthesis and yields

Host plant in China — Cultivated plants

Lycopersicon esculentum
(tomato)

Solanum tuberosum
(potato)

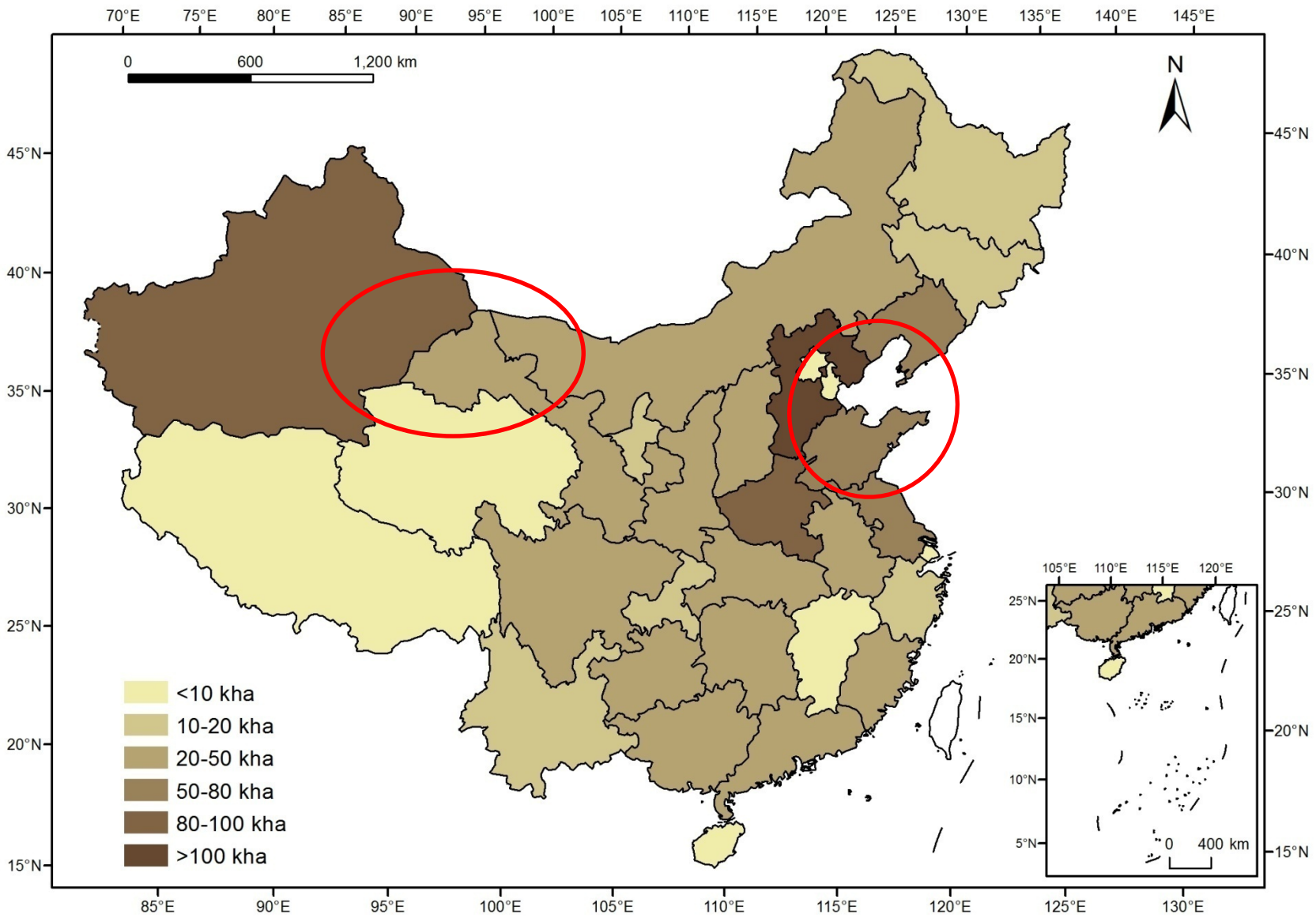
Solano melongena
(Eggplant)

Capsicum annuum
(Bell pepper)

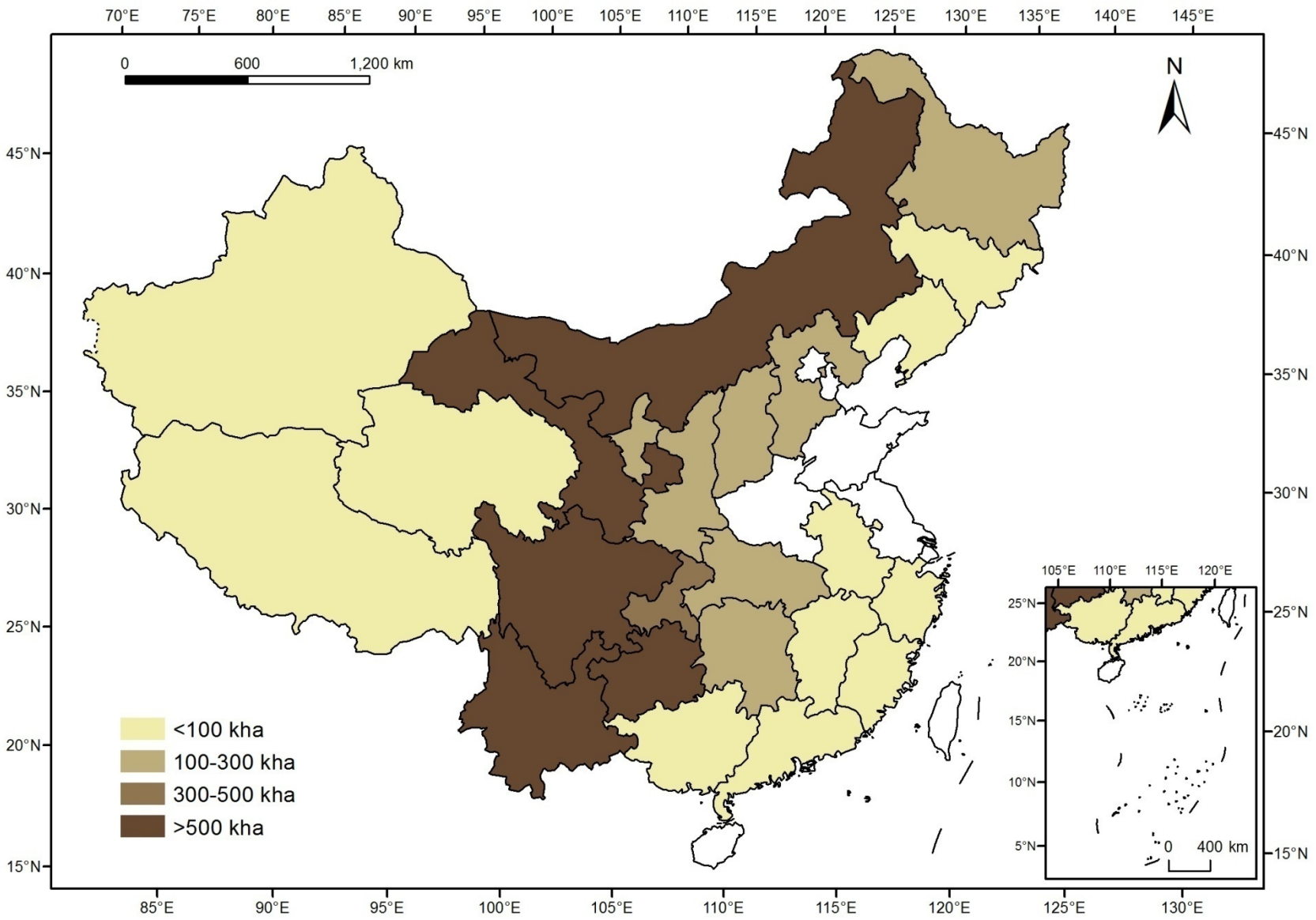
Nicotiana tabacum
(Tobacco)

Beta vulgaris
(Beetroot)

Tomato growing areas in mainland China



Potato growing areas in mainland China



Host plant in China — wild plants

Solanum nigrum
(Black nightshade)

Convolvulus arvensis
(Field bindweed)

Datura stramonium
(Jimsonweed)

Sonchus oleraceus
(Common sowthistle)

Amaranthus viridis
(Slender amaranth)

Sorghum halepense
(Johnson grass)

Potential establishment

- Host plants availability
- Climate suitability

Data and Methods

Software

CLIMEX 3.0 and ArcGIS 9.3

Species data

Published paper and report, GBIF, CABI

(525 locations of 72 countries)

Climate data

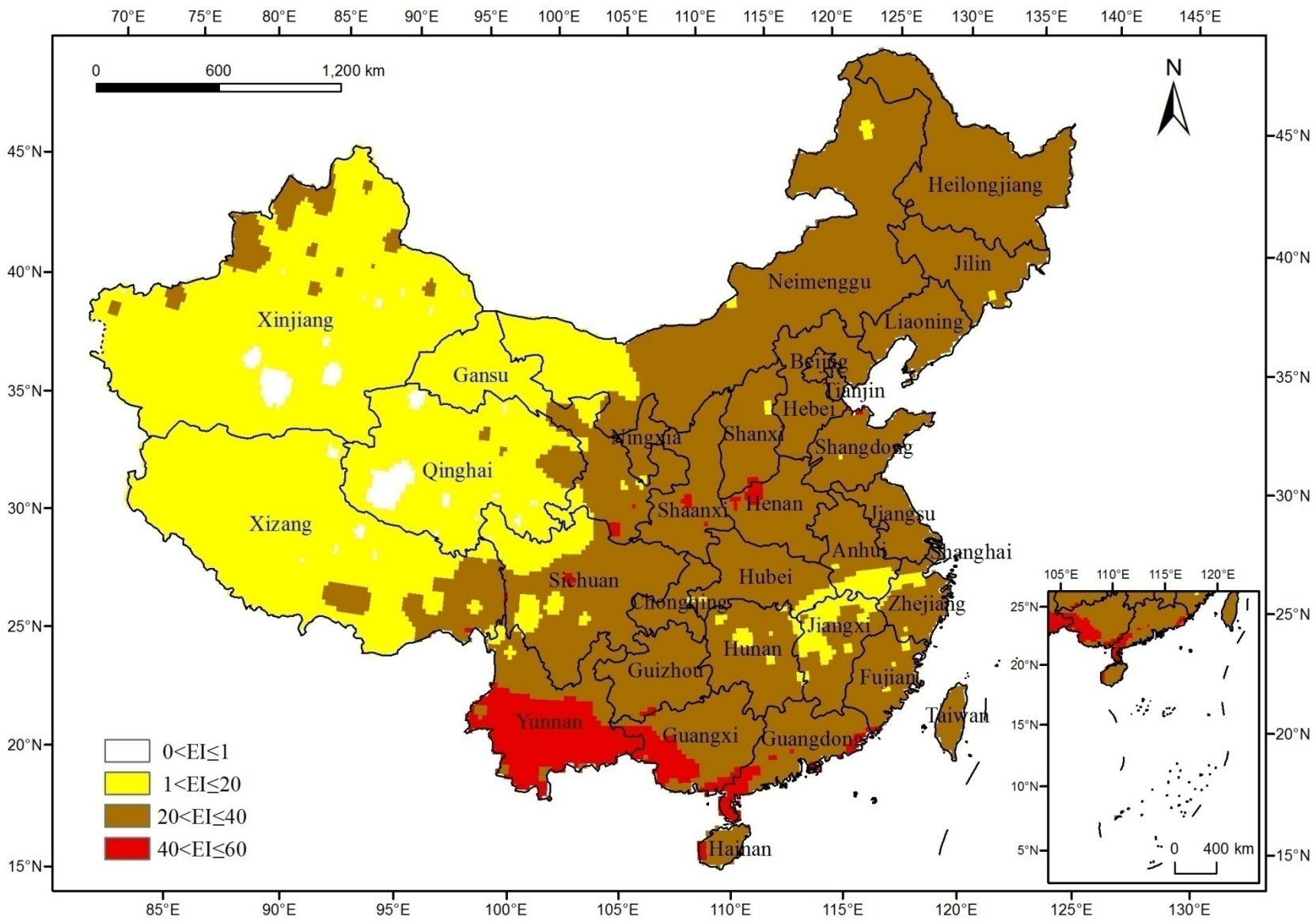
Standard meteorological dataset in CLIMEX

Monthly average data (821 stations, China, 1981-2010)

Model parameters

Referred to Desneux et al. (2010)

Potential geographic distribution *T. absoluta* in China



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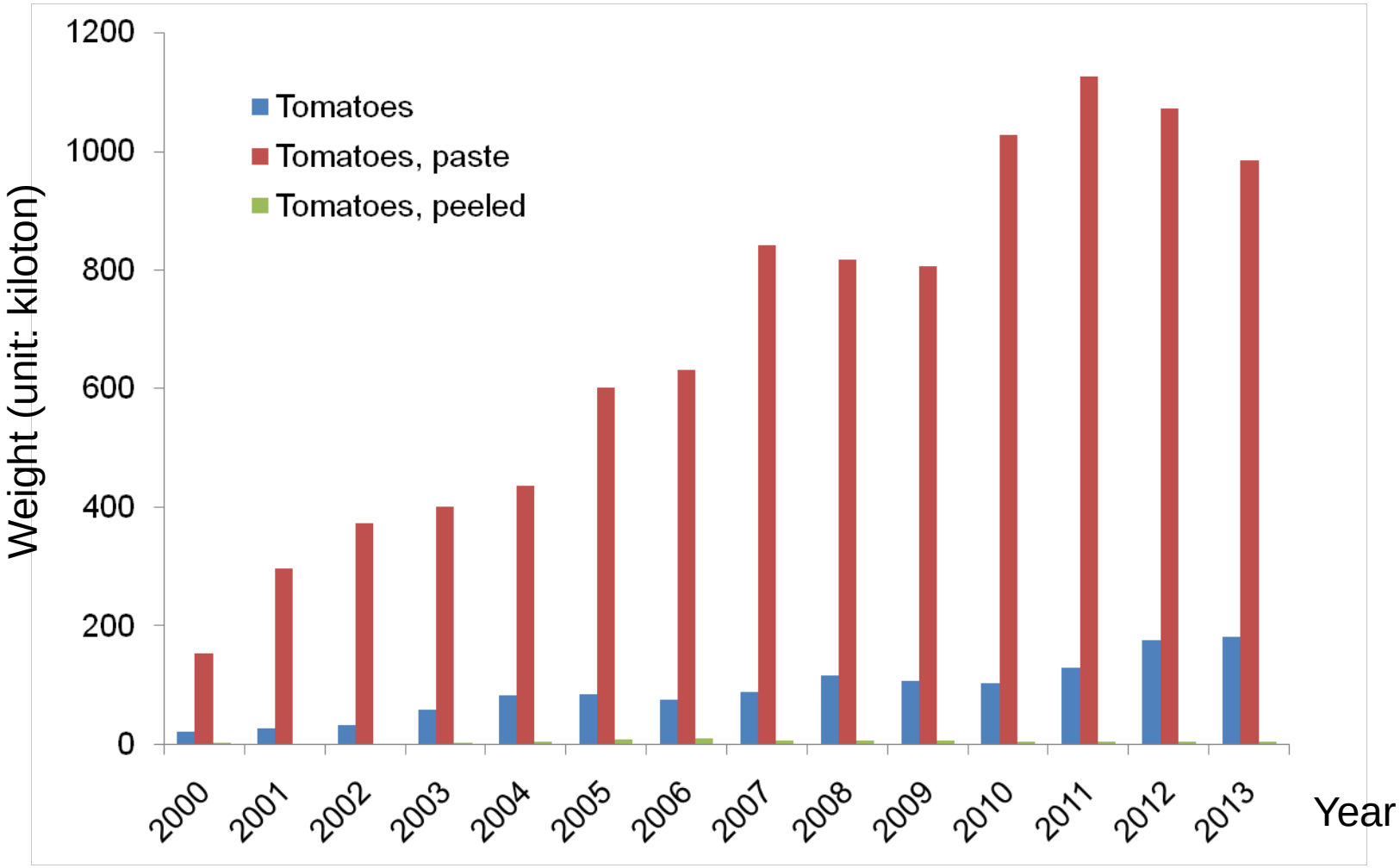
China's exports of tomato and its products



China's imports of fresh tomato & potato importation

Commodity	Year	Export	Import	Weight(kg)
Fresh/Refrigerated tomato	2015	Italy	Beijing	40
Potato tuber	2016	Netherlands	Harbin	8
	2017	U.S.A.	Qingdao	5063
	2017	Netherlands	Beijing	110
	2017	New Zealand	Dalian	5

(http://www.haiguan.info, 2017)

Quarantine blank & monitoring efforts in China

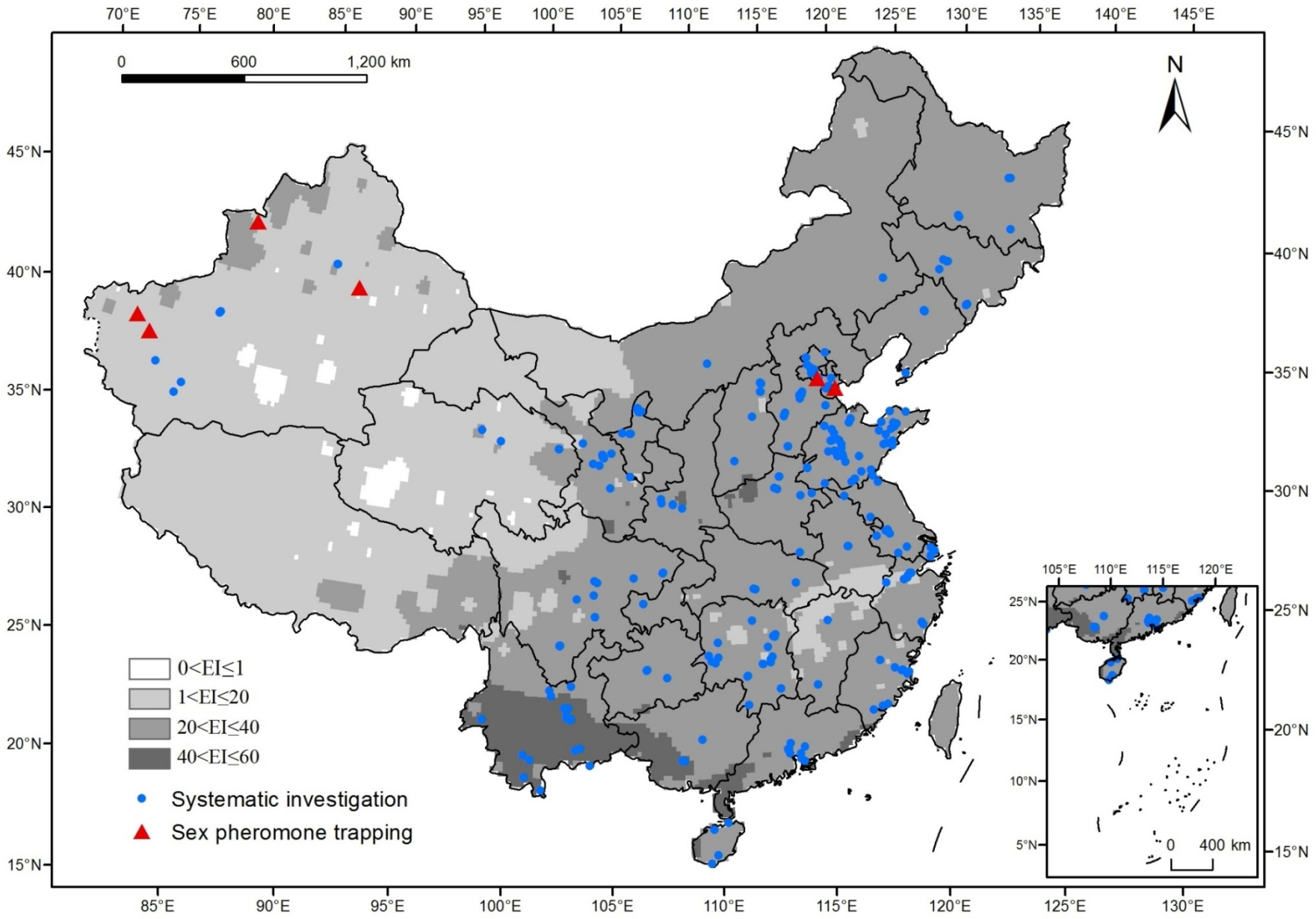
- Still not in the list of quarantine pests of imported plants in China
- No interception from General Administration of Quality Supervision, Inspection and Quarantine of China
- Institute of plant quarantine, Chinese Academy of Inspection and Quarantine (IPQ-CAIQ, 2011): an important potential alien species

Monitoring efforts in China since 2014

Field data acquisition system for invasive alien species based on Android operating system

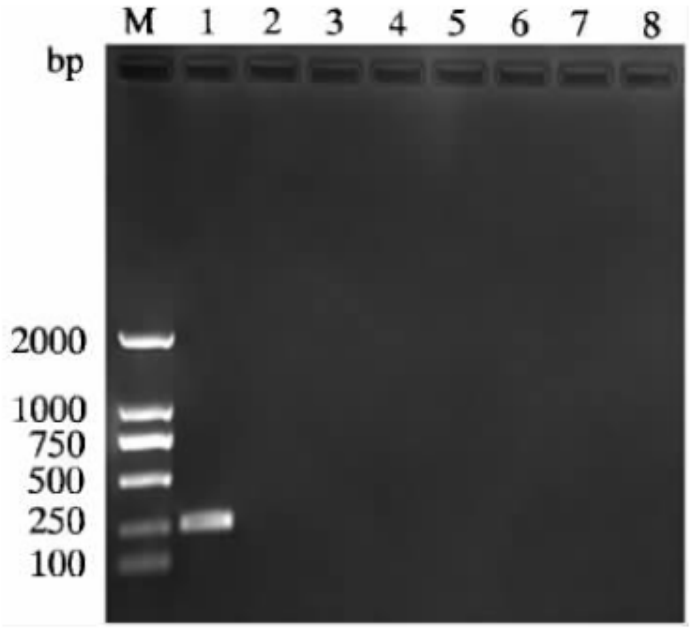
Sex pheromone traps in tomato open fields and greenhouses

Monitoring efforts in China since 2014

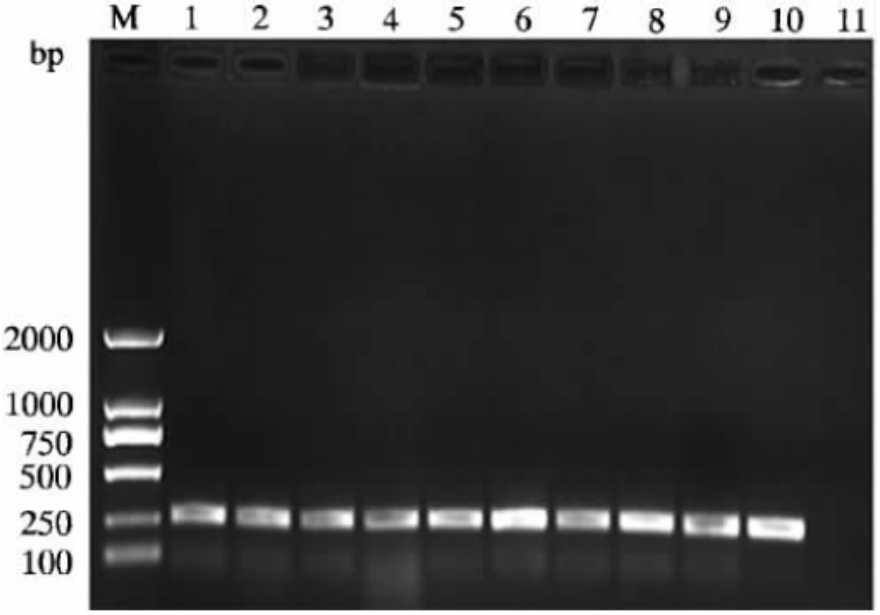


Development of DNA marker for identifying *T. absoluta*

Amplification pattern of mitochondrial DNA from egg and adult debris of *T. absoluta* using SS-COI primers TAZJCE1 /TAZJCF1 (Zhang et al., 2014)



1: *Tuta absoluta*
2-7: *Liriomyza* sp.
8: Negative control



M: DNA ladder marker
1: Egg; 2: Antenna; 3: Head; 4: Thorax;
5: Abdomen; 6: Forewing; 7: Hindwing;
8: Foreleg; 9: Midleg; 10: Hindleg
11: Negative control

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Semi-quantitative risk assessment of *Tuta absoluta* based on analytic hierarchy process and fuzzy comprehensive evaluation

外来入侵物种安全性评价系统

番茄潜叶蛾-安全性评价报告

物种中文名称：番茄潜叶蛾　　委托评价人：xxqhxc@tom.com

物种拉丁学名：Tuta absoluta　　评价时间：2017-8-30

安全性指数0.73

所选阶段	得分
传入	0.7999
定殖	0.7833
扩散	0.6333
危害-经济	0.73
入侵	0.73
危害	0.73
总得分	0.73

Tuta absoluta presented very high risk to China

- Strongly recommend a prompt launch of quarantine program by our regulatory agencies
- Build a complete network for timely, flexible and accurate detection of *T. absoluta* nationwide
- Develop preventative IPM strategies to be fully prepared for fighting against the pest in case of its arrival

Acknowledgements

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Thanks!

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